



290 Elwood Davis Road / Box 3107, Syracuse, New York 13220
 Phone 315-457-5200 · Fax 315-451-0052

JOB Ontario County Landfill / Landfill Expansion
 SHEET NO. 1 OF 8
 CALCULATED BY KCW DATE 11/3/2011
 CHECKED BY _____ DATE _____
 SUBJECT Fugitive PM-10 Uncontrolled Emissions Summary

Estimate of Particulate Matter (PM-10) Emissions			
<u>PM-10 Generation Summary</u>	<u>Emission Reference</u>	<u>lb PM-10/ Day</u>	
Waste/Leachate Haul + Site Trucks (Paved Roads)	AP-42: 13.2.1	199.25	
Waste/Leachate Haul + Site Trucks (Unpaved Roads)	AP-42: 13.2.2	236.22	
Borrow Trucks (Unpaved Roads)	AP-42: 13.2.2, 13.2.4	80.83	
Borrow Trucks (Unloading)	AP-42: 13.2.4	0.52	
Working Face Cover	AP-42: 11.9	5.00	
		Total =	521.82
$521.82 \text{ (lb PM-10/day)} \times 1/2000 \text{ (ton/lb)} \times 307 \text{ (days/yr)} = 80.1$			
		80.10	Tons Uncontrolled PM-10/Yr
<u>Emissions Estimates Assumptions:</u>			
1)	Vehicle weights estimated by vehicle type and load capacity		
	* Per Existing daily truck counts (average annual): 212 total waste trucks to the working face per day. (50% tractor trailers, 50% straight trucks); 15 onsite trucks to working face per day; 13 Leachate Tankers per day.		
2)	All trucks are empty leaving landfill.		
3)	Precipitation - Assume 171 precipitation days per year. (>0.01" precip.) (Syracuse, NY Data)		
4)	Vehicle Speeds average 15 mph.		
5)	Solid waste and sludges contains no PM-10 content. Assume ALL PM-10 generated from road traffic & cover soil operations.		
6)	Assume negligible weight change on support vehicle trips (i.e. same weight in/out).		
7)	Mean Wind Speed - Assume 9.4 MPH (Syracuse, NY data)		
8)	307 operational days per year - max potential annual operations		
9)	Road lengths determined from analysis of CAD site plans		



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 SHEET NO. 2 OF 8
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 SUBJECT Fugitive PM-10 Emissions Paved Roads

<u>Estimate of Particulate Matter (PM-10) Emissions</u>									
<u>Paved Roads - Emission Factors Derived from AP-42: 13.2.1 (1/11)</u>									
$E_{ext} = [k \times (sL)^{0.91} \times (W)^{1.02}] \times (1-P/4N)$									
<u>Where:</u>									
E_{ext} = Annual size-specific emission factor extrapolated for natural mitigation (lb/VMT)									
k = PM-10 multiplier (lb/VMT) = 0.0022 lb/VMT (Table 13.2-1.1)									
sL = Road Surface Silt Loading (g/m ²) = 7.4 g/m ² (Table 13.2-1-4)									
W = Mean Vehicle Weight (tons)									
P = Number of precipitation days per year (>0.01 in precipitation) = 171 days (Syracuse, NY Data)									
N = Number of days in the averaging period = 365 days (Annual average)									
<u>Vehicles to Working Face (WF):</u>									
106	Straight Trucks			==> average weight =	20	tons			
106	Tractor Trailers			==> average weight =	32.5	tons			
15	Support Vehicles (Onsite)			==> average weight =	2.1	tons			
					W(WF) =	24.7	tons		
<u>Tanker Trucks to Leachate Loadout (LL):</u>									
13	Tanker Truck per day (peak leachate gen)			==> average weight =	32	tons			
					W(LL) =	32	tons		
<u>Length of Paved Roads:</u>									
Length of paved roads leading to working face				L(WF) =	1.35	miles			
Length of paved roads leading to leachate loadout				L(LL) =	0.52	miles			
$E(WF) = [0.0022 \times (7.4)^{0.91} \times (W)^{1.02}] \times (1-171/(4 \times 365)) =$									
227	Trips/day x 2 ways x		1.35	miles x	0.316	lb/VMT =	193.68	lb PM-10/day	
$E(LL) = [0.0022 \times (7.4)^{0.91} \times (W)^{1.02}] \times (1-171/(4 \times 365)) =$									
13	Trips/day x 2 ways x		0.52	miles x	0.412	lb/VMT =	5.57	lb PM-10/day	
					TOTAL =	199.25	lb PM-10/day		



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JOB Ontario County Landfill / Landfill Expansion
 SHEET NO. 3 OF 8
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 SUBJECT Fugitive PM-10 Emissions - Unpaved Roads

