Appendix B
SUPPORTING CALCULATIONS

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Middletown Coke Company - Heat Recovery Coke Plant Assumptions / Major Inputs										
Number of Ovens			100							
Maximum coal charge tonnage			50	wet tons/oven						
Coal moisture			8.0%							
Coal sulfur			1.30%		Calculated emission factor =			23.92	lbs SO2/wet ton coal	
Furnace coke dry yield			68.0%							
Breeze fraction (of dry coal)			4.5%							
Coke moisture			7.0%							
Ovens/HRSG			20		Calculated HRSGs =			5		
Ovens/waste heat stack			20		Calculated waste heat stacks =			5		
Days HRSG offline/year			15		HRSG maintenance days/year =			10		
SO_2 removal in spray dryer/baghouse			90%		SD/BH maintenance days/year =			5		
Coke Pile			1.5	acres						
Coal pile #1 (Dead Pile)			1.2	acres						
Coal pile #2 (Live Pile)			1.3	acres						
Emergency Breeze Pile			0.2	acres						
Emergency Screened Coke Storage Pile			0.3	acres						

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EMISSION FACTORS AND POLLUTION CONTROL EFFICIENCIES AND MECHANISMS FOR HEAT RECOVERY COKE BATTERY

Emission Unit	Pollutant	Uncontrolled EF	Units	Control Mechanism	Control Efficiency	Controlled EF	Reference	Comment
Coal unloading	PM	1.69E-03	lb/ton coal	enclosure + wet suppression or baghouse	70.00%	5.07E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coal	enclosure + wet suppression or baghouse	70.00%	2.40E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coal	enclosure + wet suppression or baghouse	70.00%	7.53E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Coal crushing	PM	0.16	lb/ton coal	Total enclosure + wet material	99.00%	0.0016	AP-40, Coal Processing section, Table 1	
	PM_{10}	0.08	lb/ton coal	Total enclosure + wet material	99.00%	0.0008	AP-40, Coal Processing section, Table 1	Assumed PM10 = 50% of PM
	$PM_{2.5}$	0.024	lb/ton coal	Total enclosure + wet material	99.00%	0.00024	AP-40, Coal Processing section, Table 1	Assumed PM2.5 = 15% of PM
Coal Pile	PM	10.08	lb/day/acre	Wet suppression	50.00%	5.04	AP-40, Section 4, Equation (5)	
	PM_{10}	5.04	lb/day/acre	Wet suppression	50.00%	2.52	AP-40, Section 4, Equation (5)	k = 0.5 for PM_{10}
	$PM_{2.5}$	2.02	lb/day/acre	Wet suppression	50.00%	1.01	AP-40, Section 4, Equation (5)	k = 0.2 for $PM_{2.5}$
Coal bin load-in and loadout	PM	1.69E-03	lb/ton coal	Enclosure, wet material	95.00%	8.45E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coal	Enclosure, wet material	95.00%	4.00E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coal	Enclosure, wet material	95.00%	1.26E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Coal transfer	PM	1.69E-03	lb/ton coal	Enclosure, wet material	95.00%	8.45E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coal	Enclosure, wet material	95.00%	4.00E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coal	Enclosure, wet material	95.00%	1.26E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Charging	PM (fug)	0.027	lb/ton coal	traveling hood w/ baghouse	90.00%	0.0027	AP-42 Coke Production section, Table 12.2-21	Capture efficiency * control efficiency = 90%; Considered fugitive controlled EF since this EF consists mostly of fugitives.
	PM_{10} (fug)	0.008	lb/ton coal	traveling hood w/ baghouse	90.00%	0.0008	AP-42 Coke Production section, Table 12.2-21	Capture efficiency * control efficiency = 90%; PM_{10} = 30% of PM; Considered fugitive controlled EF since this EF consists mostly of fugitives.
	$PM_{2.5}$ (fug)	0.00405	lb/ton coal	traveling hood w/ baghouse	90.00%	0.00041	AP-42 Coke Production section, Table 12.2-21	Capture efficiency * control efficiency = 90%; $PM_{2.5}$ = 50% PM; Considered fugitive controlled EF since this EF consists mostly of fugitives.
	PM (BH)	See Note	lb/dry ton coal	traveling hood w/ baghouse	99.00%	0.0081	MACT standard	Note: emission factors are controlled values; therefore the percent control is for informational purposes only and is not used in the calculation.
	PM_{10} (BH)	See Note	lb/dry ton coal	traveling hood w/ baghouse	99.00%	0.016	MACT standard plus estimate for condensable PM	Note: emission factors are controlled values; therefore the percent control is for informational purposes only and is not used in the calculation.
	$PM_{2.5}$ (BH)	See Note	lb/dry ton coal	traveling hood w/ baghouse	99.00%	0.0081	MACT standard	Note: emission factors are controlled values; therefore the percent control is for informational purposes only and is not used in the calculation.
	VOC	0.0020	lb/ton coal				Jewell stack test data, Vansant, VA	
	SO2	0.0003	lb/ton coal				Jewell stack test data, Vansant, VA	
	CO	0.0028	lb/ton coal				Jewell stack test data, Vansant, VA	
	Lead	See Note	lb/ton coal	traveling hood w/ baghouse		1.0E-07	AP-42 Coke Production section, Table 12.2-21.	Note: emission factor includes baghouse control

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EMISSION FACTORS AND POLLUTION CONTROL EFFICIENCIES AND MECHANISMS FOR HEAT RECOVERY COKE BATTERY

Emission Unit	Pollutant	Uncontrolled EF	Units	Control Mechanism	Control Efficiency	Controlled EF	Reference	Comment
Waste gas	PM	0.049	gr/dscf	baghouse	99.00%	0.005	Uncontrolled is Haverhill Limit. Engineering Estimate. Particulate from spray dryer also removed in baghouse.	Emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.
	PM_{10}	0.083	gr/dscf	baghouse	99.00%	0.011	Engineering estimate. Particulate from spray dryer also removed in baghouse. Includes estimate for condensable PM (GECC limit).	Emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.
	$PM_{2.5}$	0.049	gr/dscf	baghouse	99.00%	0.005	Engineering estimate. Particulate from spray dryer also removed in baghouse.	Emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.
	SO_2	23.92	lb/ton coal	dry scrubber	90.00%	2.39	Material balance	
	NOx	1.00	lb/ton coal				Haverhill limit	
	CO	20.0	ppm				Provided by Sun Coke Co.	
	VOC	10.0	ppm				Provided by Sun Coke Co.	
	Lead	4.56E-03	lb/ton coal	baghouse	95.00%	0.0002	Haverhill April 2006 stack test data.	
	H_2SO_4	1.22	lb/ton coal	dry scrubber	98.00%	0.024	Haverhill data.	Uncontrolled = 0.051 lb H_2SO_4/lb SO_2.
Pushing	PM	See Note	lb/ton coke	flat car push / multicyclone	98.00%	0.04	MACT standard for pushing into mobile device that captures emissions during travel.	Note: Engineering estimate of controlled EF. The percent control is given for informational purposes only and is not used in the calculation.
	PM_{10}	See Note	lb/ton coke	flat car push / multicyclone	98.00%	0.08	MACT standard for pushing into mobile device that captures emissions during travel. Includes estimate for condensable PM	Note: Engineering estimate of controlled EF. The percent control is given for informational purposes only and is not used in the calculation.
	$PM_{2.5}$	See Note	lb/ton coke	flat car push / multicyclone	98.00%	0.04	MACT standard for pushing into mobile device that captures emissions during travel.	Note: Engineering estimate of controlled EF. The percent control is given for informational purposes only and is not used in the calculation.
	CO	0.063	lb/ton coal				AP-42 Coke Production section, Table 12.2-9	
	VOC	0.02	lb/ton coal				Provided by Sun Coke Co.	
	SO_2	0.098	lb/ton coal				AP-42 Coke Production section, Table 12.2-9	
	NOx	0.019	lb/ton coal				AP-42 Coke Production section, Table 12.2-9	
	Lead	1.53E-05	lbs/ton coal				AP-42 Coke Production section, Table 12.2-10	
	H_2SO_4	5.00E-03	lbs/ton coal					No data. Estimated from ratio in Haverhill waste gas = 0.051 lb H_2SO_4/lb SO_2.
Quenching	PM	See Note	lb/ton coal	baffles, cleaned make-up water		0.12	AP-42, Coke Production Section,Table 12.2-12. Filterable PM. No data for condensable PM.	Note: emission factor with baffles as controls; emission factor from AP-42 with TDS = 1100 mg/l. Additional PM control with improved baffle design
	PM_{10}	See Note	lb/ton coal	baffles, cleaned make-up water		0.044	AP-42, Coke Production Section,Table 12.2-12. Filterable PM_{10}. No data for condensable PM.	Note: emission factor with baffles as controls; 9.8% of PM.
	$PM_{2.5}$	See Note	lb/ton coal	baffles, cleaned make-up water		0.027	AP-42, Coke Production Section,Table 12.2-12. Filterable $PM_{2.5}$. No data for condensable PM.	Note: emission factor with baffles as controls; 6.0% of PM.
	Lead	8.69E-05	lb/ton coal				Haverhill data, August 2005	
Coke screening	PM	See Note	gr/dscf	baghouse	99.00%	0.008	Engineering estimate.	Note: emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.
	PM_{10}	See Note	gr/dscf	baghouse	99.00%	0.008	Engineering estimate.	Note: emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.
	$PM_{2.5}$	See Note	gr/dscf	baghouse	99.00%	0.008	Engineering estimate.	Note: emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.
Coke/screened coke storage pile	PM	2.19	lb/day/acre	none	0.00%		AP-40, Section 4, Equation (5)	
	PM_{10}	1.10	lb/day/acre	none	0.00%		AP-40, Section 4, Equation (5)	k = 0.5 for PM_{10}
	$PM_{2.5}$	0.44	lb/day/acre	none	0.00%		AP-40, Section 4, Equation (5)	k = 0.2 for $PM_{2.5}$

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EMISSION FACTORS AND POLLUTION CONTROL EFFICIENCIES AND MECHANISMS FOR HEAT RECOVERY COKE BATTERY

Emission Unit	Pollutant	Uncontrolled EF	Units	Control Mechanism	Control Efficiency	Controlled EF	Reference	Comment
Coke pile load-in	PM	1.69E-03	lb/ton coke	Partial enclosure, stacking tube	70.00%	5.07E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coke	Partial enclosure, stacking tube	70.00%	2.40E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coke	Partial enclosure, stacking tube	70.00%	7.53E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Coke breeze bin	PM	1.69E-03	lb/ton coke	Enclosure, wet material	70.00%	5.07E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coke	Enclosure, wet material	70.00%	2.40E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coke	Enclosure, wet material	70.00%	7.53E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Coke transfer	PM	1.69E-03	lb/ton coke	Enclosure, wet material	70.00%	5.07E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coke	Enclosure, wet material	70.00%	2.40E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coke	Enclosure, wet material	70.00%	7.53E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Breeze loadout	PM	1.69E-03	lb/ton coke	Enclosure, wet material	70.00%	5.07E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coke	Enclosure, wet material	70.00%	2.40E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coke	Enclosure, wet material	70.00%	7.53E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11
Breeze Pile	PM	10.74	lb/day/acre	none	0.00%		AP-40, Section 4, Equation (5)	
	PM_{10}	5.37	lb/day/acre	none	0.00%		AP-40, Section 4, Equation (5)	k = 0.5 for PM_{10}
	$PM_{2.5}$	2.15	lb/day/acre	none	0.00%		AP-40, Section 4, Equation (5)	k = 0.2 for PM_{10}
Coke loadout	PM	1.69E-03	lb/ton coke	Enclosure, wet material	70.00%	5.07E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74
	PM_{10}	7.99E-04	lb/ton coke	Enclosure, wet material	70.00%	2.40E-04	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35
	$PM_{2.5}$	2.51E-04	lb/ton coke	Enclosure, wet material	70.00%	7.53E-05	AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)	per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11

