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		
SO2 removal in spray dryer/baghouse			90%		SD/BH maintenance days/year =			5		
Coal Pile			6.1	acres						
Coke pile			1.5	acres						
Thaw Shed Maximum Fuel Used			19.60	MMcf/yr						

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 car thaw shed w natural gas	PM	7.6	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-2	Natural gas in thaw shed
	PM_{10}	7.6	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-2	Natural gas in thaw shed
	$PM_{2.5}$	7.6	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-2	Natural gas in thaw shed
	SO_2	0.6	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-2	Natural gas in thaw shed
	NOx	100	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-1	Natural gas in thaw shed
	CO	84	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-1	Natural gas in thaw shed
	VOC	5.5	lb/MMCF				AP-42 Section 1.4 Natural gas combustion, Table 1.4-2	Natural gas in thaw shed
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_{10}
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	Draft Final 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	Draft Final AP-42 Coke Production section, Table 12.2-21	Capture efficiency * control efficiency = 90%; PM_{10} = 30% 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	Draft Final 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%	0.016	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_{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%	0.016	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.
	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	Draft Final AP-42 Coke Production section, Table 12.2-21.	Note: emission factor includes baghouse control

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	0.083	gr/dscf	baghouse	99.00%	0.014	Engineering estimate. Particulate from spray dryer also removed in baghouse. Includes estimate for condensable PM (Haverhill 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_{10}	0.083	gr/dscf	baghouse	99.00%	0.014	Engineering estimate. Particulate from spray dryer also removed in baghouse. Includes estimate for condensable PM (Haverhill 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.
	$PM_{2.5}$	0.083	gr/dscf	baghouse	99.00%	0.014	Engineering estimate. Particulate from spray dryer also removed in baghouse. Includes estimate for condensable PM (Haverhill 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.
	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%	0.08	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_{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%	0.08	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.
	CO	0.063	lb/ton coal				Draft Final 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				Draft Final AP-42 Coke Production section, Table 12.2-9	
	NOx	0.019	lb/ton coal				Draft Final AP-42 Coke Production section, Table 12.2-9	
	Lead	1.53E-05	lbs/ton coal				Draft Final AP-42 Coke Production section, Table 12.2-9	
	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	Draft Final 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	Draft Final 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	Draft Final 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 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_{10}

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
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

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 2500
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																	
	PM		PM_{10}		$PM_{2.5}$		SO_2		NO_X		CO		VOC		Lead		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)	Emissions (tons/yr)
Coal Unloading, Storage, and Handling		11.66		5.67		2.02											
Coal Crushing	0.0016	0.73	0.0008	0.37	0.00024	0.11											
Thaw Shed	7.6	0.07	7.6	0.07	7.6	0.07	0.6	0.01	100.0	0.98	84.0	0.82	5.5	0.05			
Charging (fugitive)	0.0027	1.23	0.00081	0.37	0.00041	0.18											
Charging (baghouse) [1]	0.016	6.72	0.016	6.72	0.016	6.72	0.0003	0.14			0.0028	1.28	0.002	0.91	1.00E-07	4.56E-05	neg
Main stack [2]	0.014	131.40	0.014	131.40	0.014	131.40	2.39	1091.35	1.00	456.25	20	95.54	10	20.47	2.28E-04	0.10	11.13
Individual waste heat stacks [2]	0.083	32.01	0.083	32.01	0.083	32.01	23.92	448.50	1.00	18.75	20	3.93	10	0.84	4.56E-03	0.09	22.88
Pushing (collector) [3]	0.080	26.18	0.080	26.18	0.080	26.18	0.098	44.71	0.019	8.67	0.063	28.74	0.020	9.13	1.53E-05	6.98E-03	2.28
Quenching [4]	0.12	54.75	0.044	20.08	0.027	12.32									8.69E-05	3.96E-02	
Coke screening [5]	0.008	15.02	0.008	15.02	0.008	15.02											
Coke Storage, Handling, and Loadout		4.95		2.36		0.77											
Lime Silo		0.13		0.13		0.13											
FGD Silo		0.01		0.01		0.01											
Paved Roads & Parking		15.48		3.02		0.76											
Total		**300.36**		**243.40**		**227.70**		**1584.71**		**484.65**		**130.31**		**31.41**		**0.24**	**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

Notes for emissions spreadsheet:

