A K Steel - Middletown, Ohio, Dicks Creek and Monroe Ditch Remediation

Emission Summary

	PM (lb/year)	Actual Operating Schedule (days/year)	PM (lb/day)	Permit Exemption (OAC 3745-15-05 - lbs/day)	Permit to Install Required? (Y/N)
Load-In/Load-Out	4.90	250.00	0.02	**10.00**	N
Wind Erosion	38.80	250.00	0.16	**10.00**	N
Unpaved Roadways (Uncontrolled)	27,120.33	250.00	74.30	**10.00**	Y

A K Steel - Middletown, Ohio, Dicks Creek and Monroe Ditch Remediation Air Permit Calculations

Load-in/Load-out calculations

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

Staging Area	Mean wind speed (U)[1]	PM Aerodynamic particle size multiplier (k)[2]	PM10 Aerodynamic particle size multiplier (k)[2]	PM2.5 Aerodynamic particle size multiplier (k)[2]	Moisture content (M)[3]	PM Emission factor (E)	PM10 Emission factor (E)	PM2.5 Emission factor (E)	Volume of stockpiled soil[4]		Quantity of stockpiled soil (Q)[4]	Total PM load-in/load-out emissions = E*Q	Total PM10 load-in/load-out emissions = E*Q	Total PM2.5 load-in/load-out emissions = E*Q
	(mph)				(%)	(lb/ton)	(lb/ton)	(lb/ton)	(ft^3)	(yd^3)	(ton)	(lb/year)	(lb/year)	(lb/year)
SA#1	9.9	0.74	0.35	0.053	19.41	0.000238969	0.0001130	0.0000171	75,141	2,783	3,618	0.86	0.41	0.41
SA#2	9.9	0.74	0.35	0.053	19.41	0.000238969	0.0001130	0.0000171	300,564	11,132	14,472	3.46	1.64	1.64
SA#2 (TSCA)	9.9	0.74	0.35	0.053	19.41	0.000238969	0.0001130	0.0000171	50,094	1,855	2,412	0.58	0.27	0.27
											Total:	4.90	2.32	2.32

Notes

Soil handling and storage piles emission rate calculations are based on the AP-42 equation in Chapter 13.2.4.

Key Assumptions Made

1. Wind speed of 9.9 mph, based on average Cincinnati meteorological data.
2. Aerodynamic particle size multipliers based oninformation taken from AP-42 Chapter 13.2.4 for PM30 (PM), PM10 and PM2.5.
3. Moisture content is average of values provided in Table 7 "Summary of Unconsolidated-Undrained triaxial Compression and Unconfined Compression Tests" of Attachment 3

4.

Staging Area	Acres
SA#1	0.46
SA#2	1.38
SA#2 (TSCA)	0.23

1 acre = 43,560 ft2

Assumed max usage of staging area would be 25% of total area

Assumed the max height of the SA#1 pile would be 15 ft and the remaining two piles would be 20 ft.

1 cubic yard = 27 cubic feet and 1 cubic yard = 1.3 tons

5. The 0.0032 value is a conversion factor

A K Steel - Middletown, Ohio, Dicks Creek and Monroe Ditch Remediation Air Permit Calculations

Wind erosion calculations

	Legend	Equations		SA#1	SA#2	SA#2 (TSCA)
Fastest mile of reference anemometer for period during disturbances [1]	u10+		m/s	21	21	21
Friction velocity[2]	u*	$= 0.053*u_{10}^{+}$	m/s	1.113	1.113	1.113
Threshold friction velocity[1]	u_t		m/s	1.02	1.02	1.02
Erosion potential[3]	P	$= 58(u^*-u_t)^2 + 25(u^*-u_t)$	g/m^2	2.827	2.827	2.827
Particle size multiplier (for PM)[4]	k		dimensionless	1.0	1.0	1.0
Particle size multiplier (for PM_{10})[4]	k		dimensionless	0.5	0.5	0.5
Particle size multiplier (for $PM_{2.5}$)[4]	k		dimensionless	0.075	0.075	0.075
PM Emission factor[5]	E	$= k \sum_{i=1}^{N} P_i$	g/m^2	2.827	2.827	2.827
PM10 Emission factor[5]	E		g/m^2	1.413	1.413	1.413
PM2.5 Emission factor[5]	E		g/m^2	0.212	0.212	0.212
Volume of pile[6]	V		m^3	2104	8416	1403
Height[7]	H		m	4.57	6.10	6.10
Assumed rectangular prism shape of pile and L:W = 4:1						
Width	W	= square root of V/(H*4)	m	10.73	18.58	7.58
Length	L	= W x 4	m	42.90	74.31	30.34
Area	A	= (2 x L x W) + (2 x H x L) + (2 x H x W)	m^2	1410.75	3893.59	922.52
Emissions (PM)		= E x A	g	3987.69	11005.79	2607.65
Emissions (PM10)		= E x A	g	1993.8	5502.9	1303.8
Emissions (PM2.5)		= E x A	g	299.1	825.4	195.6
Emissions (PM)[8]		= PM Emissions (g) x 0.0022046	lb PM	8.8	24.3	5.7
Emissions (PM10)[8]		= PM10 Emissions (g) x 0.0022046	lb PM10	4.40	12.13	2.87
Emissions (PM2.5)[8]		= PM2.5 Emissions (g) x 0.0022046	lb PM2.5	0.66	1.82	0.43
			Total lb/year PM	**38.80**		
			Total lb/yr PM10	**19.40**		
			Total lb/yr PM2.5	**2.91**		