Wind speed	9.9	mph	Tanks 4.09 Meteorological database (Dayton, OH)
% time wind speed exceeds 12 mph	29	%	Dayton/International Airport, Ohio: 1984 - 1992 Wind Rose
Min. coal moisture content	4.8	%	Maximum for use of Equation (1)
Actual coal moisture content	8.0	%	Engineering estimate
Coke moisture content	7.0	%	Engineering estimate
Coal silt content	4.6	%	AP-42 5th ed. Table 13.2.4-1
Coke silt content	1	%	Engineering estimate
Coke breeze silt content	4.9	%	AP-42 5th ed. Table 13.2.4-1
Days with >=0.01 in rain per year	130	days	AP-42, Fig. 13.2.1-2

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Middletown Coke Company **100 Ovens**

0.6 MM tons furnace coke/year

Assumptions

	% moisture	MM wet tons/yr	MM dry tons/yr	
Furnace Coke Production:	7.0%	0.6138	0.5709	Based on 2,500
Coal Used:	8.0%	0.9125	0.8395	tons wet coal/day charge rate
Coke Breeze:	7.0%	0.0406	0.0378	
Total Coke Production:		0.6544	0.6086	
Yield:	68.0% (dry coke to dry coal)		4.5% dry coal to dry breeze	

Individual waste heat stacks:

Days per year / individual wh stack	15	Days with 20.0%	gas through wh stack	50
Percent gas through ind wh stacks	4.1%	Days with 100% gas through wh stacks		5
		Days with 100% gas through main stack		310

Emission Units	Estimated Emissions																			
	Filterable PM		Total PM_{10}		Filterable PM_{10}		Filterable $PM_{2.5}$		SO_2		NO_X		CO		VOC		Lead[6]		H_2SO_4	
	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	EF	Emissions (tons/yr)	Emissions (tons/yr)	
Coal Unloading, Storage, and Handling		9.51		4.56		4.56		1.53												
Coal Crushing	0.0016	0.73	0.0008	0.37	0.0008	0.37	0.00024	0.11												
Charging (fugitive)	0.0027	1.23	0.00081	0.37	0.00081	0.37	0.00041	0.18												
Charging (baghouse) [1]	0.0081	3.40	0.016	6.72	0.0081	3.40	0.0081	3.40	0.0003	0.14			0.0028	1.28	0.002	0.91	1.00E-07	5.48E-05	neg	
Main stack [2]	0.005	46.93	0.011	103.24	0.005	46.93	0.005	46.93	2.39	1091.35	1.00	456.25	20	95.54	10	20.47	2.28E-04	0.12	11.13	
Individual waste heat stacks [2]	0.049	18.90	0.083	32.01	0.049	18.90	0.049	18.90	23.92	448.50	1.00	18.75	20	3.93	10	0.84	4.56E-03	0.10	22.88	
Pushing (collector) [3]	0.040	13.09	0.080	26.18	0.040	13.09	0.040	13.09	0.098	44.71	0.019	8.67	0.063	28.74	0.020	9.13	1.53E-05	8.38E-03	2.28	
Quenching [4]	0.12	54.75	0.044	20.08	0.044	20.08	0.027	12.32									8.69E-05	4.76E-02		
Coke screening [5]	0.008	15.02	0.008	15.02	0.008	15.02	0.008	15.02												
Coke Storage, Handling, and Loadout		9.78		4.66		4.66		1.51												
Lime Silo		0.13		0.13		0.13		0.13												
FGD Silo		0.01		0.01		0.01		0.01												
Paved Roads & Parking		21.57		4.21		4.21		1.05												
Total		**195.04**		**217.54**		**131.71**		**114.19**		**1584.70**		**483.67**		**129.49**		**31.35**		**0.28**	**36.29**	

[1] EF lb/wet ton coal, particulate lb/dry ton coal

[2] EF lb/wet ton coal, particulate grains/dscf, CO and VOC ppm

[3] EF lb/wet ton coal, particulate lb/wet ton coke

[4] EF lb/wet ton coal

[5] EF grains/dscf

[6] Lead emissions include 20% buffer that recognizes the EF are based on AP-42 emission factors that can change or limited test data but still establishes a limit that maintains the facility's status as a minor source for lead

Notes for emissions spreadsheet:

Waste gas flow = 250,000 dscfm (main stack)

Coke screening baghouse gas flow = 50,000 dscfm

20.833333

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Middletown Coke Company **100 Ovens**

Material Handling and Vehicles Fugitive PM / PM_{10} / $PM_{2.5}$

		Thruput	Conv. Enc/Unc	PM (lb/hr)	PM_{10} (lb/hr)	$PM_{2.5}$ (lb/hr)
x1	Coal Unloading	100%	Controlled	0.0528	0.0250	0.0078
x2	To Unloader Conveyor	100%	Enc	0.0088	0.0042	0.0013
x3	Coal Transfer #1	100%	Enc	0.0088	0.0042	0.0013
	Coal Transfer #2	100%	Enc	0.0088	0.0042	0.0013
x4	Transfer to Stacker Conveyor	100%	Unc	0.1760	0.0832	0.0262
x5	Transfer to Stacker	100%	Unc	0.1760	0.0832	0.0262
x6	Coal Storage Pile #1 In	50%	Unc	0.0880	0.0416	0.0131
x7	Coal Storage Pile #1 (Dead Pile)		Controlled	0.2520	0.1260	0.0504
x8	Coal Storage Pile#1 Out	50%	Unc	0.0880	0.0416	0.0131
x9	Coal Transfer from Storage Pile #1 to Storage Pile #2	50%	Unc	0.0880	0.0416	0.0131
x10	Coal Storage Pile #2 In	50%	Unc	0.0880	0.0416	0.0131
x11	Coal Storage Pile #2 (Live Pile)		Controlled	0.2730	0.1365	0.0546
x12	Coal Storage Pile #2 Out	100%	Enc	0.0088	0.0042	0.0013
x13	Stacker (Front End Loadout)	20%	Unc	0.0352	0.0166	0.0052
x14	Transfer to Stacker Reclaim Hopper	20%	Unc	0.0352	0.0166	0.0052
x16	Coal Transfer #3	100%	Enc	0.0088	0.0042	0.0013
x17	Coal Transfer #4	100%	Enc	0.0088	0.0042	0.0013
x18	Transfer to Coal Crushing Towe	100%	Enc	0.0088	0.0042	0.0013
x19	Coal Crushing	100%	Controlled	0.1667	0.0833	0.0250
x20	Transfer to Silo Feed Conveyo	100%	Enc	0.0088	0.0042	0.0013
x21	Transfer to Silo	100%	Enc	0.0088	0.0042	0.0013
x22	Transfer to Batch Bin	100%	Enc	0.0088	0.0042	0.0013
x23	Transfer to tripper conveyor	100%	Unc	0.1760	0.0832	0.0262
x24	Tripper point 1	100%	Unc	0.1760	0.0832	0.0262
x25	Tripper point 2	100%	Unc	0.1760	0.0832	0.0262
x26	Tripper point 3	100%	Unc	0.1760	0.0832	0.0262
x27	Extra Coal Transfer Point #1	100%	Enc	0.0088	0.0042	0.0013
x28	Extra Coal Transfer Point #2	100%	Enc	0.0088	0.0042	0.0013
x29	Extra Coal Transfer Point #3	100%	Enc	0.0088	0.0042	0.0013
y1	Coke from Hot Car to Quench Car	100%	Partial	0.0379	0.0179	0.0056
y2	Coke from Quench Car to Wharf	100%	Unc	0.1262	0.0597	0.0188
y3	Transfer to Wharf conveyor	100%	Unc	0.1262	0.0597	0.0188
y4	Coke Transfer #1	100%	Enc	0.0379	0.0179	0.0056
y5	Coke Transfer (Stacking Conveyor)	100%	Unc	0.1262	0.0597	0.0188
y6	Coke emergency storage pile in	100%	Unc	0.1262	0.0597	0.0188
y7	Coke emergency storage pile winc		Unc	0.1369	0.0685	0.0274
y8	Coke emergency storage pile out	100%	Unc	0.1262	0.0597	0.0188
y9	Unloading to Coke Reclaim Hopper	100%	Unc	0.1262	0.0597	0.0188
y10	Coke Transfer (Plant Feed Conveyor	120%	Enc	0.0454	0.0215	0.0068
y11	Transfer to Screening Station	120%	Enc	0.0454	0.0215	0.0068
y12	Transfer to Recirculating Conveyor	20%	Enc	0.0076	0.0036	0.0011
y13	Recirculating Transfer to Plant Feed Conveyo	20%	Enc	0.0076	0.0036	0.0011
y14	Transfer Breeze to Bunker	6.2%	Enc	0.0024	0.0011	0.0003
y15	Breeze loadout at bunker	6.2%	Enc	0.0024	0.0011	0.0003
y16	Emergency Breeze Pile In	6.2%	Unc	0.0078	0.0037	0.0012
y17	Emergency Breeze Pile		Unc	0.0895	0.0447	0.0179
y18	Emergency Breeze Pile Out	6.2%	Unc	0.0078	0.0037	0.0012
y19	Transfer to coke product conveyor	100%	Enc	0.0379	0.0179	0.0056
y20	Coke Transfer #2	100%	Enc	0.0379	0.0179	0.0056
y21	Transfer to screened coke stacker conveyor	100%	Unc	0.1262	0.0597	0.0188
y22	Emergency Screened coke storage pile in	100%	Unc	0.1184	0.0560	0.0176
y23	Emergency Screened coke storage pile		Unc	0.0274	0.0137	0.0055
y24	Emergency Screened coke storage pile out	100%	Unc	0.1184	0.0560	0.0176
y25	Unloading to Screened Coke Reclaim Hopper	100%	Unc	0.1262	0.0597	0.0188
y26	Coke Transfer #3	100%	Enc	0.0379	0.0179	0.0056
y27	Coke Transfer #4	100%	Enc	0.0379	0.0179	0.0056
y28	Coke Transfer #5	100%	Enc	0.0379	0.0179	0.0056
y29	Coke Rail Loadout Transfer #1	100%	Enc	0.0379	0.0179	0.0056
y30	Coke Rail Loadout Transfer #2	100%	Enc	0.0379	0.0179	0.0056
y31	Coke Rail Loadout Transfer #3	100%	Enc	0.0379	0.0179	0.0056
y32	Coke Rail Loadout Transfer #4	100%	Enc	0.0379	0.0179	0.0056
y33	Transfer to coke loadout conveyo	100%	Enc	0.0379	0.0179	0.0056
y34	Coke Rail Loadout	100%	Enc	0.0379	0.0179	0.0056
y35	Extra Coke Transfer Point #1	100%	Enc	0.0379	0.0179	0.0056
y36	Extra Coke Transfer Point #2	100%	Enc	0.0379	0.0179	0.0056
y37	Extra Coke Transfer Point #3	100%	Enc	0.0379	0.0179	0.0056
	Vehicles			4.92	0.96	0.24
	Total fugitive			9.49	3.15	0.96
	Annual (tpy)					
	Coal Piles			4.19	2.04	0.74
	Coal handling			6.05	2.88	0.90
	Coke Piles			3.32	1.60	0.55
	Coke handling			6.46	3.05	0.96
	Vehicles			21.57	4.21	1.05
	Total annual fugitive (tpy			**41.58**	**13.79**	**4.20**

Maximum Production data:

Maximum daily rate = 2500 tons wet coal/day

Maximum daily furnace coke = 1682 tons wet coke/day

Maximum ROV coke = 1793 tons wet coke/day

Conv. Transfer	**PM EF (lb/ton)**	**PM_{10} EF (lb/ton)**	**$PM_{2.5}$ EF (lb/ton)**
Coal crushing			
- controlled	1.60E-03	8.00E-04	2.40E-04
Coal Unloading			
- controlled	5.07E-04	2.40E-04	7.53E-05
Coal Transfer points			
- enclosed	8.45E-05	4.00E-05	1.26E-05
- partial	5.07E-04	2.40E-04	7.53E-05
- unenclosed	1.69E-03	7.99E-04	2.51E-04
Coke Transfer points			
- enclosed	5.07E-04	2.40E-04	7.53E-05
- partial	5.07E-04	2.40E-04	7.53E-05
- unenclosed	1.69E-03	7.99E-04	2.51E-04
Coal Pile			
-uncontrolled (lb/acre/day)	10.08	5.04	2.02
-controlled (lb/acre/day)	5.04	2.52	1.01