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

Coke screening baghouse gas flow = 50,000 dscfm

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	Coal Transfer #1	100%	Enc	0.0088	0.0042	0.0013
x3	Transfer to Stacker Conveyor	100%	Unc	0.1760	0.0832	0.0262
x4	Transfer to Stacker	100%	Unc	0.1760	0.0832	0.0262
x5 - x9	Coal Storage Pile In	20%	Unc	0.1760	0.0832	0.0262
x10	Coal Storage Pile		Controlled	1.2809	0.6404	0.2562
x11 - x15	Coal Storage Pile Out	20%	Enc	0.0088	0.0042	0.0013
x16 - x20	Transfer to Stockpile Reclaim Transfer Conveyor	20%	Enc	0.0088	0.0042	0.0013
x21	Coal Transfer #2	100%	Enc	0.0088	0.0042	0.0013
x22	Transfer to Coal Crushing Tower	100%	Enc	0.0088	0.0042	0.0013
x23	Coal Crushing	100%	Controlled	0.1667	0.0833	0.0250
x24	Transfer to Silo Feed Conveyor	100%	Enc	0.0088	0.0042	0.0013
x25	Transfer to Silo	100%	Enc	0.0088	0.0042	0.0013
x26	Transfer to Batch Bin	100%	Enc	0.0088	0.0042	0.0013
x27	Transfer to tripper conveyor	100%	Unc	0.1760	0.0832	0.0262
x28	Tripper point 1	100%	Unc	0.1760	0.0832	0.0262
x29	Tripper point 2	100%	Unc	0.1760	0.0832	0.0262
x30	Tripper point 3	100%	Unc	0.1760	0.0832	0.0262
x31	Extra Coal Transfer Point #1	100%	Enc	0.0088	0.0042	0.0013
x32	Extra Coal Transfer Point #2	100%	Enc	0.0088	0.0042	0.0013
x33	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 #2 (Stacking Conveyor)	100%	Partial	0.0379	0.0179	0.0056
y6	Coke emergency storage pile in	100%	Partial	0.0379	0.0179	0.0056
y7	Coke emergency storage pile wind		Unc	0.1369	0.0685	0.0274
y8	Coke emergency storage pile out	100%	Unc	0.1262	0.0597	0.0188
y9	Unloading to Hopper	100%	Unc	0.1262	0.0597	0.0188
y10	Coke Transfer #3	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 Coke Transfer #3	20%	Enc	0.0076	0.0036	0.0011
y14	Coke Loadout to boom	100%	Enc	0.0379	0.0179	0.0056
y15	Transfer Breeze to Bunker	6%	Enc	0.0024	0.0011	0.0004
y16	Breeze loadout	6%	Enc	0.0024	0.0011	0.0004
y17	Coke Transfer #4	100%	Enc	0.0379	0.0179	0.0056
y18	Coke Transfer #5	100%	Enc	0.0379	0.0179	0.0056
y19	Extra Coke Transfer Point #1	100%	Enc	0.0379	0.0179	0.0056
y20	Extra Coke Transfer Point #2	100%	Enc	0.0379	0.0179	0.0056
y21	Extra Coke Transfer Point #3	100%	Enc	0.0379	0.0179	0.0056
	Vehicles			3.54	0.69	0.17
	Total fugitive			7.50	2.61	0.83
	Annual (tpy)					
	Coal handling			12.39	6.03	2.13
	Coke handling			4.95	2.36	0.77
	Vehicles			15.48	3.02	0.76
	Total annual fugitive (tpy)			**32.83**	**11.41**	**3.65**

Maximum Production data:

Maximum daily rate =	2,500	tons wet coal/day
Maximum daily furnace coke =	1,682	tons wet coke/day
Maximum ROV coke =	1,793	tons wet coke/day

Coal Pile 5 piles

Conv. Transfer	**PM EF (lb/ton)**	**PM10 EF (lb/ton)**	**PM2.5 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			
- controlled (lb/acre/day)	5.04	2.52	1.01

Middletown Coke Company

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 DRAFT [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 DRAFT 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

a - DRAFT Final 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 Draft Final 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

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

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
Coal Used	8.00%	0.9125	0.8395
Coke Breeze	7.00%	0.0406	0.0378
Total Coke (Coke + Breeze)		0.6544	0.6086

100	Ovens
50.0	Short Tons per Charge
46.0	Dry Tons per Charge
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 he
No. of days/yr with waste heat exhausted through each individual waste h
Da
Days with no gas through individual waste
Days with partial (20%) gas through individual waste
Days with 100% gas through individual waste
Total gas through individual waste h
654,44

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	2268	tons wet coal/day	2,300	tons dry coal/day	2087	tons dry coal/day
Maximum daily coke produced =	1,682	tons wet coke/day	1526	tons wet coke/day	1,564	tons dry coke/day	1419	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	1627	tons wet coke and breeze/day	1,668	tons dry coke and breeze/day	1513	tons dry coke and breeze/day

0.9072 Metric ton per Short ton

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

Signature: A. Tang Date: 11/13/2007 Checked: J. Carson Date:11/15/2007
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
Maximum daily coal charge =	2,500	tons wet coal/day

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

Maximum Hourly Emissions:

PM (lb/hr) = (tons/day) * (0.00169 lb/ton coal) * (1-0.7) * (day/24 hours) * (1 transfer point)
= 0.0528 lb PM/hr

PM_{10} (lb/hr) = (tons/day) * (0.00080 lb/ton coal) * (1-0.7) * (day/24 hours) * (1 transfer point)
= 0.0250 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (tons/day) * (0.00025 lb/ton coal) * (1-0.7) * (day/24 hours) * (1 transfer point)
= 0.0078 lb $PM_{2.5}$/hr

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 due to thaw shed burners.