Notes

Aggregate handling and storage piles emission rate calculations are based on the AP-42 equation in Chapter 13.2.5

Key Assumptions Made

1. Taken from AP-42 Table 13.2.5-2 for Overburden, where Zo (roughness height) = Act., based on a roughness height of 0.3 cm.
2. Friction velocity calculated using equation 4 from AP-42 Chapter 13.2.5.
3. Erosion potential calculated using equation 3 from AP-42 Chapter 13.2.5.
4. Particle size multiplier based on information taken from AP-42 Chapter 13.2.5-3 for PM30 (PM), PM10 and PM2.5.
5. Emission factor calculated using equation 2 from AP-42 Chapter 13.2.5.
where:
N = number of disturbances per year (assumed only one disturbance at time of loadout)
Pi = erosion potential corresponding to the probable fastest mile of wind for the ith period between disturbances
6. 1 ft^3 = 0.028 m^3
7. Assumed the max height of the SA#1 pile would be 15 ft and the remaining two piles would be 20 ft.
1 ft = 0.3048 m
8. 1 gram = 0.0022046 lbs

Uncontrolled Unpaved Roadways

Dicks Creek and Monroe Ditch Remediation Project
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E = k * (s/12)^a * (W/3)^b

E = Emissions factor (lb/VMT)
k = Base emission factor (lb/VMT)
s = Surface material silt content (%)
W = Mean vehicle weight (tons)
a = empirical constant
b = empirical constant