	PM (tons/yr)	**PM_{10} (tons/yr)**	**$PM_{2.5}$ (tons/yr)**
F002	7.51	3.64	1.29
F003	6.05	2.88	0.90
F004	21.47	18.07	15.98

Middletown Coke Company

Revised July 2008

Maximum Annual Production = 912,500 tons wet coal/year Tons individual wg stacks 37,500
Gas through ind wg stacks = 4.1%

Compound	CAS#	AP-42 [a] Emission Factor (lbs/ton)	Ind WG Stack Annual Emissions (tons/yr)	Main Stack [b] Spray Dryer/BH Removal (%)	Main Stack [c] Annual Emissions (tons/yr)	Total Stack Annual Emissions (tons/yr)	Charging [a,d] AP-42 Emission Factor (lbs/ton)	Charging Annual Emissions (tons/yr)	Pushing [e] Test Data Emission Factor (lbs/ton)	Pushing Annual Emissions (tons/yr)	Quenching [f] Test Data Emission Factor (lbs/ton)	Quenching Annual Emissions (tons/yr)	Total Emissions (tons/yr)
Benzene	71-43-2	4.80E-04	9.00E-03	0%	2.19E-01	2.28E-01	3.60E-05	1.64E-02	NM		ND		2.44E-01
Bromoform	75-25-2	1.20E-06	2.25E-05	0%	5.48E-04	5.70E-04	ND/NR		NM		ND		5.70E-04
Bromomethane	74-83-9	5.60E-04	1.05E-02	0%	2.56E-01	2.66E-01	ND/NR		NM		ND		2.66E-01
2-Butanone	78-93-3	6.30E-05	1.18E-03	0%	2.87E-02	2.99E-02	ND/NR		NM		ND		2.99E-02
Carbon Disulfide	75-15-0	1.60E-05	3.00E-04	0%	7.30E-03	7.60E-03	2.10E-06	9.58E-04	NM		ND		8.56E-03
Chlorobenzene	108-90-7	1.20E-06	2.25E-05	0%	5.48E-04	5.70E-04	ND/NR		NM		ND		5.70E-04
Chloromethane	74-87-3	7.60E-04	1.43E-02	0%	3.47E-01	3.61E-01	2.00E-06	9.13E-04	NM		ND		3.62E-01
Chloroform	67-66-3	1.10E-05	2.06E-04	0%	5.02E-03	5.23E-03	ND/NR		NM		ND		5.23E-03
Cumene	98-82-8	1.40E-06	2.63E-05	0%	6.39E-04	6.65E-04	ND/NR		NM		ND		6.65E-04
Ethyl Benzene	100-41-4	3.20E-06	6.00E-05	0%	1.46E-03	1.52E-03	7.30E-07	3.33E-04	NM		ND		1.85E-03
Hydrogen Chloride [g]	7647-01-0	2.84	53.25	95.0%	64.79	118.04	NM		NM		NM		118.04
Iodomethane	74-88-4	6.30E-06	1.18E-04	0%	2.87E-03	2.99E-03	ND/NR		NM		ND		2.99E-03
Isooctane	540-84-1	1.60E-05	3.00E-04	0%	7.30E-03	7.60E-03	ND/NR		NM		ND		7.60E-03
Methylene Chloride	75-09-2	6.60E-04	1.24E-02	0%	3.01E-01	3.14E-01	ND/NR		NM		ND		3.14E-01
n-Hexane	110-54-3	1.50E-05	2.81E-04	0%	6.84E-03	7.13E-03	ND/NR		NM		ND		7.13E-03
4-Methyl-2-Pentanone	108-10-1	8.90E-06	1.67E-04	0%	4.06E-03	4.23E-03	ND/NR		NM		ND		4.23E-03
2-Methylphenol	95-48-7	ND/NR		-			ND/NR		NM		1.04E-05	4.75E-03	4.75E-03
4-Methylphenol/3-Methylphenol	106-44-5/108-39-4	ND/NR		-			ND/NR		NM		3.35E-05	1.53E-02	1.53E-02
Phenol	108-95-2	7.10E-05	1.33E-03	0%	3.24E-02	3.37E-02	ND/NR		NM		2.44E-05	1.11E-02	4.49E-02
Styrene	100-42-5	6.90E-06	1.29E-04	0%	3.15E-03	3.28E-03	ND/NR		NM		ND		3.28E-03
Tert-butyl Methyl Ether	1634-04-4	4.70E-08	8.81E-07	0%	2.14E-05	2.23E-05	ND/NR		NM		ND		2.23E-05
Tetrachloroethane	25322-20-7	4.10E-07	7.69E-06	0%	1.87E-04	1.95E-04	ND/NR		NM		ND		1.95E-04
1,1,2,2-Tetrachloroethane	79-34-5	2.00E-06	3.75E-05	0%	9.13E-04	9.50E-04	ND/NR		NM		ND		9.50E-04
Toluene	108-88-3	5.10E-04	9.56E-03	0%	2.33E-01	2.42E-01	1.70E-05	7.76E-03	NM		ND		2.50E-01
1,1,1-Trichloroethane	71-55-6	2.50E-06	4.69E-05	0%	1.14E-03	1.19E-03	ND/NR		NM		ND		1.19E-03
1,1,2-Trichloroethane	79-00-5	5.80E-07	1.09E-05	0%	2.65E-04	2.76E-04	ND/NR		NM		ND		2.76E-04
Trichloroethene	79-01-6	8.70E-06	1.63E-04	0%	3.97E-03	4.13E-03	ND/NR		NM		ND		4.13E-03
Vinyl Acetate	108-05-4	6.90E-06	1.29E-04	0%	3.15E-03	3.28E-03	ND/NR		NM		ND		3.28E-03
Xylenes	1330-20-7	1.62E-05	3.04E-04	0%	7.39E-03	7.70E-03	6.70E-06	3.06E-03	NM		ND		1.08E-02
BSO	83730-53-4	ND/NR		-			ND/NR		2.10E-04	9.58E-02	ND		9.58E-02
Total PAHs		2.71E-04	5.08E-03	0%	1.24E-01	1.29E-01	4.40E-05	2.01E-02	NM		7.82E-06	3.57E-03	1.52E-01
Anthracene	120-12-7	part of total PAHs		-			part of total PAHs		NM		part of total PAHs		part of total PAHs
Benzo (b&k) fluoranthene	205-99-2 & 207-80-9	"		-			"		NM		"		"
Benzo (a) pyrene	50-32-8	"		-			"		NM		"		"
Chrysene	218-01-9	"		-			"		NM		"		"
Fluoranthene	206-44-0	"		-			"		NM		"		"
Fluorene	86-73-7	"		-			"		NM		"		"
2-Methylnapthalene	91-57-6	"		-			"		NM		"		"
Naphthalene	91-20-3	"		-			"		NM		"		"
Phenanthrene	85-01-8	"		-			"		NM		"		"
Pyrene	129-00-0	"		-			"		NM		"		"
Antimony	7440-36-0	1.30E-04	2.44E-03	95.0%	2.97E-03	5.40E-03	ND/NR		ND		8.15E-06	3.72E-03	9.12E-03
Arsenic	7440-38-2	1.30E-03	2.44E-02	95.0%	2.97E-02	5.40E-02	2.40E-07	1.10E-04	1.20E-05	5.48E-03	1.62E-04	7.39E-02	1.34E-01
Beryllium	7440-41-7	2.00E-05	3.75E-04	95.0%	4.56E-04	8.31E-04	8.70E-09	3.97E-06	ND		5.38E-07	2.45E-04	1.08E-03
Cadmium	7440-43-9	1.80E-04	3.38E-03	95.0%	4.11E-03	7.48E-03	ND/NR		ND		ND		7.48E-03
Chromium	7440-47-3	6.30E-04	1.18E-02	95.0%	1.44E-02	2.62E-02	1.00E-07	4.56E-05	ND		2.82E-06	1.29E-03	2.75E-02
Cobalt	7440-48-4	ND/NR		-			7.10E-08	3.24E-05	ND		1.73E-06	7.89E-04	8.22E-04
Lead	7439-92-1	4.56E-03	8.55E-02	95.0%	1.04E-01	1.90E-01	1.00E-07	4.56E-05	1.53E-05	6.98E-03	8.69E-05	3.96E-02	2.36E-01
Manganese	7439-96-5	3.00E-04	5.63E-03	95.0%	6.84E-03	1.25E-02	4.60E-07	2.10E-04	2.10E-06	9.58E-04	3.24E-05	1.48E-02	2.84E-02
Mercury [h]	7439-97-6	3.30E-04	6.19E-03	50.0%	7.53E-02	8.15E-02	7.90E-10	3.60E-07	ND		ND		8.15E-02
Nickel	7440-02-0	5.80E-04	1.09E-02	95.0%	1.32E-02	2.41E-02	1.50E-07	6.84E-05	ND		4.09E-06	1.87E-03	2.60E-02
Phosphorus	7723-14-0	1.40E-02	2.63E-01	95.0%	3.19E-01	5.82E-01	ND/NR		ND		7.77E-05	3.55E-02	6.17E-01
Selenium	7782-49-2	3.20E-04	6.00E-03	95.0%	7.30E-03	1.33E-02	ND/NR		ND		1.32E-05	6.02E-03	1.93E-02
Total HAPs (tons/yr)			53.73		66.96	120.70		0.05		0.11		0.21	121.07
Total HAPs wo HCl (tons/year)			0.48		2.17	2.66		0.05		0.11		0.21	3.03
Total HAPs (except HCl) with 20% buffer (tons/year) [i]													3.64

a - Chapter 12.2, "Coke Production," Air Pollutant Emission Factors, AP-42, Fifth Ed., Vol. 1, Lead for uncontrolled coking emission factor from Haverhill April 2006 waste heat stack test.
b - Estimated 0% removal for organic compounds; 95% removal for all metals except mercury
c - Using maximum annual production
d - Controlled emission factors
e - Jewell test data, October 1989, Lead from AP-42
f - Jewell test data, January 1999; lead from Haverhill test data, Aug. 2005
g - Uncontrolled coking emission factor from maximum coal blend specification
h - Minimum 50% mercury removal expected
i - Total HAPs (except HCl) emissions include 20% buffer that recognizes the EF are based on AP-42 emission factors that can change and limited test data.

ND/NR - Not detected or not reported
NM - Not measured
ND - Not detected

MIDDLETOWN COKE COMPANY
URS Corporation CALCULATION SHEET

Signature: A. Tang Date: 07/23/2007 Checked: J. Carson Date: 09/28/2007
Project: Preliminary Calculation - Middletown Coke Company Project No.: 39400297.26000
Subject: Process Data Used in Sample Calculations

	% moisture	MM wet tons/yr	MM dry tons/yr				
Furnace Coke Production:	7.00%	0.6138	0.5709	100	Ovens		
Coal Used	8.00%	0.9125	0.8395	50.0	Short Tons per Charge		
Coke Breeze	7.00%	0.0406	0.0378	46.0	Dry Tons per Charge		
Total Coke (Coke + Breeze)		0.6544	0.6086	35.9	Wet Tons per Push		
				912,500	Tons Coal per Year		
				[Based on 2500 tons wet coal/day charge rate (50x50) ovens)]			

No. of waste heat stacks =	5	
No. of days/yr with waste heat exhausted through each individual waste heat stack =	15	days/yr
Days per year	365	
Days with no gas through individual waste heat stacks	310	
Days with partial (20%) gas through individual waste heat stacks	50	
Days with 100% gas through individual waste heat stacks	5	
Total gas through individual waste heat stacks	4.1%	
654,449 Tons Coke per Year		

Yield: 68.0% (dry coal to dry furnace coke) 4.5% dry coal to dry breeze

	Short Tons		Metric Tons		Short Tons		Metric Tons	
Maximum daily rate =	2,500	tons wet coal/day	2,268	tons wet coal/day	2,300	tons dry coal/day	2,087	tons dry coal/day
Maximum daily coke produced =	1,682	tons wet coke/day	1,526	tons wet coke/day	1,564	tons dry coke/day	1,419	tons dry coke/day
Maximum daily breeze produced =	111	tons wet breeze/day	101	tons wet breeze/day	104	tons dry breeze/day	94	tons dry breeze/day
Total max. coke and breeze produced =	1,793	tons wet coke and breeze/day	1,627	tons wet coke and breeze/day	1,668	tons dry coke and breeze/day	1,513	tons dry coke and breeze/day

100 oven FGD gas stack flowrate = 250,000 dscfm (main stack)

0.9072 Metric ton per Short ton

URS Corporation CALCULATION SHEET **Calc. No.** **1**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to coal unloading.