Basis
Combined size of all burners ~20MMBtu/hr
Natural Gas Heat Content ~1020 Btu/cf

Total hours operated =	1,000	hr
Maximum hourly usage of fuel =	0.0196	MMcf/hr
Maximum fuel used =	19.60	MMcf/yr

Emission Factor

PM EF (lbs/MMscf) =	7.6	AP-42 Section 1.4 Natural gas combustion, Table 1.4-2
PM_{10} EF (lbs/MMscf) =	7.6	AP-42 Section 1.4 Natural gas combustion, Table 1.4-2
$PM_{2.5}$ EF (lbs/MMscf) =	7.6	AP-42 Section 1.4 Natural gas combustion, Table 1.4-2
VOC EF (lbs/MMscf) =	5.5	AP-42 Section 1.4 Natural gas combustion, Table 1.4-2
SO_2 EF (lbs/MMscf) =	0.6	AP-42 Section 1.4 Natural gas combustion, Table 1.4-2
NO_x EF (lbs/MMscf) =	100	AP-42 Section 1.4 Natural gas combustion, Table 1.4-1
CO EF (lbs/MMscf) =	84	AP-42 Section 1.4 Natural gas combustion, Table 1.4-1

Potential emissions estimation:

PM (tons/yr) = PM EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.07 tons PM/yr

PM_{10} (tons/yr) =PM_{10} EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.07 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.07 tons $PM_{2.5}$/yr

VOC (tons/yr) = VOC EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.05 tons VOC/yr

SO_2 (tons/yr) = SO_2 EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.01 tons SO_2/yr

NOx (tons/yr) = NOx EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.98 tons NOx/yr

CO (tons/yr) = CO EF (lb/MMcf) * Maximum Fuel Used (MMcf/yr) * (ton/2000 lb)
= 0.82 tons CO/yr

Signature: A. Tang Date: 11/13/2007 Checked: J. Carson Date:11/15/2007
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
Five storage piles (Open storage piles)

Total number of coal transfer points =	5	(one each)
Maximum annual coal charge =	912,500	tons wet coal/yr
Maximum daily coal charge =	2,500	tons wet coal/day

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.
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)
= 0.77 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * tons coal transferred
= (0.00080 lb/ton coal) * (tons coal handled) * (ton/2000 lb)
= 0.36 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * tons coal transferred
= (0.00025 lb/ton coal) * (tons coal handled) * (ton/2000 lb)
= 0.11 tons $PM_{2.5}$/yr

Maximum Hourly Emissions:

PM (lb/hr) = (tons/day) * (day/24 hours) * (0.00169 lb/ton coal)
= 0.176 lb PM/hr

PM_{10} (lb/hr) = (tons/day) * (day/24 hours) * ((0.00080 lb/ton coal)
= 0.083 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (tons/day) * (day/24 hours) * ((0.00025 lb/ton coal)
= 0.026 lb $PM_{2.5}$/hr

Part II. Coal Storage Piles

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

Basis
Total Coal Storage acres = 6.1 acres (5 Piles - 1.22 acres each)

Assumptions
Number days pile worked in = 365 days
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 Haverhill, 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)
= 5.61 tons PM/yr

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)
= 2.81 tons PM_{10}/yr

$PM_{2.5}$ (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)
= 1.12 tons PM_{10}/yr

Maximum Hourly Emissions:
PM (lb/hr) = (tons emissions/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 1.28 lb PM/hr

PM_{10} (lb/hr) = (tons emissions /yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.64 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (tons emissions /yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.26 lb $PM_{2.5}$/hr

Uncontrolled Maximum Hourly Emissions:
PM (lb/hr) = (tons emissions/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 2.56 lb PM/hr

PM_{10} (lb/hr) = (tons emissions /yr) * (2000 lb/ton) * (yr/8760 hrs)
= 1.28 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (tons emissions /yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.51 lb $PM_{2.5}$/hr

Part III. Coal Loadout

Purpose
To estimate criteria pollutant emissions due to coal loadout.

Basis
Five storage piles (Open storage piles)

Total number of coal transfer points =	5	(one each)
Maximum annual coal charge =	912,500	tons wet coal/yr
Maximum daily coal charge =	2,500	tons wet coal/day

Assumptions
Assume coal load out from all piles to be from Underpile conveyor
Coal is loaded out of only 1 pile at a time
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%

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

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

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

Maximum Hourly Emissions:

PM (lb/hr) = (EF lb/ton coal) * (tons/day) * (1 -control efficiency/100) * (day/24 hours)
= 0.0088 lb PM/hr

PM_{10} (lb/hr) = (EF lb/ton coal) * (tons/day) * (100% -control efficiency/100) * (day/24 hours)
= 0.0042 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (EF lb/ton coal) * (tons/day) * (100% -control efficiency/100) * (day/24 hours)
= 0.0013 lb $PM_{2.5}$/hr

Part IV. Total Coal Emissions:

Open Storage Pile

PM (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr)
= 6.42 tons PM/yr total

PM_{10} (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr)
= 3.19 tons PM_{10}/yr total

$PM_{2.5}$ (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr)
= 1.24 tons $PM_{2.5}$/yr total

PM (lb/hr) = coal load-in (lb/hr) + coal pile (lb/hr) + coal loadout (lb/hr)
= 1.47 lb/hr total

PM_{10} (lb/hr) = coal load-in (lb/hr) + coal pile (lb/hr) + coal loadout (lb/hr)
= 0.73 lb/hr total