<u>Estimate of Particulate Matter (PM-10) Emissions</u>									
Waste Trucks (Unpaved Roads) - Emission Factors Derived from AP-42: 13.2.2 (11/06)									
$E_{ext} = k (s/12)^a (W/3)^b \times [(365 - P)/365]$									
<u>Where:</u>									
E_{ext} = Annual size-specific emission factor extrapolated for natural mitigation (lb/VMT)									
s = Surface material silt content for MSW Landfills (%) = 6.4 % (Table 13.2.2-1)									
W = Mean Vehicle Weight									
k = 1.5 lb/VMT (Table 13.2.2-2)									
a = 0.9 (Table 13.2.2-2)									
b = 0.45 (Table 13.2.2-2)									
P = Number of precipitation days per year (>0.01 in precipitation) = 171 days (Syracuse, NY Data)									
<u>Length of Unpaved Roads:</u>									
L(WF) =		0.43	miles	Length of unpaved road to working face.					
L(LL) =		0.24	miles	Length of unpaved road to leachate loadout.					
$E(WF) = 1.5 \times (6.4/12)^{0.9} \times (W/3)^{0.45} \times [(365-171)/365] = 1.168 \text{ lb/VMT}$									
227	Trips/day x 2 ways x		0.43	miles x	1.168	lb/VMT	=	228.02	lb PM-10/day
$E(LL) = 1.5 \times (6.4/12)^{0.9} \times (W/3)^{0.45} \times [(365-171)/365] = 1.314 \text{ lb/VMT}$									
13	Trips/day x 2 ways x		0.24	miles x	1.314	lb/VMT	=	8.20	lb PM-10/day
								TOTAL =	236.22 lb PM-10/day



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JOB Ontario County Landfill / Landfill Expansion
 SHEET NO. 4 OF 8
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 SUBJECT Fugitive PM-10 Emissions Borrow Trucks/Soil Mining

<u>Estimate of Particulate Matter (PM-10) Emissions</u>											
Borrow Trucks (Unpaved Roads): Emission Factors Derived from AP-42: 13.2.2 (11/06)											
W = Mean Vehicle Weight											
Full Truck =		55.84	tons	(Terex A30D max. gross vehicle weight)							
Empty Truck =		24.84	tons	(Terex A30D manufacturer specifications)							
Wave =		40.34	tons	42	= average number of loads per day (assume full load)						
Ext = $1.5 \times (6.4/12)^{0.9} \times (W/3)^{0.45} \times [(365-171)/365] = 1.458$ lb/VMT											
Assume borrow trucks haul 12 months of the year. Actual usage expected to be less.											
Average length of unpaved road =		3,500	feet								
		3,500	x 1 mile/5,280 feet =	0.66	miles						
Borrow trucks currently haul approximately		42	loads per day.								
42 loads/day x 2 ways x		0.66	miles =	55.44	VMT						
PM-10 =		55.44	VMT x	1.458	lb/VMT =	80.83 lb PM-10/day					
Soil Mining (Unloading): Emission factors derived from AP-42: 13.2.4 "Aggregate Handling and Storage Piles" (11/06)											
From 13.2.4 equation (1):			where:								
$E = k(0.0032) \times (U/5)^{1.3}$			E = Material handling emission factor (lb/ton handled)								
$(M/2)^{1.4}$			k = Particle size multiplier =			0.35					
			U = Mean wind speed (miles per hour (mph)) =			9.4	(Syracuse, NY)				
			M = Material Moisture Content (%) =			12	(Table 13.2.4-1)				
$E = 0.35(0.0032) \times (9.4/5)^{1.3}$			=			0.0002	lb PM-10/ton				
$(12/2)^{1.4}$											
Average daily cover mining is approximately		1300	tons								
PM-10 =		0.0002	lb PM-10/ton x	2 (load/unload) x	1300	tons =	0.52 lb PM-10/day				



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JOB Ontario County Landfill / Landfill Expansion
 SHEET NO. 5 OF 8
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 SUBJECT Fugitive PM-10 Emissions - Working Face

Estimate of Particulate Matter (PM-10) Emissions

Working Face Cover Operations:

Emission Factors Derived from AP-42: 11.9 (10/98), 13.2.3 (11/06), 13.2.4 (11/06)

Equipment Utilized Include:	3	John Deere 850 Bulldozer	2	hours per day
	1	John Deere 1050 Bulldozer	2	hours per day

Assumptions:

- 1) Waste materials arrive moist - no significant PM-10.
- 2) Worst case - all machinery working at the same time.
- 3) Assume cover soils are used 12 months of the year.