Basis
Total number of coal transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr

Control method: wet suppression or baghouse. Control efficiency = 70%
(based on Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:
k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
k, particle size multiplier for PM_{10} = 0.35 (from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ = 0.11 (from AP-42, 5th edition)
U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content = 4.80 % (for coal - max for equation)

PM EF (lb/ton coal) = 0.00169
PM_{10} EF (lb/ton coal) = 0.00080
$PM_{2.5}$ EF (lb/ton coal) = 0.00025

Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points * tons coal transferred * (1 - control efficiency/100) *(ton/2000 lb)
= (0.00169 lb/ton coal) * [(number transfer points) * (tons coal handled/transfer point)] * (ton/2000 lb) * (1-control efficiency /100)
= 0.23 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * # transfer points * tons coal transferred * (100% - control efficiency)/100% * (ton/2000 lb)
= (0.00080 lb/ton coal) * [(number transfer points) * (tons coal handled/transfer point)] * (ton/2000 lb) * (1-control efficiency / 100)
= 0.11 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * # transfer points * tons coal transferred * (100% - control efficiency)/100% * (ton/2000 lb)
= (0.00025 lb/ton coal) * [(number transfer points) * (tons coal handled/transfer point)] * (ton/2000 lb) * (1-control efficiency / 100)
= 0.03 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **3**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions from the coal storage piles.
(Includes coal load-in, fugitives from the pile itself, and coal loadout)
Emissions are broken down by part.
Total emissions for all storage piles included.

Part I. Coal Load-In

Purpose
To estimate criteria pollutant emissions due to coal load-in.

Basis
Two storage piles (Open storage piles)
Total number of coal transfer points = 2 (one each) One "live" pile (Pile #2) with underpile conveyors
One "dead" pile (Pile #1)
Load-in by radial stacker
Maximum annual coal charge = 912,500 tons wet coal/yr

Assumptions
Coal load in to Open storage piles
Coal is loaded onto only 1 pile at a time
Assume the maximum annual coal charge for a conservative estimate of emissions
50% of coal loaded to each pile
Control efficiency for fully enclosed points for PM, PM_{10} and $PM_{2.5}$ = 95% (estimated from Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:
k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
k, particle size multiplier for PM_{10} = 0.35 (from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ = 0.11 (from AP-42, 5th edition)
U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content = 4.80 % (for coal - max for equation)

PM EF (lb/ton coal) = 0.00169
PM_{10} EF (lb/ton coal) = 0.00080
$PM_{2.5}$ EF (lb/ton coal) = 0.00025

Potential emissions estimation:

PM (tons/yr) = PM EF * tons coal transferred
= (0.00169 lb/ton coal) * (tons coal handled) * (ton/2000 lb)
= 0.39 tons PM/yr Coal Pile #1
= 0.39 tons PM/yr Coal Pile #2

PM_{10} (tons/yr) = PM_{10} EF * tons coal transferred
= (0.00080 lb/ton coal) * (tons coal handled) * (ton/2000 lb)
= 0.18 tons PM_{10}/yr Coal Pile #1
= 0.18 tons PM_{10}/yr Coal Pile #2

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * tons coal transferred
= (0.00025 lb/ton coal) * (tons coal handled) * (ton/2000 lb)
= 0.06 tons $PM_{2.5}$/yr Coal Pile #1
= 0.06 tons $PM_{2.5}$/yr Coal Pile #2

Part II. Coal Storage Piles

Purpose
To estimate criteria pollutant emissions from the coal storage piles.

Basis

Total Coal Storage acres =	1.2 acres	Coal Pile #1 (Dead Pile)
	1.3 acres	Coal Pile #2 (Live Pile)

Assumptions

Number days pile worked in =	365 days	(worst case - work both piles everyday)
Control efficiency for Open storage pile =	50% (watering)	

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

EF (lb/day/acre) = k * 1.7 * (s/1.5) * ((365-p)/235) * (f/15)

where:

k, particle size multiplier for PM =	1	
k, particle size multiplier for PM_{10} =	0.5	
k, particle size multiplier for $PM_{2.5}$ =	0.2	
s, silt content for coal =	4.6 %	(from AP-42, 5th edition, Table 13.2.4-1)
f, percentage of time that the unobstructed wind speed exceeds ≥5.4 m/s at mean pile height =	29	
p, number of days with ≥0.01 inch of precipitation per year =	130 days	
(for Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)		

PM EF (lb/day/acre) =	10.08
PM_{10} EF (lb/day/acre) =	5.04
$PM_{2.5}$ EF (lb/day/acre) =	2.02

Potential annual emissions:
PM (tons/yr) = PM EF * Acres of pile * days pile worked in * (1 - control efficiency / 100)
= (10.08 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb) * (1-control efficiency/100)

=	1.10	tons PM/yr	Coal Pile #1
=	1.20	tons PM/yr	Coal Pile #2

PM_{10} (tons/yr) = PM_{10} EF * Acres of pile * days pile worked in * (1-control efficiency/100)
= (5.04 lb/day/acre) * (acre) * (365 days/yr) * (ton/2000 lb) * (1-efficiency/100)

=	0.55	tons PM_{10}/yr	Coal Pile #1
=	0.60	tons PM_{10}/yr	Coal Pile #2

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * Acres of pile * days pile worked in * (1-control efficiency/100)
= (2.02 lb/day/acre) * (acre) * (365 days/yr) * (ton/2000 lb) * (1-efficiency/100)

=	0.22	tons $PM_{2.5}$/yr	Coal Pile #1
=	0.24	tons $PM_{2.5}$/yr	Coal Pile #2

URS Corporation CALCULATION SHEET **Calc. No.** **3**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part III. Coal Loadout

Purpose
To estimate criteria pollutant emissions due to coal loadout.

Basis
Storage piles (Open storage piles) 1 Coal Pile #1 (Dead Pile)
1 Coal Pile #2 (Live Pile)
Maximum annual coal charge = 912,500 tons wet coal/yr

Assumptions
Assume coal from coal pile #1 (50% coal) is loaded out to coal pile #2 and emissions are the same as 2 uncontrolled transfer points
Assume 100% coal load out from coal pile #2 from underpile conveyor to the ovens
Assume additional 20% loadout from front end loader (2 uncontrolled points)
Assume the maximum annual coal charge for a conservative estimate of emissions
Control efficiency for load out using Underpile converyor for PM, PM_{10} and $PM_{2.5}$= 95% (Coal Pile #2 only)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

$EF (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.80	% (for coal - max for equation)

PM EF (lb/ton coal) =	0.00169
PM_{10} EF (lb/ton coal) =	0.00080
$PM_{2.5}$ EF (lb/ton coal) =	0.00025

Potential emissions estimation:

PM (tons/yr) = (EF lb/ton coal) * (tons coal handled) *(# transfer points) * (ton/2000 lb) * (1 - efficiency/100)

=	0.771	tons PM/yr	Coal Pile #1 to Coal Pile #2
=	0.039	tons PM/yr	Coal Pile #2
=	0.308	tons PM/yr	Front end loader

PM_{10} (tons/yr) = (EF lb/ton coal) * (tons coal handled) * (# transfer points) * (ton/2000 lb) * (1- efficiency/100)

=	0.365	tons PM_{10}/yr	Coal Pile #1 to Coal Pile #2
=	0.018	tons PM_{10}/yr	Coal Pile #2
=	0.146	tons PM_{10}/yr	Front end loader

$PM_{2.5}$ (tons/yr) = (EF lb/ton coal) * (tons coal handled) * (# transfer points) * (ton/2000 lb) * (1- efficiency/100)

=	0.115	tons $PM_{2.5}$/yr	Coal Pile #1 to Coal Pile #2
=	0.006	tons $PM_{2.5}$/yr	Coal Pile #2
=	0.046	tons $PM_{2.5}$/yr	Front end loader

Part IV. Total Coal Emissions:

Storage Piles

PM (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr)	=	2.26	tons PM/yr total	Coal Pile #1
		1.62	tons PM/yr total	Coal Pile #2
		0.31	tons PM/yr total	Front end loader
PM_{10} (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr)	=	1.10	tons PM_{10}/yr total	Coal Pile #1
		0.80	tons PM_{10}/yr total	Coal Pile #2
		0.15	tons PM_{10}/yr total	Front end loader
$PM_{2.5}$ (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr)	=	0.39	tons $PM_{2.5}$/yr total	Coal Pile #1
		0.30	tons $PM_{2.5}$/yr total	Coal Pile #2
		0.05	tons $PM_{2.5}$/yr total	Front end loader

URS Corporation CALCULATION SHEET **Calc. No.** 3

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Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part V. Total Emissions from All Storage Piles (F002):

PM

Total Coal Storage Piles =	4.19	tons PM/yr	
Total Run of Oven Coke Storage Pile =	1.71	tons PM/yr	(from Calculation No. 10)
Total Emergency Coke Breeze Storage Pile =	0.46	tons PM/yr	(from Calculation No. 16)
Total Emergency Screened Coke Storage Pile =	1.16	tons PM/yr	(from Calculation No. 17)
Total Storage Piles =	7.51	tons PM/yr	

PM_{10}

Total Coal Storage Piles =	2.04	tons PM_{10}/yr	
Total Run of Oven Coke Storage Pile =	0.82	tons PM_{10}/yr	(from Calculation No. 10)
Total Emergency Coke Breeze Storage Pile =	0.23	tons PM_{10}/yr	(from Calculation No. 16)
Total Emergency Screened Coke Storage Pile =	0.55	tons PM_{10}/yr	(from Calculation No. 17)
Total Storage Piles =	3.64	tons PM_{10}/yr	

$PM_{2.5}$

Total Coal Storage Piles =	0.74	tons $PM_{2.5}$/yr	
Total Run of Oven Coke Storage Pile =	0.28	tons $PM_{2.5}$/yr	(from Calculation No. 10)
Total Emergency Coke Breeze Storage Pile =	0.09	tons $PM_{2.5}$/yr	(from Calculation No. 16)
Total Emergency Screened Coke Storage Pile =	0.18	tons $PM_{2.5}$/yr	(from Calculation No. 17)
Total Storage Piles =	1.29	tons $PM_{2.5}$/yr	

URS Corporation CALCULATION SHEET **Calc. No.** 4

Signature: A. Tang Date: 06 /24/2008 Checked: J. Carson Date:06 /27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to coal handling and crushing.