$PM_{2.5}$ (lb/hr) = coal load-in (lb/hr) + coal pile (lb/hr) + coal loadout (lb/hr)
= 0.28 lb/hr total

Part V. Total Emissions from All Storage Piles:

PM

Total Coal Storage Piles	=	6.42	tons PM/yr	
Total Coke Storage Piles	=	1.32	tons PM/yr	(from Calculation No. 10)
Total Storage Piles		7.74	tons PM/yr	

PM_{10}

Total Coal Storage Piles	=	3.19	tons PM_{10}/yr	
Total Coke Storage Piles	=	0.64	tons PM_{10}/yr	(from Calculation No. 10)
Total Storage Piles		3.83	tons PM_{10}/yr	

$PM_{2.5}$

Total Coal Storage Piles	=	1.24	tons $PM_{2.5}$/yr	
Total Coke Storage Piles	=	0.23	tons $PM_{2.5}$/yr	(from Calculation No. 10)
Total Storage Piles		1.47	tons $PM_{2.5}$/yr	

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 due to coal handling and crushing.

Basis

Total number of coal transfer points = 20 enclosed = 9 (100%) 5 (20%) unc. = 6
Maximum annual coal charge = 912,500 tons wet coal/yr
Maximum daily coal charge = 2,500 tons wet coal/day

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, PM10 and PM2.5 = 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	lbs/hr
9	100%	95%	0.3469	0.079
5	20%	95%	0.0385	0.009
6	100%	0%	4.6249	1.056
Total			5.010	1.144

PM Emissions estimation for Coal Crushing

No. points	Efficiency	Emissions	
		ton/yr	lbs/hr
1	99%	0.730	0.167
Total		0.730	0.167

PM_{10} Emissions estimation for Coal Handling

No. points	Throughput	Efficiency	Emissions	
			ton/yr	lbs/hr
9	100%	95%	0.1641	0.037
5	20%	95%	0.0182	0.004
6	100%	0%	2.1875	0.499
Total			2.370	0.541

PM_{10} Emissions estimation for Coal Crushing

No. points	Efficiency	Emissions	
		ton/yr	lbs/hr
1	99%	0.365	0.083
Total		0.365	0.083

$PM_{2.5}$ Emissions estimation for Coal Handling

No. points	Throughput	Efficiency	Emissions	
			ton/yr	lbs/hr
9	100%	95%	0.0516	0.012
5	20%	95%	0.0057	0.001
6	100%	0%	0.6875	0.157
Total			0.745	0.170

$PM_{2.5}$ Emissions estimation for Coal Crushing

No. points	Efficiency	Emissions	
		ton/yr	lbs/hr
1	99%	0.110	0.025
Total		0.110	0.025

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

Enclosed Transfer points

PM (lb/hr) = PM EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.0088 lb PM/hr
PM (ton/yr) = PM EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) =	0.0385 TPY PM
PM_{10} (lb/hr) = PM_{10} EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.0042 lb PM_{10}/hr
PM_{10} (ton/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) =	0.0182 TPY PM_{10}
$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.0013 lb $PM_{2.5}$/hr
$PM_{2.5}$ (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 (lb/hr) = TSP EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.167 lb PM/hr
TSP (tons/yr) = TSP EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) =	0.73 TPY PM
PM_{10} (lb/hr) = PM_{10} EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.083 lb PM_{10}/hr
PM_{10} (tons/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) =	0.365 TPY PM_{10}
$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.025 lb $PM_{2.5}$/hr
$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) =	0.110 TPY $PM_{2.5}$

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

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 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 =	2,500	tons wet coal/day	2,300	tons drycoal/day
Number Pusher/Charger machines =	1		46	dry tons/oven
Charges per day =	50		50	wet tons/oven

Note: Each oven can only be charged every 48 hours. Inherently limited to 50 charges per day.

Emission Factors:

PM EF (lb/tons coal charged) =	0.027	(uncontrolled) (from Draft Final 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 Draft Final AP-42 Coke Production section, Table 12.2-21 controlled)

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

Total PM EF =	0.016	lb/ton	(MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal - Total PM with Condensible estimated as 0.016 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)
Total $PM_{2.5}$ EF =	0.016	lb/ton	(MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal - Total $PM_{2.5}$ with Condensible estimated as 0.016 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 * 2,500 tons coal charged/day * day/ 24 hrs * (1-.90) =	0.28	lbs/hr fugitive PM	daily restriction
0.027 lb PM / ton coal charged * 912,500 tons coal charged/yr * 1 ton / 2000 lbs * (1-.90)	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	0.08	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	0.04	lbs/hr fugitive $PM_{2.5}$	daily restriction
0.15 * annual PM	0.18	TPY fugitive $PM_{2.5}$	annual restriction

Uncontrolled Fugitive PM

0.027 lb PM / ton coal charged * 50 wet tons coal/charge * 10 charges/hr =	13.5	lbs/hr fugitive PM	max. hourly
0.027 lb PM / ton coal charged * 2,500 tons coal charged/day * day/ 24 hrs =	2.81	lbs/hr fugitive PM	daily restriction
0.027 lb PM / ton coal charged * 912,500 tons coal charged/yr * 1 ton / 2000 lbs =	12.32	TPY fugitive PM	annual restriction