Emissions based on Table 11.9-1 Bulldozer Emissions

$$E = 1.0 \times (s)^{1.5} \times (0.75) \frac{(M)^{1.4}}{(12)^{1.4}}$$

where:

E = PM-10 emissions (lb/hr) (from Table 11.9-1)
 s = Material silt content (%) = 9 (AP-42 13.2.4 - Table 13.2.4-1)
 M = Material moisture content (%) = 12 (Table 13.2.4-1)

$$E = 1.0 \times (9)^{1.5} \times (0.75) \frac{(12)^{1.4}}{(12)^{1.4}} = 0.625 \text{ lb/hr}$$

3	Bulldozer	0.625 lb/hr x	2 hrs/day =	3.75
1	Bulldozer	0.625 lb/hr x	2 hrs/day =	1.25

Total = 5.00 lbs PM-10/day



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JOB Ontario County Landfill / Landfill Expansion
 SHEET NO. 6 OF 8
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 SUBJECT Fugitive PM-10 Emissions Control Efficiency

<u>Efficiency of Mitigation Measures on Particulate Matter (PM-10) Emissions:</u>									
<u>Paved Roads:</u>									
For Paved Roads, control efficiency can be estimate by Table 2-4 from <u>Control of Open Fugitive Dust Sources</u>									
(Cowherd, Et. Al. for USEPA), which states that the control efficiency of water flushing has been measured in the									
field as:									
<i>Assume PM-10 control is the same for PM-2.5.</i>									
Cited Efficiency of water flushing (%) = $69 - 0.231 V$,									
where V = # of vehicle passes since application									
<i>Assume all vehicles entering landfill travel paved roads to be conservative.</i>									
<u>Average number of vehicle passes since last application:</u>									
240	Combined vehicles/ day x 2 directions =				480	Vehicle passes/day			
4	# times roads watered per day								
480	passes/day / # applications/day =				120	= V = Average Veh. Passes between applications			
For paved roads, the estimated efficiency is:									
$C_{\text{paved}} (\%) = 69 - 0.231 (V)$									
$C_{\text{paved}} =$	41.3	%							
<u>Unpaved Roads:</u>									
For Unpaved Roads, control efficiency can be estimate by equation 3-2 from <u>Control of Open Fugitive Dust Sources</u>									
(Cowherd, Et. Al. for USEPA), which states that the control efficiency of unpaved road watering is:									
$C_{\text{unpaved}} = 100 - \frac{[0.8(p)(d)(t)]}{i}$									
where:									
C = Average control efficiency (%)									
p = Potential average hourly daytime evaporation rate (mm/hr)									
p = 0.0049 x (Value in Figure 3-2) for Annual Conditions									
d = Daily average daytime traffic rate (h^{-1})									
i = Application intensity (l/m^2)									
t = Time between applications (h)									



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 SHEET NO. 7 OF 8
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 SUBJECT Fugitive PM-10 Emissions Control Efficiency

<p>Efficiency of Mitigation Measures on Particulate Matter (PM-10) Emissions:</p>																																																																																																			
<p>Using average annual evaporation conditions for the site,</p>																																																																																																			
<p>$P = 0.0049 \times (40) = 0.196$ mm/h</p>																																																																																																			
<p>The average daytime traffic rate "d" is estimated by dividing the number of vehicle passes per day by the average length of day. For unpaved roads = 480 vehicle passes per day (2 directions - includes waste vehicles traveling on road to working face. It is assumed that the borrow road is not watered). So,</p>																																																																																																			
<p>$480 \text{ vehicle passes per day} / 8 \text{ (hrs/day)} = 60$ Vehicles per hour</p>																																																																																																			
<p>The application intensity "I" has been estimated at 2.174 liters per square meter. This value was the factor (0.48 gal/yd²) for water flushing in Control of Open Fugitive Dust Sources (Cowherd, Et. Al. for USEPA).</p>																																																																																																			
<p>The control efficiency realized by watering unpaved roads was calculated using eight hours between applications. Unpaved roads are watered a minimum of four times daily, and more frequent as site conditions require.</p>																																																																																																			
<p>2 hours between applications (4x/day)</p>																																																																																																			
<p>The resulting control efficiency is:</p>																																																																																																			
<p>$C_{(4x/day)} = 91.3$ %</p>																																																																																																			



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 SHEET NO. 8 OF 8
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 SUBJECT Fugitive PM-10 Controlled Emissions

Applying Efficiency of Mitigation Measures to the Estimated Particulate Matter (PM-10) Emissions:			
PM-10 Generation Summary	Uncontrolled PM-10 (lb/day)	Control Eff (%)	Controlled PM-10 (lb/day)
Waste/Leachate Haul+Site Trucks (Paved)	199.25	41.3	117.00
Waste/Leachate Haul+Site Trucks (Unpaved)	236.22	91.3	20.44
Borrow Trucks (Unpaved Roads)	80.83	0.0	80.83
Borrow Trucks (Unloading)	0.52	0.0	0.52
Working Face Cover	5.00	0.0	5.00
	521.8		223.79
223.79 (lb PM-10/day) x 1/2000 (ton/lb) x 307 (days/yr) = 34.35			
		34.35	Tons Controlled PM-10/Yr
		68,705	Pounds Controlled PM-10/Yr
Overall Control Efficiency =	57.1%		