Basis

Total number of coal transfer points = 18 enclosed = 12 unc. = 6
Maximum annual coal charge = 912,500 tons wet coal/yr

Assumptions
Control eff. for fully enclosed transfer points and wet suppression/wet material for PM, PM_{10} and $PM_{2.5}$ 95% (estimated from Ohio RACM Table 2.2.1-2)
Control eff. for fully enclosed coal crushing operations for PM, PM_{10} and $PM_{2.5}$ = 99% (estimated from AP-40 and Ohio RACM)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.80	% (for coal - max for equation)

PM EF (lb/ton coal) =	1.69E-03	for Coal Handling
PM_{10} EF (lb/ton coal) =	7.99E-04	for Coal Handling
$PM_{2.5}$ EF (lb/ton coal) =	2.51E-04	for Coal Handling

Use emission factors for coal sizing from AP-40, Coal Processing Section, Table 1 (same as RACM)

PM EF (lb/ton coal) =	0.16	for Coal Crushing	
PM_{10} EF (lb/ton coal) =	0.08	for Coal Crushing	(PM_{10} assumed to be 50% of PM)
$PM_{2.5}$ EF (lb/ton coal) =	0.024	for Coal Crushing	($PM_{2.5}$ assumed to be 15% of PM)

PM Emissions estimation for Coal Handling

No. points	Throughput	Efficiency	Emissions ton/yr
12	100%	95%	0.4625
6	100%	0%	4.6249
Total			5.087

PM Emissions estimation for Coal Crushing

No. points	Efficiency	Emissions ton/yr
1	99%	0.730
Total		0.730

PM_{10} Emissions estimation for Coal Handling

No. points	Throughput	Efficiency	Emissions ton/yr
12	100%	95%	0.2187
6	100%	0%	2.1875
Total			2.406

PM_{10} Emissions estimation for Coal Crushing

No. points	Efficiency	Emissions ton/yr
1	99%	0.365
Total		0.365

$PM_{2.5}$ Emissions estimation for Coal Handling

No. points	Throughput	Efficiency	Emissions ton/yr
12	100%	95%	0.0687
6	100%	0%	0.6875
Total			0.756

$PM_{2.5}$ Emissions estimation for Coal Crushing

No. points	Efficiency	Emissions ton/yr
1	99%	0.110
Total		0.110

URS Corporation CALCULATION SHEET **Calc. No.** **4**

Signature: A. Tang Date: 06 /24/2008 Checked: J. Carson Date:06 /27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Maximum Emissions for points with 100% of coal throughput - Coal Handling

Enclosed Transfer points

PM (ton/yr) = PM EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) = 0.0385 TPY PM

PM_{10} (ton/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) = 0.0182 TPY PM_{10}

$PM_{2.5}$ (ton/yr) = $PM_{2.5}$ EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) = 0.0057 TPY $PM_{2.5}$

Maximum Emissions for Coal Crushing

TSP (tons/yr) = TSP EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.73 TPY PM

PM_{10} (tons/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.365 TPY PM_{10}

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.110 TPY $PM_{2.5}$

Total Emissions from Coal Handling & Processing (F003):

PM

Coal Unloading =	0.23 tons PM/yr	(from Calculation No.1)
Total Coal Handling =	5.09 tons PM/yr	
Total Coal Crushing =	0.73 tons PM/yr	
Total Coal Handling & Processing =	6.05 tons PM/yr	

PM_{10}

Coal Unloading =	0.11 tons PM_{10}/yr	(from Calculation No.1)
Total Coal Handling =	2.41 tons PM_{10}/yr	
Total Coal Crushing =	0.37 tons PM_{10}/yr	
Total Coal Handling & Processing =	2.88 tons PM_{10}/yr	

$PM_{2.5}$

Coal Unloading =	0.03 tons $PM_{2.5}$/yr	(from Calculation No.1)
Total Coal Handling =	0.76 tons $PM_{2.5}$/yr	
Total Coal Crushing =	0.11 tons $PM_{2.5}$/yr	
Total Coal Handling & Processing =	0.90 tons $PM_{2.5}$/yr	

URS Corporation CALCULATION SHEET **Calc. No.** **5**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date: 06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to the charging of the ovens with coal.

Basis

Maximum annual coal charge =	912,500 tons wet coal/yr	839,500 tons dry coal/yr
Maximum daily coal charge =	3,750 tons wet coal/day	3,450 tons dry coal/day
Number Pusher/Charger machines =	1	46 dry tons/oven
Charges per typical day =	50	50 wet tons/oven

Note: Each oven can only be charged every 48 hours.

Maximum charge rate = 10 ovens/hour
Typically charge 50 ovens/day. For maximum daily charge, assume possible to charge 75 ovens/day
PM = PM filterable
PM_{10} = PM10 total (filterable plus condensable)
$PM_{2.5}$ = $PM_{2.5}$ filterable

Emission Factors:
PM EF (lb/tons coal charged) = 0.027 (uncontrolled)
(from AP-42 Coke Production section, Table 12.2-21 uncontrolled)
PM EF (lb/tons coal charged) = 0.0027 (assuming 90% capture efficiency for emissions controlled by traveling hood and baghouse)
VOC EF (lb/ton coal charged) = 0.0020 Jewell stack test data, Vansant, VA
SO_2 EF (lb/ton coal charged) = 0.0003 Jewell stack test data, Vansant, VA
CO EF (lb/ton coal charged) = 0.0028 Jewell stack test data, Vansant, VA
Lead (lb/ton coal charged) = 1.00E-07 (from AP-42 Coke Production section, Table 12.2-21 controlled) - Add 20% to lead EF for buffer

PM_{10}: Assume PM_{10} = 30% of PM fugitives
Assume PM_{10} = 100% of PM stack

$PM_{2.5}$: Assume $PM_{2.5}$ = 15% of PM fugitives
Assume $PM_{2.5}$ = 100% of PM stack

PM EF =	0.0081 lb/ton	(MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal)
Total PM_{10} EF =	0.016 lb/ton	(MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal - Total PM_{10} with Condensible estimated as 0.016 lb/dry ton coal)
$PM_{2.5}$ EF =	0.0081 lb/ton	(MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal)
Charges per hour =	10	

Emissions Estimation

Fugitive PM

0.027 lb PM/ ton coal charged * 50 wet tons coal/charge * 10 charges/hr * (1-.90) =	1.35 lbs/hr fugitive PM	max. hourly
0.027 lb PM / ton coal charged * 3,750 tons coal charged/day * day/ 24 hrs * (1-.90) =	0.42 lbs/hr fugitive PM	daily restriction
0.027 lb PM / ton coal charged * 912,500 tons coal charged/yr * 1 ton / 2000 lbs * (1-.9	1.23 TPY fugitive PM	annual restriction

Fugitive PM_{10} (30% of PM)

0.3 * max hourly PM	0.41 lbs/hr fugitive PM_{10}	max. hourly
0.3 * daily PM	0.13 lbs/hr fugitive PM_{10}	daily restriction
0.3 * annual PM	0.37 TPY fugitive PM_{10}	annual restriction

Fugitive $PM_{2.5}$ (15% of PM)

0.15 * max hourly PM	0.20 lbs/hr fugitive $PM_{2.5}$	max. hourly
0.15 * daily PM	0.06 lbs/hr fugitive $PM_{2.5}$	daily restriction
0.15 * annual PM	0.18 TPY fugitive $PM_{2.5}$	annual restriction

Stack Filterable PM/$PM_{2.5}$

0.0081 lb/tons dry coal * 46 tons dry coal/charge * 10 charges/hr =	3.73 lbs/hr	max. hourly
0.0081 lb/dry tons coal * 3,450 dry tons/day *day/24 hours =	1.16 lbs/hr	daily restriction
Annual rate = 0.016 lb/drt ton coal charged * 839,500 wet tons coal/yr * 1 ton/2000 lbs =	3.40 TPY	annual restriction

Stack Total PM_{10}

0.016 lb/tons dry coal * 46 tons dry coal/charge * 10 charges/hr =	7.36 lbs/hr	max. hourly
0.016 lb/dry tons coal * 3,450 dry tons/day *day/24 hours =	2.30 lbs/hr	daily restriction
Annual rate = 0.016 lb/drt ton coal charged * 839,500 wet tons coal/yr * 1 ton/2000 lbs =	6.72 TPY	annual restriction

SO_2

0.0003 lb SO_2/wet ton coal charged * 50 wet tons coal /charge * 10 charges / hr =	0.15 lbs SO_2/hr	max. hourly
0.0003 lb SO_2/wet ton coal charged * 3,750 tonscharged/day * 1/24 hr =	0.05 lbs SO_2/hr	daily restriction
0.0003 lb SO_2/wet ton coal charged * 912,500 wet tons coal/yr * 1 ton/2000 lbs =	0.14 TPY SO_2	annual restriction

VOC

0.0020 lb VOC/wet ton coal charged * 50 wet tons/charge * 10 charges/ hr =	1.00 lbs VOC/hr	max. hourly
0.0020 lb VOC/wet ton coal charged * 3,750 tons charged/ day * 1/24 hr =	0.31 lbs VOC/hr	daily restriction
0.0020 lb VOC/wet ton coal charged * 912,500 wet tons coal/yr * 1 ton/2000 lbs =	0.91 TPY VOC	annual restriction

CO

0.0028 lb CO/wet ton coal charged * 50 wet tons/charge * 10 charges/hr =	1.40 lbs CO/hr	max. hourly
0.0028 lb CO/wet ton coal charged * 3,750 tons charged/ day * 1/24 hr =	0.44 lbs CO/hr	daily restriction
0.0028 lb CO/wet ton coal charged * 912,500 wet tons coal/yr * 1 ton/2000 lbs =	1.28 TPY CO	annual restriction

Pb

0.0000001 lb Pb/wet ton coal charged * 50 wet tons/charge * 10 charges/hr * 1.2	6.00E-05 lbs Pb/hr	max. hourly
0.0000001 lb Pb/wet ton coal charged * 3,750 tons charged/ day * 1/24 hr * 1.2 =	1.88E-05 lbs Pb/hr	daily restriction
0.0000001 lb Pb/wet ton coal charged * 912,500 wet tons coal/yr * 1 ton/2000 lbs * 1.2 =	5.48E-05 TPY Pb	annual restriction

URS Corporation CALCULATION SHEET **Calc. No.** **6**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to the coking process.
The waste gas from the HRSGs goes to a lime spray dryer which then exhausts to a baghouse except during HRSG or SD/BH maintenance.

Basis

	Main Stack	Individual Waste Heat Stack	
Maximum annual coal charge =	912,500	7,500	tons wet coal/year
Maximum daily coal charge =	2,500	500	tons wet coal/day
Max Airflow (dscfm) =	250,000	50,000	dscfm total
No. of main stacks =	1		
No. of waste heat stacks =	5		
*No. of days/yr with waste gas exhausted through each individual waste heat stack =		15	

*** Note:** HRSG maintenance:
10 days/yr/HRSG - 1 waste heat stack open at a time
SD/BH Maintenance:
5 days/yr - All waste heat stack open simultaneously

PM = PM filterable
PM_{10} = PM_{10} total (filterable plus condensable)
$PM_{2.5}$ = $PM_{2.5}$ filterable
3-hr SO_2/24-hr SO_2 ratio = 1.2 (same as Haverhill)

Days with all waste gas exhausted through main stack	=	310
Days with 80% waste gas through main stack and 20% through individual waste heat stack	=	50
Days with 0% waste gas through main stack and 100% through individual waste heat stack	=	5
Total gas through individual waste heat stacks	=	4.1%

Emission factors:	Main Stack	Waste Heat Stack	
PM EF (grains/dscf) =	0.005	0.049	(Engineering estimate- Filterable PM - Waste Heat Stack Haverhill Limit)
Total PM_{10} EF (grains/dscf) =	0.011	0.083	(Engineering estimate-Total PM_{10} with condensible)
$PM_{2.5}$ EF (grains/dscf) =	0.005	0.049	(Engineering estimate- Filterable $PM_{2.5}$)
SO_2 EF (lb/tons coal charged) =	23.92	23.92	(Material Balance)
NO_x EF Coking (lb/tons coal charged) =	1	1	(Haverhill Limit)
CO EF (ppm) =	20	20	(Provided by Sun Coke)
VOC EF (ppm)=	10	10	(Provided by Sun Coke)
H_2SO_4 (lb/tons coal charged) =	1.22	1.22	(Haverhill Data)
Uncontrolled HCL EF (lbs/ton wet coal charged)	2.84	2.84	(Maximum coal blend specification)
Uncontrolled Lead EF (lb/tons wet coal charged)	0.00456	0.00456	(Haverhill April 2006 Stack Test) - Add 20% to lead EF for buffer

Assumptions
Main stacks annual emissions based on maximum hourly rate and 8760 hours/year

Lime spray scrubber control efficiency for SO_2=	90%	0%	(engineering estimate)
Lime spray scrubber control efficiency for HCl=	95%	0%	(engineering estimate)
Baghouse control efficiency for lead =	95%	0%	(engineering estimate)
Baghouse control efficiency for H_2SO_4 =	98%	0%	(engineering estimate)