Uncontrolled Fugitive PM_{10} (30% of PM)

0.3 * max hourly PM	4.05	lbs/hr fugitive PM_{10}	max. hourly
0.3 * daily PM	0.84	lbs/hr fugitive PM_{10}	daily restriction
0.3 * annual PM	3.70	TPY fugitive PM_{10}	annual restriction

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

0.15 * max hourly PM	2.03	lbs/hr fugitive $PM_{2.5}$	max. hourly
0.15 * daily PM	0.42	lbs/hr fugitive $PM_{2.5}$	daily restriction
0.15 * annual PM	1.85	TPY fugitive $PM_{2.5}$	annual restriction

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

Stack Total $PM/PM_{10}/PM_{2.5}$

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 * 46 dry tons coal/day * 50 charges/day *day/24 hours =	1.53	lbs/hr	daily restriction
Annual rate = daily rate (lbs/hour) * 8,760 hours/year * 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 * 2500 tonscharged/day * 1/24 hr =	0.03	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 * 2500 tons charged/ day * 1/24 hr =	0.21	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 * 2500 tons charged/ day * 1/24 hr =	0.29	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 =	5.00E-05	lbs Pb/hr	max. hourly
0.0000001 lb Pb/wet ton coal charged * 2500 tons charged/ day * 1/24 hr =	1.04E-05	lbs Pb/hr	daily restriction
0.0000001 lb Pb/wet ton coal charged * 912,500 wet tons coal/yr * 1 ton/2000 lbs =	4.56E-05	TPY Pb	annual restriction

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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

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:

Total PM EF (grains/dscf) =	0.014	0.083	(Engineering estimate-Total PM with condensible)
Total PM_{10} EF (grains/dscf) =	0.014	0.083	(Engineering estimate-Total PM_{10} with condensible)
Total $PM_{2.5}$ EF (grains/dscf) =	0.014	0.083	(Engineering estimate-Total $PM_{2.5}$ with condensible)
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)

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	Total Emissions from all stacks	
Total $PM/PM_{10}/PM_{2.5}$					
gr $PM/PM_{10}/PM_{2.5}$ /dscf * dscf/min * 60 min/hr * 1 lb/7000 gr =	30.00	35.57	35.57	65.57	lbs/hr Total $PM/PM_{10}/PM_{2.5}$
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	131.40	6.40	32.01	163.41	TPY Total $PM/PM_{10}/PM_{2.6}$
SO_2					
Daily average = lb SO_2/ton coal charged * tons charged/day* 1/24 hr * (1-eff.)	249.17	498.33	498.33	747.50	lbs SO_2/hr
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	1091.35	89.70	448.50	1539.85	TPY SO_2
Uncontrolled SO_2					
lb SO_2/ton coal charged * tons charged/day* 1/24 hr	2491.67				lbs SO_2/hr

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Subject: Pollutant Emissions Calculations

	Main Stack	Individual Waste Heat Stack	Total from Individual Waste Heat Stacks	Total Emissions from all stacks	
NO_X					
Coking - lb NO_X/ton coal charged * tons charged/day* 1/24 hr	104.17	20.83	20.83	125.00	lbs NO_X/hr
Coking annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	456.25	3.75	18.75	475.00	TPY NO_X
CO					
dscf/min * 60 min/hr * ppm CO * (28/385100000) lb/dscf =	21.81	4.36	4.36	26.18	lbs/hr CO
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	95.54	0.79	3.93	99.47	TPY CO
VOC					
dscf/min * 60 min/hr * ppm VOC * (12/385100000) lb/dscf =	4.67	0.93	0.93	5.61	lbs/hr VOC
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	20.47	0.17	0.84	21.31	TPY VOC
HCL					
Daily = lb HCL/ton coal * tons charged/day* 1/24 hr * (1-eff.)	14.79	59.17	59.17	73.96	lbs/hr HCL
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	64.79	10.65	53.25	118.04	TPY HCL
Pb					
lb Pb/ton coal charged * tons charged/day* 1/24 hr * (1-eff.)	0.024	0.095	0.10	0.12	lbs lead/hr
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	0.104	0.017	0.086	0.19	TPY lead
Uncontrolled Pb					
lb Pb/ton coal charged * tons charged/day* 1/24 hr * (1-eff.)	0.475				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	25.42	27.96	lbs H_2SO_4/hr
Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb	11.13	4.58	22.88	34.01	TPY H_2SO_4

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

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 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 =	2,500	tons wet coal/day (100 Ovens)	Maximum daily production =	1,793	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. Inherently limited to 50 pushes per day.