Paved Roadways	Number of Round Trips/day [a]	Vehicle Miles Per Trip [b]	k lb/VMT	s [e] (%)	W tons [c]	a	b	E lb/VMT	Control Efficiency %	Miles Traveled Per Day	Emissions (lbs/day) PM	PM10	PM2.5	Emissions (lbs/hr) [d] PM	PM10	PM2.5	Emissions (TPY) [d] PM	PM10	PM2.5
Roadway Segment Phase 1 Area - PM	6	0.216	4.9	4.0	17.5	0.7	0.45	5.02	0	1.30	6.51E+00			8.13E-01			1.19E+00		
Roadway Segment Phase 1 Area - PM10	6	0.216	1.5	4.0	17.5	0.9	0.45	1.23	0	1.30		1.60E+00			2.00E-01			2.92E-01	
Roadway Segment Phase 1 Area - PM2.5	6	0.216	0.15	4.0	17.5	0.9	0.45	0.12	0	1.30			1.60E-01			2.00E-02			2.92E-02
Roadway Segment Phase 2 Area - PM	6	0.182	4.9	4.0	17.5	0.7	0.45	5.02	0	1.09	5.48E+00			6.85E-01			1.00E+00		
Roadway Segment Phase 2 Area - PM10	6	0.182	1.5	4.0	17.5	0.9	0.45	1.23	0	1.09		1.35E+00			1.68E-01			2.46E-01	
Roadway Segment Phase 2 Area - PM2.5	6	0.182	0.15	4.0	17.5	0.9	0.45	0.12	0	1.09			1.35E-01			1.68E-02			2.46E-02
Roadway Segment Phase 3 Area - PM	6	0.341	4.9	4.0	17.5	0.7	0.45	5.02	0	2.05	1.03E+01			1.28E+00			1.87E+00		
Roadway Segment Phase 3 Area - PM10	6	0.341	1.5	4.0	17.5	0.9	0.45	1.23	0	2.05		2.52E+00			3.16E-01			4.61E-01	
Roadway Segment Phase 3 Area - PM2.5	6	0.341	0.15	4.0	17.5	0.9	0.45	0.12	0	2.05			2.52E-01			3.16E-02			4.61E-02
Roadway Segment Phase 4 Area - PM	6	0.659	4.9	4.0	17.5	0.7	0.45	5.02	0	3.95	1.99E+01			2.48E+00			3.62E+00		
Roadway Segment Phase 4 Area - PM10	6	0.659	1.5	4.0	17.5	0.9	0.45	1.23	0	3.95		4.88E+00			6.10E-01			8.91E-01	
Roadway Segment Phase 4 Area - PM2.5	6	0.659	0.15	4.0	17.5	0.9	0.45	0.12	0	3.95			4.88E-01			6.10E-02			8.91E-02
Roadway Segment Phase 5 Area - PM	6	0.886	4.9	4.0	17.5	0.7	0.45	5.02	0	5.32	2.67E+01			3.34E+00			4.87E+00		
Roadway Segment Phase 5 Area - PM10	6	0.886	1.5	4.0	17.5	0.9	0.45	1.23	0	5.32		6.56E+00			8.20E-01			1.20E+00	
Roadway Segment Phase 5 Area - PM2.5	6	0.886	0.15	4.0	17.5	0.9	0.45	0.12	0	5.32			6.56E-01			8.20E-02			1.20E-01
Roadway Segment Staging Area #1 - PM	6	0.136	4.9	4.0	17.5	0.7	0.45	5.02	0	0.82	4.11E+00			5.14E-01			7.50E-01		
Roadway Segment Staging Area #1 - PM10	6	0.136	1.5	4.0	17.5	0.9	0.45	1.23	0	0.82		1.01E+00			1.26E-01			1.84E-01	
Roadway Segment Staging Area #1 - PM2.5	6	0.136	0.15	4.0	17.5	0.9	0.45	0.12	0	0.82			1.01E-01			1.26E-02			1.84E-02
Roadway Segment Staging Area #2 - PM	6	0.023	4.9	4.0	17.5	0.7	0.45	5.02	0	0.14	6.85E-01			8.56E-02			1.25E-01		
Roadway Segment Staging Area #2 - PM10	6	0.023	1.5	4.0	17.5	0.9	0.45	1.23	0	0.14		1.68E-01			2.10E-02			3.07E-02	
Roadway Segment Staging Area #2 - PM2.5	6	0.023	0.15	4.0	17.5	0.9	0.45	0.12	0	0.14			1.68E-02			2.10E-03			3.07E-03
Roadway Segment Staging Area #2 (TSCA) - PM	6	0.023	4.9	4.0	17.5	0.7	0.45	5.02	0	0.14	6.85E-01			8.56E-02			1.25E-01		
Roadway Segment Staging Area #2 (TSCA) - PM10	6	0.023	1.5	4.0	17.5	0.9	0.45	1.23	0	0.14		1.68E-01			2.10E-02			3.07E-02	
Roadway Segment Staging Area #2 (TSCA) - PM2.5	6	0.023	0.15	4.0	17.5	0.9	0.45	0.12	0	0.14			1.68E-02			2.10E-03			3.07E-03
									TOTAL:	**44.39**	**74.30**	**18.26**	**1.83**	**9.29**	**2.28**	**0.23**	**13.56**	**3.33**	**0.33**

Note

a Worst case of 44.39 vehicle miles traveled per day.
b Based on Revised Dicks Creek Reach 1 - Conceptual Site Plan (March 20, 2009)
c Assumed as the average of empty weight (10 tons) and full weight (25 tons)
d Assumes total project duration of 365 days/year, 8 hours per day.
e Since the road segments will be constructed of gravel, we assumed a silt content of 4% based on California Environmental Quality Act (CEQA) Table A9-9-D-1 (1997) Guidelines

Controlled Unpaved Roadways

Dicks Creek and Monroe Ditch Remediation Project
AP-42 (November 2006) Ch. 13.2.1

E = k * (s/12)^a * (W/3)^b

E = Emissions factor (lb/VMT)
k = Base emission factor (lb/VMT)
s = Surface material silt content (%)
W = Mean vehicle weight (tons)
a = empirical constant
b = empirical constant