Emissions Estimation

	Main Stack	Individual Waste Heat Stack	Total from Individual Waste Heat Stacks	
Filterable $PM/PM_{2.5}$				
gr $PM/PM_{10}/PM_{2.5}$ /dscf * dscf/min * 60 min/hr * 1 lb/7000 gr =	10.71	21.00		lbs/hr Filterable $PM/PM_{2.5}$
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	46.93	3.78	18.90	TPY Filterable $PM/PM_{2.5}$
Total PM_{10}				
gr $PM/PM_{10}/PM_{2.5}$ /dscf * dscf/min * 60 min/hr * 1 lb/7000 gr =	23.57	35.57		lbs/hr Total PM_{10}
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	103.24	6.40	32.01	TPY Total PM_{10}
SO_2				
Daily average = lb SO_2/ton coal charged * tons charged/day* 1/24 hr * (1-eff.)	249.17	498.33		lbs SO_2/hr
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	1091.35	89.70	448.50	TPY SO_2
3-Hour maximum hourly rate = daily average * 1.2	299.00			lbs SO_2/hr
Uncontrolled SO_2				
lb SO_2/ton coal charged * tons charged/day* 1/24 hr	2491.67			lbs SO_2/hr

URS Corporation CALCULATION SHEET **Calc. No.** **6**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

	Main Stack	Individual Waste Heat Stack	Total from Individual Waste Heat Stacks	
NO_X				
Coking - lb NO_X/ton coal charged * tons charged/day* 1/24 hr	104.17	20.83		lbs NO_X/hr
Coking annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	456.25	3.75	18.75	TPY NO_X
CO				
dscf/min * 60 min/hr * ppm CO * (28/385100000) lb/dscf =	21.81	4.36		lbs/hr CO
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	95.54	0.79	3.93	TPY CO
VOC				
dscf/min * 60 min/hr * ppm VOC * (12/385100000) lb/dscf =	4.67	0.93		lbs/hr VOC
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	20.47	0.17	0.84	TPY VOC
HCL				
Daily = lb HCL/ton coal * tons charged/day* 1/24 hr * (1-eff.)	14.79	59.17		lbs/hr HCL
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	64.79	10.65	53.25	TPY HCL
Pb				
lb Pb/ton coal charged * tons charged/day* 1/24 hr * (1-eff.) * 1.2	0.029	0.114		lbs lead/hr
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb *1.2	0.125	0.021	0.103	TPY lead
Uncontrolled Pb				
lb Pb/ton coal charged * tons charged/day* 1/24 hr * (1-eff.) *1.2	0.570			lbs lead/hr
H_2SO_4				
lb H_2SO_4/ton coal charged * tons charged/day* 1/24 hr * (1-eff.)	2.54	25.42		lbs H_2SO_4/hr
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	11.13	4.58	22.88	TPY H_2SO_4

URS Corporation CALCULATION SHEET **Calc. No.** 7

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date: 06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to the pushing process.

Basis

Maximum annual coal charge =	912,500	tons wet coal/yr (100 Ovens)	Maxium annual production =	654,449	tons wet coke/yr (100 Ovens)
Maximum daily coal charge =	3,750	tons wet coal/day (100 Ovens)	Maximum daily production =	2,690	tons wet coke/day (100 Ovens)
No. of coke cars =	1				
No. of tons coal per charge =	50	wet tons			
No. of tons coke per push =	35.9	wet tons			

Note: Each oven can only be charged every 48 hours.

Maximum charge rate = 10 ovens/hour
Typically charge 50 ovens/day. For maximum daily charge, assume possible to charge 75 ovens/day
PM = PM filterable
PM_{10} = PM10 total (filterable plus condensable)
$PM_{2.5}$ = $PM_{2.5}$ filterable

Emission Factors:

PM EF (lb/ton coke pushed) =	0.04	MACT standard = 0.04 lb/ton coke for mobile device that captures emissions during travel [40 CFR 63.7290 (a) (4)].
Total PM_{10} EF (lb/ton coke pushed) =	0.08	Engineering Estimate for Total PM_{10}. MACT standard = 0.04 lb/ton coke for mobile device that captures emissions during travel [40 CFR 63.7290 (a) (4)]. Estimate Total PM_{10} with condensible = 0.08 lb/ton coke
$PM_{2.5}$ EF (lb/ton coke pushed) =	0.04	MACT standard = 0.04 lb/ton coke for mobile device that captures emissions during travel [40 CFR 63.7290 (a) (4)].
CO EF (lb/tons coal charged) =	0.063	EF from AP-42 Coke Production Section, Table 12.2-9
NO_x EF (lb/tons coal charged) =	0.019	EF from AP-42 Coke Production Section, Table 12.2-9
VOC EF (lb/tons coal charged) =	0.02	Provided by Sun Coke Co.
SO_2 EF (lb/tons coal charged) =	0.098	EF from AP-42 Coke Production Section, Table 12.2-9
Pb EF (lb/tons coal charged)=	1.53E-05	EF from AP-42 Coke Production Section, Table 12.2-10 - Add 20% to lead EF for buffer
H_2SO_4 EF (lb/tons coal charged)=	5.00E-03	Haverhill Data

Charges / Pushes per hour = 10

Uncontrolled Emission Factors:

PM (uncontrolled)	1.96 lbs PM/ton coke	AP-42 Coke Production Section, Table 12.2-6	(adjusted to coke basis using yield, 35.9 tons coke/50 tons coal)
PM_{10} (43.3% of PM)	0.86 lbs PM_{10}/ton coke	AP-42 Coke Production Section, Table 12.2-6	(adjusted to coke basis using yield, 35.9 tons coke/50 tons coal)
$PM_{2.5}$ (16.7% of PM)	0.34 lbs $PM_{2.5}$/ton coke	AP-42 Coke Production Section, Table 12.2-6	(adjusted to coke basis using yield, 35.9 tons coke/50 tons coal)

Potential emissions estimation:

Filterable PM

(0.04 lb/ton coke) * (35.9 wet tons/push) * (10 pushes/hr) =	14.34	lbs PM/hr	max. hourly
(0.04 lb/ton coke) * (tons coke pushed/day) * (day/24 hours) =	4.48	lbs PM/hr	daily restriction
(0.04 lb/ton coke) * (tons coke pushed/yr) * (ton/2000 lb) =	13.09	tons PM/yr	annual restriction

Total PM_{10}

(0.08 lb/ton coke) * (35.9 wet tons/push) * (10 pushes/hr) =	28.69	lbs PM_{10}/hr	max. hourly
(0.08 lb/ton coke) * (tons coke pushed/day) * (day/24 hours) =	8.97	lbs PM_{10}/hr	daily restriction
(0.08 lb/ton coke) * (tons coke pushed/yr) * (ton/2000 lb) =	26.18	tons PM_{10}/yr	annual restriction

Filterable $PM_{2.5}$

(0.04 lb/ton coke) * (35.9 wet tons/push) * (10 pushes/hr) =	14.34	lbs $PM_{2.5}$/hr	max. hourly
(0.04 lb/ton coke) * (tons coke pushed/day) * (day/24 hours) =	4.48	lbs $PM_{2.5}$/hr	daily restriction
(0.04 lb/ton coke) * (tons coke pushed/yr) * (ton/2000 lb) =	13.09	tons $PM_{2.5}$/yr	annual restriction

CO

(0.063 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	31.50	lbs CO/hr	max. hourly
(0.063 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	9.84	lbs CO/hr	daily restriction
(0.063 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	28.74	tons CO/yr	annual restriction

NO_x

(0.019 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	9.50	lbs NO_x/hr	max. hourly
(0.019 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	2.97	lbs NO_x/hr	daily restriction
(0.019 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	8.67	tons NO_x/yr	annual restriction

VOC

(0.02 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	10.00	lbs VOC/hr	max. hourly
(0.02 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	3.13	lbs VOC/hr	daily restriction
(0.02 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	9.13	tons VOC/yr	annual restriction

SO_2

(0.098 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	49.00	lbs SO_2/hr	max. hourly
(0.098 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	15.31	lbs SO_2/hr	daily restriction
(0.098 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	44.71	tons SO_2/yr	annual restriction

Pb

(0.0000153 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) * 1.2	0.009	lbs Pb/hr	max. hourly
(0.0000153 lb/ton coal) * (tons coal charged/day) * (day/24 hours) * 1	0.003	lbs Pb/hr	daily restriction
(0.0000153 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) *1.2 =	0.008	tons Pb/yr	annual restriction

H_2SO_4

(0.005 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	2.50	lbs H_2SO_4/hr	max. hourly
(0.005 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	0.78	lbs H_2SO_4/hr	daily restriction
(0.005 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	2.28	tons H_2SO_4/yr	annual restriction

URS Corporation CALCULATION SHEET **Calc. No.** **8**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to quenching.

Basis

Maximum annual coal charge =	912,500	tons wet coal/yr (100 Ovens)
Maximum daily coal charge =	3,750	tons wet coal/day (100 Ovens)
No. of tons per charge =	50	
Filterable PM EF (lb/tons coal charg	0.12	(Emission factor with baffles as controls; 0.448 lb/ton emission factor from AP-42 with TDS = 1100 mg/l, 73% additional PM control with improved baffle design. Refer to Calc. No. 8A)
Filterable PM_{10} EF (lb/tons coal cha	0.044	(AP-42 5th edition, Coke Production Section, Table 12.2-12, with clean water and baffles)
Filterable $PM_{2.5}$ EF (lb/tons coal cha	0.027	(AP-42 5th edition, Coke Production Section, Table 12.2-12, with clean water and baffles)
Number of quench towers =	1	
Charges per hour =	10	

Potential Emissions estimation:

Filterable PM			
(0.12 lb/ton coal) * (50 tons/charge) * (10 charges/hr) =	60.00	lbs PM/hr	max hourly
(0.12 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	18.75	lbs PM/hr	daily restriction
(0.12 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	54.75	tons PM/yr	annual restriction
Filterable PM_{10}			
(0.044 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	22.00	lbs PM_{10}/hr	max hourly
(0.044 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	6.88	lbs PM_{10}/hr	daily restriction
(0.044 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	20.08	tons PM_{10}/yr	annual restriction
Filterable $PM_{2.5}$			
(0.027 lb/ton coal) * (50 wet tons/charge) * (10 charges /hr) =	13.50	lbs PM_{10}/hr	max hourly
(0.027 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	4.22	lbs PM_{10}/hr	daily restriction
(0.027 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	12.32	tons PM_{10}/yr	annual restriction

URS Corporation CALCULATION SHEET **Calc. No.** **8A**

Signature: A. Tang Date: 09/20/2004 Checked: J. Carson Date: 10/1/2004
Project: Middletown Coke Company Project No.:
Subject: Baffle Efficiency

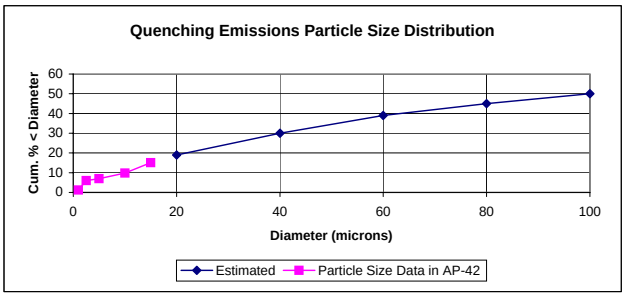
Improved Quench Tower Baffle Performance

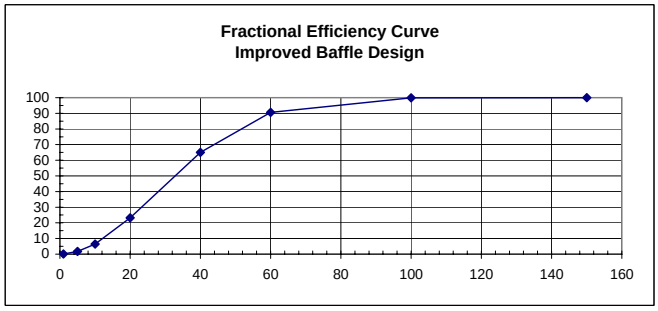
Particle Diameter (um)	% less than Diameter (%)	Size Range (um)	% in range	Average Diameter (um)	Fractional Removal Eff (%)	Fraction Removed (%)	Comment
>100	100	>100	50	100	100	50	Graphically Estimated From EPA Data
100	50	80-100	5	90	98	4.9	"
80	45	60-80	6	70	93	5.6	"
60	39	40-60	8	50	77	6.2	"
40	31	20-40	12	30	45	5.4	"
20	19	15-20	3.9	17.5	20	0.8	"
15	15.1	10-15	5.3	12.5	10	0.5	Particle Size Data in AP-42
10	9.8	5-10	2.8	7.5	5	0.1	"
5	7	2.5-5	1	3.75	1.5	0.02	"
2.5	6	1-2.5	4.8	1.75	0.5	0.02	"
1	1.2	0-1	1.2	0.5	0.05	0.001	"
Total			100			73.5	

	Estimated	Particle Size Data in AP-42
100	50	
80	45	
60	39	
40	30	
20	19	
15		15.1
10		9.8
5		7
2.5		6
1		1.2

Fractional Efficiency Curve for Case 5
from Wayne T. Davis, "Final Report, Coke Quench Tower Modeling Results," August 17, 2003.