Emission Factors:

Total PM EF (lb/ton coke pushed) =	0.08	Engineering Estimate for Total PM/PM $_{10}$/PM$_{2.5}$. MACT standard = 0.04 lb/ton coke for mobile device that captures emissions during travel [40 CFR 63.7290 (a) (4)]. Estimate Total PM/PM $_{10}$/PM$_{2.5}$ with condensible = 0.08 lb/ton coke
Total PM$_{10}$ EF (lb/ton coke pushed) =	0.08	
Total PM$_{2.5}$ EF (lb/ton coke pushed) =	0.08	
CO EF (lb/tons coal charged) =	0.063	Draft Final EF from AP-42 Coke Production Section, Table 12.2-9
NO_X EF (lb/tons coal charged) =	0.019	Draft Final 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	Draft Final EF from AP-42 Coke Production Section, Table 12.2-9
Pb EF (lb/tons coal charged)=	1.53E-05	Draft Final EF from AP-42 Coke Production Section, Table 12.2-10
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	Draft Final 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	Draft Final 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	Draft Final 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:

Total PM

(0.08 lb/ton coke) * (35.9 wet tons/push) * (10 pushes/hr) =	28.69	lbs PM/hr	max. hourly
(0.08 lb/ton coke) * (tons coke pushed/day) * (day/24 hours) =	5.98	lbs PM/hr	daily restriction
(0.08 lb/ton coke) * (tons coke pushed/yr) * (ton/2000 lb) =	26.18	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) =	5.98	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

Total PM$_{2.5}$

(0.08 lb/ton coke) * (35.9 wet tons/push) * (10 pushes/hr) =	28.69	lbs PM$_{2.5}$/hr	max. hourly
(0.08 lb/ton coke) * (tons coke pushed/day) * (day/24 hours) =	5.98	lbs PM$_{2.5}$/hr	daily restriction
(0.08 lb/ton coke) * (tons coke pushed/yr) * (ton/2000 lb) =	26.18	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) =	6.56	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) =	1.98	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) =	2.08	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) =	10.21	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) =	0.008	lbs Pb/hr	max. hourly
(0.0000153 lb/ton coal) * (tons coal charged/day) * (day/24 hours) =	0.002	lbs Pb/hr	daily restriction
(0.0000153 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	0.007	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) =	0.52	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: 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 due to quenching.

Basis

Maximum annual coal charge =	912,500	tons wet coal/yr (100 Ovens)
Maximum daily coal charge =	2,500	tons wet coal/day (100 Ovens)
No. of tons per charge =	50	
PM EF (lb/tons coal charged) =	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. 5A)
PM_{10} EF (lb/tons coal charged) =	0.044	(Draft Final AP-42 5th edition, Coke Production Section, Table 12.2-12, with clean water and baffles)
PM_{10} EF (lb/tons coal charged) =	0.027	(Draft Final 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:

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) =	12.50	lbs PM/hr	daily restriction
(0.12 lb/ton coal) * (tons coal charged/yr) * (ton/2000 lb) =	54.75	tons PM/yr	annual restriction

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) =	4.58	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

$PM_{2.5}$

(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) =	2.81	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

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

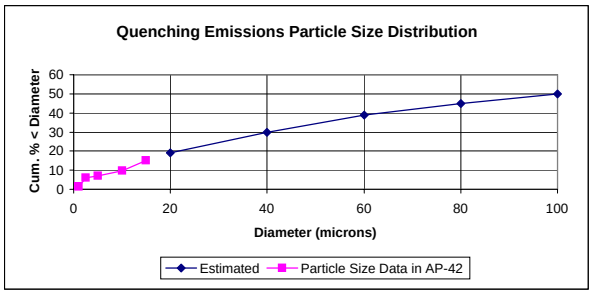
Improved Quench Tower Baffle Performance

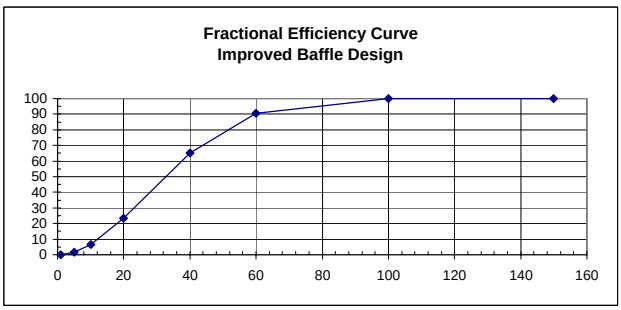
Particle Diameter (um)	% less than Diameter (%)	Size Range (um)	% in range	Average Diameter (um)	Fractional Removal Eff (%)	Fraction Removed (%)	Comment
>100	100	>100	50	100	100	50	Graphically Estimated From EPA Data
100	50	80-100	5	90	98	4.9	"
80	45	60-80	6	70	93	5.6	"
60	39	40-60	8	50	77	6.2	"
40	31	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: 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 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) * (45,000 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) * (45,000 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) * (45,000 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

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 1 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.