Paved Roadways	Number of Round Trips/day [a]	Vehicle Miles Per Trip [b]	k lb/VMT	s [e] (%)	W tons [c]	a	b	E lb/VMT	Control Efficiency % [f]	Miles Traveled Per Day	Emissions (lbs/day) PM	PM10	PM2.5	Emissions (lbs/hr) [d] PM	PM10	PM2.5	Emissions (TPY) [d] PM	PM10	PM2.5
Roadway Segment Phase 1 Area - PM	6	0.216	4.9	4.0	17.5	0.7	0.45	5.02	55	1.30	2.93E+00			3.66E-01			5.34E-01		
Roadway Segment Phase 1 Area - PM10	6	0.216	1.5	4.0	17.5	0.9	0.45	1.23	55	1.30		7.19E-01			8.99E-02			1.31E-01	
Roadway Segment Phase 1 Area - PM2.5	6	0.216	0.15	4.0	17.5	0.9	0.45	0.12	55	1.30			7.19E-02			8.99E-03			1.31E-02
Roadway Segment Phase 2 Area - PM	6	0.182	4.9	4.0	17.5	0.7	0.45	5.02	55	1.09	2.47E+00			3.08E-01			4.50E-01		
Roadway Segment Phase 2 Area - PM10	6	0.182	1.5	4.0	17.5	0.9	0.45	1.23	55	1.09		6.06E-01			7.57E-02			1.11E-01	
Roadway Segment Phase 2 Area - PM2.5	6	0.182	0.15	4.0	17.5	0.9	0.45	0.12	55	1.09			6.06E-02			7.57E-03			1.11E-02
Roadway Segment Phase 3 Area - PM	6	0.341	4.9	4.0	17.5	0.7	0.45	5.02	55	2.05	4.62E+00			5.78E-01			8.44E-01		
Roadway Segment Phase 3 Area - PM10	6	0.341	1.5	4.0	17.5	0.9	0.45	1.23	55	2.05		1.14E+00			1.42E-01			2.07E-01	
Roadway Segment Phase 3 Area - PM2.5	6	0.341	0.15	4.0	17.5	0.9	0.45	0.12	55	2.05			1.14E-01			1.42E-02			2.07E-02
Roadway Segment Phase 4 Area - PM	6	0.659	4.9	4.0	17.5	0.7	0.45	5.02	55	3.95	8.94E+00			1.12E+00			1.63E+00		
Roadway Segment Phase 4 Area - PM10	6	0.659	1.5	4.0	17.5	0.9	0.45	1.23	55	3.95		2.20E+00			2.75E-01			4.01E-01	
Roadway Segment Phase 4 Area - PM2.5	6	0.659	0.15	4.0	17.5	0.9	0.45	0.12	55	3.95			2.20E-01			2.75E-02			4.01E-02
Roadway Segment Phase 5 Area - PM	6	0.886	4.9	4.0	17.5	0.7	0.45	5.02	55	5.32	1.20E+01			1.50E+00			2.19E+00		
Roadway Segment Phase 5 Area - PM10	6	0.886	1.5	4.0	17.5	0.9	0.45	1.23	55	5.32		2.95E+00			3.69E-01			5.39E-01	
Roadway Segment Phase 5 Area - PM2.5	6	0.886	0.15	4.0	17.5	0.9	0.45	0.12	55	5.32			2.95E-01			3.69E-02			5.39E-02
Roadway Segment Staging Area #1 - PM	6	0.136	4.9	4.0	17.5	0.7	0.45	5.02	55	0.82	1.85E+00			2.31E-01			3.37E-01		
Roadway Segment Staging Area #1 - PM10	6	0.136	1.5	4.0	17.5	0.9	0.45	1.23	55	0.82		4.54E-01			5.68E-02			8.29E-02	
Roadway Segment Staging Area #1 - PM2.5	6	0.136	0.15	4.0	17.5	0.9	0.45	0.12	55	0.82			4.54E-02			5.68E-03			8.29E-03
Roadway Segment Staging Area #2 - PM	6	0.023	4.9	4.0	17.5	0.7	0.45	5.02	55	0.14	3.08E-01			3.85E-02			5.62E-02		
Roadway Segment Staging Area #2 - PM10	6	0.023	1.5	4.0	17.5	0.9	0.45	1.23	55	0.14		7.57E-02			9.47E-03			1.38E-02	
Roadway Segment Staging Area #2 - PM2.5	6	0.023	0.15	4.0	17.5	0.9	0.45	0.12	55	0.14			7.57E-03			9.47E-04			1.38E-03
Roadway Segment Staging Area #2 (TSCA) - PM	6	0.023	4.9	4.0	17.5	0.7	0.45	5.02	55	0.14	3.08E-01			3.85E-02			5.62E-02		
Roadway Segment Staging Area #2 (TSCA) - PM10	6	0.023	1.5	4.0	17.5	0.9	0.45	1.23	55	0.14		7.57E-02			9.47E-03			1.38E-02	
Roadway Segment Staging Area #2 (TSCA) - PM2.5	6	0.023	0.15	4.0	17.5	0.9	0.45	0.12	55	0.14			7.57E-03			9.47E-04			1.38E-03
									TOTAL:	**44.39**	**33.44**	**8.22**	**0.82**	**4.18**	**1.03**	**0.10**	**6.10**	**1.50**	**0.15**

Note

a Worst case of 44.39 vehicle miles traveled per day.
b Based on Revised Dicks Creek Reach 1 - Conceptual Site Plan (March 20, 2009)
c Assumed as the average of empty weight (10 tons) and full weight (25 tons)
d Assumes total project duration of 365 days/year, 8 hours per day.
e Since the road segments will be constructed of gravel, we assumed a silt content of 4% based on California Environmental Quality Act (CEQA) Table A9-9-D-1 (1997) Guidelines
f Control efficiency based on watering roadways and posted speed limit signs.