Particle Diameter (um)	Fractional Removal Eff (%)
1	0.08
5	1.7
10	6.5
20	23.2
40	65.0
60	90.6
100	99.9
150	100





URS Corporation CALCULATION SHEET **Calc. No.** **9**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to coke screening. The emissions are controlled by a baghouse and are emitted through the baghouse exhaust stack.

Basis

Maximum annual coal charge (requested limit) =	912,500	tons coal/yr
=	654,449	tons coke/yr
Operating hours =	8760	hrs/yr (24 hrs/day, 365 days/yr)
PM Grain loading =	0.008	gr/dscf
PM_{10} grain loading =	0.008	gr/dscf
$PM_{2.5}$ grain loading =	0.008	gr/dscf
Airflow =	50,000	scfm

Potential emissions estimation:

PM (tons/yr) = (grain loading grains/dscf) * (lb/7,000 gr) * (ton/2000 lb) * (airflow scfm) * (60 min/hr) * (operating hrs/yr)
= (0.008 gr/dscf) * (1 lb/7000 gr) * (ton/2000 lb) * (50,000 scfm) * (60 min/hr) * (hr/yr)
= 15.02 tons PM/yr

PM_{10} (tons/yr) = (grain loading grains/dscf) * (lb/7,000 gr) * (ton/2000 lb) * (airflow scfm) * (60 min/hr) * (operating hrs/yr)
= (0.008 gr/dscf) * (1 lb/7000 gr) * (ton/2000 lb) * (50,000 scfm) * (60 min/hr) * (hr/yr)
= 15.02 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = (grain loading grains/dscf) * (lb/7,000 gr) * (ton/2000 lb) * (airflow scfm) * (60 min/hr) * (operating hrs/yr)
= (0.008 gr/dscf) * (1 lb/7000 gr) * (ton/2000 lb) * (50,000 scfm) * (60 min/hr) * (hr/yr)
= 15.02 tons $PM_{2.5}$/yr

Maximum Hourly Emissions:

PM (lb/hr) = (grain loading grains/dscf) * (lb/7,000 gr) * (airflow scfm) * (60 min/hr)
= 3.43 lb PM/hr

PM_{10} (lb/hr) = (grain loading grains/dscf) * (lb/7,000 gr) * (airflow scfm) * (60 min/hr)
= 3.43 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (grain loading grains/dscf) * (lb/7,000 gr) * (airflow scfm) * (60 min/hr)
= 3.43 lb $PM_{2.5}$/hr

Total Emissions from Coke Handling, Screening & Processing (F004):

PM

Coke Screening =	15.02	tons PM/yr	
Total Breeze Loadout =	0.02	tons PM/yr	(from Calculation No.11)
Total Coke Handling =	6.44	tons PM/yr	(from Calculation No.12)
Total Coke Handling, Screening & Processing =	21.47	tons PM/yr	

PM_{10}

Coke Screening =	15.02	tons PM_{10}/yr	
Total Breeze Loadout =	0.01	tons PM_{10}/yr	(from Calculation No.11)
Total Coke Handling =	3.04	tons PM_{10}/yr	(from Calculation No.12)
Total Coke Handling, Screening & Processing =	18.07	tons PM_{10}/yr	

$PM_{2.5}$

Coke Screening =	15.02	tons $PM_{2.5}$/yr	
Total Breeze Loadout =	0.003	tons $PM_{2.5}$/yr	(from Calculation No.11)
Total Coke Handling =	0.96	tons $PM_{2.5}$/yr	(from Calculation No.12)
Total Coke Handling, Screening & Processing =	15.98	tons $PM_{2.5}$/yr	

URS Corporation CALCULATION SHEET **Calc. No.** **10**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions from 1 run of oven coke storage pile.
(Includes coke load-in, fugitives from the pile itself, and coke loadout.)
Emissions for each are broken down by part.

Note: This is an emergency coke stockpile and coke ground storage. However emissions are calculated as though the pile is used 365 days/year.

Basis
Run of plant coke storage = 1.5 acres total

Part I. Coke Load-In

Purpose
To estimate criteria pollutant emissions due to coke loading into run of oven coke storage pile

Basis
Total number of coke transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr
= 654,449 tons wet coke/yr

Assumptions
Assume 1 load-in transfer point.

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:
k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
k, particle size multiplier for PM_{10} = 0.35 (from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ = 0.11 (from AP-42, 5th edition)
U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content = 4.8 %

PM EF (lb/ton coke) = 1.69E-03 for coke load-in
PM_{10} EF (lb/ton coke) = 7.99E-04 for coke load-in
$PM_{2.5}$ EF (lb/ton coke) = 2.51E-04 for coke load-in

Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points * tons coke transferred
= (0.00169 lb/ton coke) * [(1 transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.5528 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * # transfer points * tons coke transferred
= (0.00080. lb/ton coke) * [(1 transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.2615 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * # transfer points * tons coke transferred
= (0.00025 lb/ton coke) * [(1 transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.0822 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **10**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part II. Coke Pile

Purpose
To estimate emissions due to working in the run of oven coke storage pile.

Assumptions
Number days pile worked in = 365 days

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

EF (lb/day/acre) = k * 1.7 * (s/1.5) * ((365-p)/235) * (f/15)

where:

k, particle size multiplier for PM =	1	
k, particle size multiplier for PM_{10} =	0.5	
k, particle size multiplier for $PM_{2.5}$ =	0.2	
s, silt content for coke =	1	%
f, percentage of time that the unobstructed wind speed exceeds≥5.4 m/s at mean pile height =	29	%
p, number of days with ≥0.01 inch of precipitation per year = (for Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)	130	days

PM EF (lb/day/acre) = 2.19 for coke pile
PM_{10} EF (lb/day/acre) = 1.10 for coke pile
$PM_{2.5}$ EF (lb/day/acre) = 0.44 for coke pile

Potential emissions estimation:

PM (tons/yr) = PM EF * Acres of pile * days pile worked in
= (2.19 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.5998 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * Acres of pile * days pile worked in
= (1.10 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.2999 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * Acres of pile * days pile worked in
= (0.44 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.1200 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **10**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part III. Coke Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke loadout from run of oven coke storage pile.

Basis
Total number of coke transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr
= 654,449 tons wet coke/yr

Assumptions
Assume 1 loadout transfer point

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$
where:
k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
k, particle size multiplier for PM_{10} = 0.35 (from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ = 0.11 (from AP-42, 5th edition)
U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content = 4.8 %

PM EF (lb/ton coke) = 1.69E-03 for coke load-out
PM_{10} EF (lb/ton coke) = 7.99E-04 for coke load-out
$PM_{2.5}$ EF (lb/ton coke) = 2.51E-04 for coke load-out

Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points * tons coke transferred
= (EF lb/ton coke) * [(# transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.553 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * # transfer points * tons coke transferred
= (EF lb/ton coke) * [(# transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.261 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * # transfer points * tons coke transferred
= (EF lb/ton coke) * [(# transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.082 tons $PM_{2.5}$/yr

Part IV - Total Emissions from Coke Loadin, Coke Pile, and Coke Loadout from Pile:

Annual Emissions:
PM (tons/yr) = 1.71 tons PM/yr
PM_{10} (tons/yr) = 0.82 tons PM_{10}/yr
$PM_{2.5}$ (tons/yr) = 0.28 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **11**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date: 06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to the coke breeze bunker.

Basis
Total number of coke transfer points = 2
Coke breeze = 40,621 tons wet breeze/yr

Assumptions
Assume coke bin emissions are the same as emissions from two coke transfer points.
The two transfer points represent the loadin and loadout since emissions occur at those times.
Emissions from the bin are negligible when loadin and loadout are not occuring due to the enclosure.
Control efficiency for enclosed points = 70% (estimated from Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coke handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	%

PM EF (lb/ton coke) =	1.69E-03
PM_{10} EF (lb/ton coke) =	7.99E-04
$PM_{2.5}$ EF (lb/ton coke) =	2.51E-04

Potential emissions estimation:

PM (tons/yr) = PM EF * # enclosed transfer points * tons coke breeze transferred/yr * (1 - control efficiency) * (tons/2000 lb)
= (EF lb/ton coke) * [(number enclosed transfer points) * (tons coke breeze/yr)] * (ton/2000 lb) * (1 - efficiency)
= 0.0206 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * # enclosed transfer points * tons coke breeze transferred/yr * (1 - control efficiency) * (tons/2000 lb)
= (EF lb/ton coke) * [(number enclosed transfer points) * (tons coke breeze/yr)] * (ton/2000 lb) * (1 - efficiency)
= 0.0097 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * # enclosed transfer points * tons coke breeze transferred/yr * (1 - control efficiency) * (tons/2000 lb)
= (EF lb/ton coke) * [(number enclosed transfer points) * (tons coke breeze/yr)] * (ton/2000 lb) * (1 - efficiency)
= 0.0031 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **12**

Signature: A. Tang Date: 06 /24/2008 Checked: J. Carson Date:06 /27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to coke handling transfer.

Basis

Total number of coke transfer points =		26	
Number of enclosed transfer points =		20	
Maximum annual coal charge (requested limit) =		912,500	tons wet coal/yr
	=	654,449	tons wet coke/yr

Assumptions
Assume each transfer point handles the maximum annual coke produced based on the maximum annual coal charge rate.

Control efficiency for enclosed points = 70% (based on Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	%

PM EF (lb/ton coke) =	1.69E-03
PM_{10} EF (lb/ton coke) =	7.99E-04
$PM_{2.5}$ EF (lb/ton coke) =	2.51E-04

PM Emissions

No. points	Throughput	Efficiency	Emissions tons/yr
16	100%	70%	2.654
2	120%	70%	0.398
2	20%	70%	0.066
6	100%	0%	3.317
Total			6.435

PM_{10} Emissions

No. points	Throuput	Efficiency	Emissions tons/yr
16	100%	70%	1.255
2	120%	70%	0.188
2	20%	70%	0.031
6	100%	0%	1.569
Total			3.044

$PM_{2.5}$ Emissions

No. points	Throuput	Efficiency	Emissions tons/yr
16	100%	70%	0.394
2	120%	70%	0.059
2	20%	70%	0.010
6	100%	0%	0.493
Total			0.957

Maximum Emissions for points with 100% of coke throughput

Enclosed Transfer points

PM (ton/yr) = PM EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) = 0.1659 TPY PM

PM_{10} (ton/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) = 0.0784 TPY PM_{10}

$PM_{2.5}$ (ton/yr) = $PM_{2.5}$ EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) = 0.0247 TPY $PM_{2.5}$

URS Corporation CALCULATION SHEET **Calc. No.** **13**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions due to paved roads and parking lot

Data
1. Use emission factors developed using Section 13.2.1, AP-42, Paved Roads, Equation (2)

$$EF\ (lb/VMT) = k * (sL/2)^{0.65} * (W/3)^{1.5} * (1-p/4N)$$

where: k = constant

	PM	PM_{10}	$PM_{2.5}$
k	0.082	0.016	0.0040

sL = road surface silt loading (g/sq. meter) , 9.7 for Iron and Steel Industry, Table 13.2.1-4, AP-42
W = mean vehicle weight (tons)
p = number of "wet" days with at least 0.01 in of precipitation during the averaging period
N = number of days in the averaging period (e.g. 365 for annual)