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 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
Maximum daily coke produced =		1,793	tons wet coke/day

Assumptions
Assume 1 load-in transfer point per pile.
Control efficiency for partially enclosed points = 70% (based on Ohio RACM Table 2.2.1-2 for coke handling)

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 * (1 - control efficiency/100)
= (0.00169 lb/ton coke) * [(1 transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb) * (1 - efficiency/100)
= 0.1659 tons PM/yr

PM_{10} (tons/yr) = PM_{10} EF * # transfer points * tons coke transferred * (1 - control efficiency)
= (0.00080. lb/ton coke) * [(1 transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb) * (1 - efficiency/100)
= 0.0784 tons PM_{10}/yr

$PM_{2.5}$ (tons/yr) = $PM_{2.5}$ EF * # transfer points * tons coke transferred * (1 - control efficiency)
= (0.00025 lb/ton coke) * [(1 transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb) * (1 - efficiency/100)
= 0.0247 tons $PM_{2.5}$/yr

Maximum Hourly emissions:

PM (lb/hr) = PM EF * # enclosed transfer points * max daily tons coke transferred * (1 - control efficiency/100) * (day/24 hours)
= 0.0379 lb PM/hr

PM_{10} (lb/hr) = PM_{10} EF * # enclosed transfer points * max daily tons coke transferred * (1 - control efficiency/100) * (day/24 hours)
= 0.0179 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF * # enclosed transfer points * max daily tons coke transferred * (1 - control efficiency/100) * (day/24 hours)
= 0.0056 lb $PM_{2.5}$/hr

Uncontrolled Maximum Hourly emissions:

PM (lb/hr) = PM EF * # enclosed transfer points * max daily tons coke transferred * (day/24 hours)
= 0.1262 lb PM/hr

PM_{10} (lb/hr) = PM_{10} EF * # enclosed transfer points * max daily tons coke transferred * (day/24 hours)
= 0.0597 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF * # enclosed transfer points * max daily tons coke transferred * (day/24 hours)
= 0.0188 lb $PM_{2.5}$/hr

Part II. Coke Pile

Purpose
To estimate emissions due to working in the 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 exceed≥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

Hourly emissions
PM (lb/hr) = (tons/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.1369 lb PM/hr

PM_{10} (lb/hr) = (tons/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.0685 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = (tons/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.0274 lb $PM_{2.5}$/hr

Part III. Coke Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke loadout from 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
Maximum daily coke produced =		1,793	tons wet coke/day

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

Maximum Hourly emissions:

PM (lb/hr) = PM EF * # transfer points * max daily tons coke transferred * (day/24 hours)
= 0.126 lb PM/hr

PM_{10} (lb/hr) = PM_{10} EF * # transfer points * max daily tons coke transferred * (day/24 hours)
= 0.060 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF * # transfer points * max daily tons coke transferred * (day/24 hours)
= 0.019 lb $PM_{2.5}$/hr

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

Annual Emissions:

PM (tons/yr) =	1.32	tons PM/yr
PM_{10} (tons/yr) =	0.64	tons PM_{10}/yr
$PM_{2.5}$ (tons/yr) =	0.23	tons $PM_{2.5}$/yr

Maximum Hourly Emissions:

PM (lb/hr) =	0.30	lb/hr per run of plant coke pile
PM_{10} (lb/hr) =	0.15	lb/hr per run of plant coke pile
$PM_{2.5}$ (lb/hr) =	0.05	lb/hr per run of plant coke pile

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

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 due to the coke breeze bunker.

Basis
Total number of coke transfer points = 2
Coke breeze = 40,621 tons wet breeze/yr
= 111 tons wet breeze/day

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

Maximum Hourly emissions:

PM (lb/hr) = PM EF * # enclosed transfer points * max daily tons coke transferred/day* (1 - control efficiency) * (day/24 hours)
= 4.70E-03 lb PM/hr

PM_{10} (lb/hr) = PM_{10} EF * # enclosed transfer points * max daily tons coke transferred/day * (1 - control efficiency) * (day/24 hours)
= 2.22E-03 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF * # enclosed transfer points * max daily tons coke transferred/day * (1 - control efficiency) * (day/24 hours)
= 6.99E-04 lb PM_{10}/hr

Daily emissions

PM (lb/day) = PM (lb/hr) * (24 hr/day) = 0.113 lb/day

PM_{10} (lb/day) = PM_{10}(lb/hr) * (24 hr/day) = 0.053 lb/day

$PM_{2.5}$ (lb/day) = $PM_{2.5}$(lb/hr) * (24 hr/day) = 0.017 lb/day

Uncontrolled

Maximum Hourly emissions:

PM (lb/hr) = PM EF * # enclosed transfer points * max daily tons coke transferred/day * (day/24 hours)
= 1.57E-02 lb PM/hr

PM_{10} (lb/hr) = PM_{10} EF * # enclosed transfer points * max daily tons coke transferred/day * (day/24 hours)
= 7.41E-03 lb PM_{10}/hr

$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF * # enclosed transfer points * max daily tons coke transferred/day * (day/24 hours)
= 2.33E-03 lb $PM_{2.5}$/hr

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 due to coke handling transfer.

Basis

Total number of coke transfer points =	16	
Number of enclosed transfer points =	13	
Maximum annual coal charge (requested limit) =	912,500	tons wet coal/yr
=	654,449	tons wet coke/yr
Maximum daily coke produced =	1,793	tons wet coke/day

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	
			lbs/hr	tons/yr
9	100%	70%	0.341	1.493
2	120%	70%	0.091	0.398
2	20%	70%	0.015	0.066
3	100%	0%	0.379	1.659
Total			0.825	3.616

Uncontrolled PM Emissions

No. points	Throughput	Efficiency	Emissions
			lbs/hr
9	100%	0%	1.136
2	120%	0%	0.303
2	20%	0%	0.050
3	100%	0%	0.379
Total			1.868

PM_{10} Emissions

No. points	Throuput	Efficiency	Emissions	
			lbs/hr	tons/yr
9	100%	70%	0.161	0.706
2	120%	70%	0.043	0.188
2	20%	70%	0.0072	0.031
3	100%	0%	0.179	0.784
Total			0.390	1.710

PM_{10} Emissions

No. points	Throuput	Efficiency	Emissions
			lbs/hr
9	100%	0%	0.537
2	120%	0%	0.143
2	20%	0%	0.0239
3	100%	0%	0.179
Total			0.884

$PM_{2.5}$ Emissions

No. points	Throuput	Efficiency	Emissions	
			lbs/hr	tons/yr
9	100%	70%	0.051	0.222
2	120%	70%	0.014	0.059
2	20%	70%	0.002	0.010
3	100%	0%	0.056	0.247
Total			0.123	0.537

$PM_{2.5}$ Emissions

No. points	Throuput	Efficiency	Emissions
			lbs/hr
9	100%	0%	0.169
2	120%	0%	0.045
2	20%	0%	0.008
3	100%	0%	0.056
Total			0.278

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

Maximum Emissions for points with 100% of coke throughput

Enclosed Transfer points

PM (lb/hr) = PM EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.0379 lb PM/hr
PM (ton/yr) = PM EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) =	0.1659 TPY PM
PM_{10} (lb/hr) = PM_{10} EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.0179 lb PM_{10}/hr
PM_{10} (ton/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) =	0.0784 TPY PM_{10}
$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF (lb/ton) * (tons/day) * (day/24 hours) * (1 - control efficiency/100) =	0.0056 lb $PM_{2.5}$/hr
$PM_{2.5}$ (ton/yr) = $PM_{2.5}$ EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1- control efficiency/100) =	0.0247 TPY $PM_{2.5}$

Uncontrolled Transfer points

PM (lb/hr) = PM EF (lb/ton) * (tons/day) * (day/24 hours) =	0.1262 lb PM/hr
PM (ton/yr) = PM EF (lb/ton) * (tons/yr) * (ton/2000 lb) =	0.5528 TPY PM
PM_{10} (lb/hr) = PM_{10} EF (lb/ton) * (tons/day) * (day/24 hours) =	0.0597 lb PM_{10}/hr
PM_{10} (ton/yr) = PM_{10} EF (lb/ton) * (tons/yr) * (ton/2000 lb) =	0.2615 TPY PM_{10}
$PM_{2.5}$ (lb/hr) = $PM_{2.5}$ EF (lb/ton) * (tons/day) * (day/24 hours) =	0.0188 lb $PM_{2.5}$/hr
$PM_{2.5}$ (ton/yr) = $PM_{2.5}$ EF (lb/ton) * (tons/yr) * (ton/2000 lb) =	0.0822 TPY $PM_{2.5}$

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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	10%	Breeze, lime and FGD byproduct
Maintenance	7.5	15000	30%	
Personal	2.0	30000	60%	

Fleet average weight (tons/vehicle) = 0.10 * 27.5 tons + 0.30 * 7.5 tons + 0.6 * 2 tons = 6.20

	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	0.619	0.121	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	50,000	15.48	3.02	0.76

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
= 15.48 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
= 3.02 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
= 0.76 tons $PM_{2.5}$/yr

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

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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

Hourly emissions:

PM (lb/hr) = 0.13 tons/yr * 2000 lb/ton / 8760 hours/yr
= 0.031 lb/hr/silo

Daily emissions:

PM (lb/day) = hourly emissions * operating hours/day
= 0.031 lb/hr * 24 hours/day
= 0.74 lb/day/silo

Uncontrolled Potential emissions estimation:

PM (tons/yr) = PM EF * lime transferred per silo, lb/hr * operating hours/year /# of silos * # of silo
= 2.2 lb/ton * 1400 lb/hr * ton/2000 lb * 8760 hr/yr * ton/2000 lb * 2
= 13.49 tons PM/yr/facility

Hourly emissions:

PM (lb/hr) = 13.49 tons/yr * 2000 lb/ton / hours/yr
= 3.1 lb/hr

Daily emissions:

PM (lb/day) = hourly emissions * operating hours/day
= 3.1 lb/hr * 24 hours/day
= 73.9 lb/day

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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/silo

Hourly Emissions:

PM (lb/hr) = (0.0093 tons/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.0021 lb PM/hr/silo

Daily Emissions:

PM (lb/day) = hourly emissions * operating hours/day
= 0.002 lb/hr * 24 hours/day
= 0.051 lb/day/silo

Uncontrolled Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points per silo * FGD dust transferred per silo, lb/hr * operating hours * # of silo
= (0.0017 lb/ton) * (2 transfer points) * (3150 lb/hr) * (ton/2000 lb) * (8760hours/yr) * (ton/2000 lb) * 2
= 0.04662 tons PM/yr/silo

Hourly Emissions:

PM (lb/hr) = (0.04662 tons/yr) * (2000 lb/ton) * (yr/8760 hrs)
= 0.0106 lb PM/hr/silo

Daily Emissions:

PM (lb/day) = hourly emissions * operating hours/day
= 0.011 lb/hr * 24 hours/day
= 0.255 lb/day/silo