Considering annual averaging period, N = 365, and p = 130 days from Figure 13.2.1-2, AP-42

Emission Factors and Calculation:

Vehicle type	Mean Vehicle Weight (tons)	Vehicle Miles Traveled (VMT)	Percent Use	
Heavy Trucks	27.5	5000	7%	Breeze, lime and FGD byproduct
Maintenance	7.5	30000	43%	
Personal	2.0	35000	50%	

Fleet average weight (tons/vehicle) = 0.10 * 27.5 tons + 0.30 * 7.5 tons + 0.6 * 2 tons = 6.18

	sL	W	p	N			
Vehicle	Silt Loading (g/m^2)	Fleet Average Weight (tons)	# days with >= 0.01 in. rain in the averaging period	# days in the averaging period	PM Emission Factor (lb/VMT)	PM_{10} Emission Factor (lb/VMT)	$PM_{2.5}$ Emission Factor (lb/VMT)
Fleet Average	9.7	6.2	130	365	0.616	0.120	0.030

		Emissions		
Vehicle	Vehicle Miles Traveled (VMT)	PM Emissions (tons/yr)	PM_{10} Emissions (tons/yr)	$PM_{2.5}$ Emissions (tons/yr)
Fleet Average	70,000	21.57	4.21	1.05

Example calculations (Other trucks)
PM Emissions (tons/yr) = VMT * PM EF (lb/VMT) * (ton/2000 lb)
= 50,000 VMT * 0.619 lb/VMT * ton/2000 lb
= 21.57 tons PM/yr

PM_{10} Emissions (tons/yr) = VMT * PM_{10} EF (lb/VMT) * (ton/2000 lb)
= 50,000 VMT * 0.121 lb/VMT * ton/2000 lb
= 4.21 tons PM10/yr

$PM_{2.5}$ Emissions (tons/yr) = VMT * $PM_{2.5}$ EF (lb/VMT) * (ton/2000 lb)
= 50,000 VMT * 0.030 lb/VMT * ton/2000 lb
= 1.05 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **14**

Signature: A. Tang Date: 07/23/2007 Checked: J. Carson Date: 09/28/2007
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions from lime silos.

Basis

Total number of lime silos=	2	
Amount of lime handled per silo =	1,400	lb/hr/silo
Operating hours =	8,760	hrs/yr (worst case = 24 hours/day, 365 days/yr)

Assumptions
Bin vent filter control efficiency: 99% engineering judgment

Calculation
Use emission factor for lime transfer and conveying from AP-42, 5th edition, 2/98, Table 11.17-4

EF (lb/ton) = 2.2 lb/ton

Potential emissions estimation:

PM (tons/yr) = PM EF * lime transferred per silo, lb/hr * operating hours/year * # of silo * (1 - % control efficiency)
= 2.2 lb/ton * 1400 lb/hr * ton/2000 lb * 8760 hr/yr * ton/2000 lb * 2 * (1-0.99)
= 0.135 tons PM/yr for facility

URS Corporation CALCULATION SHEET **Calc. No.** **15**

Signature: A. Tang Date: 07/23/2007 Checked: J. Carson Date: 09/28/2007
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions from flue gas desulfurization dust silos.

Basis

Total number of FGD dust silos =	2	
Amount of FGD dust handled per silo =	3,150	lb/hr
Operating hours =	8,760	hrs/yr (worst case = 24 hours/day, 365 days/yr)

Assumptions

Number of transfer points per silo:	2	(one into silo and one out of silo)
Control efficiency due to enclosure =	80%	Engineering estimate

Calculation:
Use emission factors for material handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	% (engineering judgment)

PM EF (lb/ton) = 1.69E-03

Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points per silo * FGD dust transferred per silo, lb/hr * operating hours * # of silo * (1 - control eff %)
= (0.0017 lb/ton) * (2 transfer points) * (3150 lb/hr) * (ton/2000 lb) * (8760hours/yr) * (ton/2000 lb) * (2) * (1-0.8)
= 0.0093 tons PM/yr

URS Corporation CALCULATION SHEET **Calc. No.** **16**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions from 1 emergency coke breeze storage pile.
(Includes coke breeze load-in, fugitives from the pile itself, and coke breeze loadout.)
Emissions for each are broken down by part.

Note: This is an emergency coke breeze pile
Assume use = 365 days/year

Basis
Coke Breeze storage = 0.2 acres total

Part I. Emergency Coke Breeze Load-In

Purpose
To estimate criteria pollutant emissions due to emergency coke breeze loading into coke breeze storage pile

Basis
Total number of coke transfer points = 1
Coke breeze = 40,621 tons wet breeze/yr (total for 365 days)

Assumptions
Assume 1 load-in transfer point.

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	%

PM EF (lb/ton coke) =	1.69E-03	for emergency coke breeze load-in
PM_{10} EF (lb/ton coke) =	7.99E-04	for emergency coke breeze load-in
$PM_{2.5}$ EF (lb/ton coke) =	2.51E-04	for emergency coke breeze load-in

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet breeze/year * ton/2000 lb
= 0.0343 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * tons wet breeze/year * ton/2000 lb
= 0.0162 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * tons wet breeze/year * ton/2000 lb
= 0.0051 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **16**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part II. Emergency Coke Breeze Pile

Purpose
To estimate emissions due to working in the emergency coke breeze storage pile.

Assumptions

Number days pile worked in = 365 days

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

EF (lb/day/acre) = k * 1.7 * (s/1.5) * ((365-p)/235) * (f/15)

where:

k, particle size multiplier for PM =	1	
k, particle size multiplier for PM_{10} =	0.5	
k, particle size multiplier for $PM_{2.5}$ =	0.2	
s, silt content for coke breeze=	4.9	%
f, percentage of time that the unobstructed wind speed exceeds≥5.4 m/s at mean pile height =	29	%
p, number of days with ≥0.01 inch of precipitation per year = (for Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)	130	days

PM EF (lb/day/acre) =	10.74	for emergency coke breeze pile
PM_{10} EF (lb/day/acre) =	5.37	for emergency coke breeze pile
$PM_{2.5}$ EF (lb/day/acre) =	2.15	for emergency coke breeze pile

Potential emissions estimation:

PM (tons/yr) = PM EF * Acres of pile * days pile worked in
= (10.74 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.3919 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * Acres of pile * days pile worked in
= (5.37 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.1959 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * Acres of pile * days pile worked in
= (2.15 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.0784 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **16**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part III. Emergency Coke Breeze Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke breeze loadout from emergency coke breeze storage pile.

Basis
Total number of coke transfer points = 1
Coke Breeze = 40,621 tons wet breeze/yr (total for 365 days)

Assumptions
Assume 1 loadout transfer point

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	%

PM EF (lb/ton coke) =	1.69E-03	for emergency coke breeze load-out
PM_{10} EF (lb/ton coke) =	7.99E-04	for emergency coke breeze load-out
$PM_{2.5}$ EF (lb/ton coke) =	2.51E-04	for emergency coke breeze load-out

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet breeze/year * ton/2000 lb
= 0.0343 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * tons wet breeze/year * ton/2000 lb
= 0.0162 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * tons wet breeze/year * ton/2000 lb
= 0.0051 tons $PM_{2.5}$/yr

Part IV - Total Emissions from Loadin, Pile, and Loadout from Emergency Coke Breeze Pile:

Annual Emissions:

PM (tons/yr) =	0.46	tons PM/yr
PM_{10} (tons/yr) =	0.23	tons PM_{10}/yr
$PM_{2.5}$ (tons/yr) =	0.09	tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **17**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Purpose
To estimate criteria pollutant emissions from 1 emergency screened coke storage pile.
(Includes coke load-in, fugitives from the pile itself, and coke loadout.)
Emissions for each are broken down by part.

Note: This is an emergency screened coke ground storage

Basis
Emergency screened coke storage = 0.3 acres total
Assume use = 365 days/year

Part I. Emergency Screened Coke Load-In

Purpose
To estimate criteria pollutant emissions due to coke loading into coke storage pile

Basis

Total number of coke transfer points =	1		
Maximum annual coal charge =	912,500	tons wet coal/yr	(total for 365 days)
Maximum furnace coke =	613,828	tons wet coke/yr	(total for 365 days)

Assumptions
Assume 1 load-in transfer point.

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	%

PM EF (lb/ton coke) =	1.69E-03	for coke load-in
PM_{10} EF (lb/ton coke) =	7.99E-04	for coke load-in
$PM_{2.5}$ EF (lb/ton coke) =	2.51E-04	for coke load-in

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet coke/year * ton/2000 lb
= 0.5185 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * tons wet coke/year * ton/2000 lb
= 0.2452 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * tons wet coke/year * ton/2000 lb
= 0.0771 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **17**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part II. Emergency Screened Coke Pile

Purpose
To estimate emissions due to working in the emergency screened coke storage pile.

Assumptions
Number days pile worked in = 365 days

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

EF (lb/day/acre) = k * 1.7 * (s/1.5) * ((365-p)/235) * (f/15)

where:

k, particle size multiplier for PM =	1	
k, particle size multiplier for PM_{10} =	0.5	
k, particle size multiplier for $PM_{2.5}$ =	0.2	
s, silt content for coke =	1	%
f, percentage of time that the unobstructed wind speed exceeds≥5.4 m/s at mean pile height =	29	%
p, number of days with ≥0.01 inch of precipitation per year = (for Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)	130	days

PM EF (lb/day/acre) =	2.19	for emergency screened coke pile
PM_{10} EF (lb/day/acre) =	1.10	for emergency screened coke pile
$PM_{2.5}$ EF (lb/day/acre) =	0.44	for emergency screened coke pile

Potential emissions estimation:

PM (tons/yr) = PM EF * Acres of pile * days pile worked in * ton/2000 lb
= (2.19 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.120 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * Acres of pile * days pile worked in * ton/2000 lb
= (1.10 lb/day/acre) * (acres) * (365days/yr) * (ton/2000 lb)
= 0.060 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * Acres of pile * days pile worked in * ton/2000 lb
= (0.44 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.024 tons $PM_{2.5}$/yr

URS Corporation CALCULATION SHEET **Calc. No.** **17**

Signature: A. Tang Date: 06/24/2008 Checked: J. Carson Date:06/27/2008
Project: Middletown Coke Company Project No.: 39400297.26000
Subject: Pollutant Emissions Calculations

Part III. Emergency Screened Coke Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke loadout from screened coke storage pile.

Basis

Total number of coke transfer points =	1		
Maximum annual coal charge =	912,500	tons wet coal/yr	(total for 365 days)
Maximum annual furnace coke =	613,828	tons wet coke/yr	(total for 365 days)

Assumptions
Assume 1 loadout transfer point

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

$EF\ (lb/ton) = k * 0.0032 * (U/5)^{1.3}/(M/2)^{1.4}$

where:

k, particle size multiplier for PM =	0.74	(from AP-42, 5th edition)
k, particle size multiplier for PM_{10} =	0.35	(from AP-42, 5th edition)
k, particle size multiplier for $PM_{2.5}$ =	0.11	(from AP-42, 5th edition)
U, mean wind speed =	9.9	mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content =	4.8	%

PM EF (lb/ton coke) =	1.69E-03	for coke load-out
PM_{10} EF (lb/ton coke) =	7.99E-04	for coke load-out
$PM_{2.5}$ EF (lb/ton coke) =	2.51E-04	for coke load-out

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet coke/year * ton/2000 lb
= 0.5185 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * tons wet coke/year * ton/2000 lb
= 0.2452 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * tons wet coke/year * ton/2000 lb
= 0.0771 tons $PM_{2.5}$/yr

Part IV - Total Emissions from Coke Loadin, Coke Pile, and Coke Loadout from Screened Coke Pile:

Annual Emissions:

PM (tons/yr) =	1.16	tons PM/yr
PM_{10} (tons/yr) =	0.55	tons PM_{10}/yr
$PM_{2.5}$ (tons/yr) =	0.18	tons $PM_{2.5}$/yr