

Emissions Inventory Documentation for the District of Columbia: 2011 Area Source Methodologies

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CHAPTER 1: ANNUAL EMISSIONS ESTIMATES

1.0 Fuel Use Emissions

1.1 Coal

(The District assumes the use of 100% bituminous/subbituminous coal)
Residential, 2104002000
Commercial/institutional, 2103002000
Industrial, 2102002000

1.2 Natural Gas

Residential, 2104006000 Commercial/institutional, 2103006000 Industrial, 2102006000

1.3 Distillate Oil

Residential, 2104004000 Commercial/institutional, 2103004000 Industrial, 2102004000

1.4 Kerosene

Commercial/institutional, 2103011000 Industrial, 2102011000

1.5 Residual Oil

Commercial/institutional, 2103005000 Industrial, 2102005000

1.6 Liquified Petroleum Gas

Residential, 2104007000 Commercial/institutional, 2103007000 Industrial, 2102007000

For Sections 1.1 to 1.6 – Calculation:

(fuel use in the District)*(emission factor per pollutant) = emissions; (emissions for all sources) minus (point source estimate to avoid double-counting) = area source estimate

For Sections 1.1 to 1.6 – Data Sources:

- Fuel use: Energy Information Administration (EIA) State Energy Data System (SEDS): found at http://www.eia.gov/state/seds/
- Emission factors: As determined by the Eastern Regional Technical Advisory Committee (ERTAC), found at

http://www.epa.gov/ttn/chief/net/2011inventory.html ("Nonpoint Emissions Tools and Methods") or at ftp://ftp.epa.gov/EmisInventory/2011nei/doc/

1.7 Residential Wood Combustion

The District adopted EPA's estimates using a revised RWC emissions estimation tool.

2.0 Petroleum Losses; Transport of Fuels

2.1 Railroads

Line haul locomotives, Class I operations (CSX), 2285002006 Line haul locomotives, Passenger trains (Amtrak), 2285002008 Line haul locomotives, Commuter lines (MARC, VRE), 2285002009 Yard locomotives ("switchers"), 2285002010

Calculation:

(fuel use)*(emission factor per pollutant) = emissions

Data Sources:

- Fuel use: Estimates are provided by CSX, Amtrak, MARC, and VRE. Generally, they are based on the number of trips per train per day, mileage of tracks within the District, approximation of gallons per mile, and the number of days the trains run per year.
- Emission factors: As determined by ERTAC
 - For VOCs instead of an emission factor, a HC-to-VOC conversion factor is used

2.2 Portable Fuel Containers (PFCs)

Residential

Permeation, 2501011011

Evaporation (includes diurnal losses), 2501011012

Spilling during transport, 2501011013

Refilling at the pump (vapor displacement), 2501011014

Refilling at the pump (spillage), 2501011015

Commercial

Permeation, 2501012011

Evaporation (includes diurnal losses), 2501012012

Spilling during transport, 2501012013

Refilling at the pump (vapor displacement), 2501012014

Refilling at the pump (spillage), 2501012015

The District adopted EPA's estimates using the NONROAD2008a model, which accounts for VOC controls and benzene standards.

2.3 Stage | & ||

Bulk terminals, 2501050120 – This category was not calculated because there are no petroleum bulk terminals (NAICS 42471) in the District Bulk plants, 2501055120 – This category was not calculated because there are no petroleum bulk stations (NAICS 42471) in the District

Gasoline refueling (Stage II), 2501060100

Gasoline service station unloading (balanced submerged), 2501060053 Gasoline distribution, underground storage tank (breathing and emptying), 2501060201

Tank trucks in transit, 2505030120

Calculation:

(total gallons sold annually)*(emission factor)*(conversion factor or rule effectiveness, as appropriate) = emissions

Data Sources:

- Gallons sold annually: U.S. Department of Transportation, Federal Highway
 Administration, "Monthly Motor Fuel Reported by States" (January 2012), found at http://www.fhwa.dot.gov/policyinformation/quickfinddata/qffuel.cfm
- Emission factors: As determined by ERTAC
- Conversion factor (for Stage II only): 0.002205 grams per pound
- Rule effectiveness (for balanced submerged Stage I only): According to the Maryland Department of the Environment, there was a study that determined the rule effectiveness factor for vapor balance controls was 91 percent (plus emissions for the 9 percent)

2.4 Aviation Gas

Stage I, 2501080050 Stage II, 2501080100 Underground tank breathing/emptying, 2501080201

Calculation:

(fuel consumed)*(unit conversion factor)*(emission factor per SCC) = emissions

Data Sources:

- Fuel use: Energy Information Administration (EIA) State Energy Data System (SEDS): found at http://www.eia.gov/state/seds/
 - o Presumption is that jet fuel estimates represent heliport activity
- Emission factors: As determined by ERTAC

2.5 Marine Gas

2505020000 – This category was not calculated for the District because there are no ships or barges that transport petroleum liquids in or near the District.

3.0 Emissions from Solvents

3.1 Architectural Surface Coatings

Solvent-based + water-based, 2401001000

Calculation:

(# people living in the District)*(emission factor per person) = emissions

Data Sources:

- District population: The latest MWCOG Cooperative Forecast, found at http://www.mwcog.org/publications/departmental.asp?CLASSIFICATION_ID=6&SUBCLASSIFICATION_ID=27; and/or US Census Bureau QuickFacts for the District, found at http://quickfacts.census.gov/qfd/states/11000.html
- Emission factors: As determined by ERTAC (based on 2007 Freedonia data)

3.2 Auto Refinishing

All processes, 2401005000

The District adopted EPA's estimates based on 2010 County Business Practices estimates.

3.3 Traffic Markings

2401008000

Calculation:

(# road miles paved)*(emission factor per road mile) = emissions

Data Source:

- o Road miles paved: District Department of Transportation
- Emission factor: As determined by ERTAC

3.4 Surface Coatings

Industrial maintenance, 2401100000 Other special purpose coatings, 2401200000

Calculations:

(# people living in the District)*(emission factor per person) = emissions

Data Sources:

- District population: The latest MWCOG Cooperative Forecast, found at http://www.mwcog.org/publications/departmental.asp?CLASSIFICATION_ID=6&SUBCLASSIFICATION_ID=27; and/or US Census Bureau QuickFacts for the District, found at http://quickfacts.census.gov/qfd/states/11000.html
- o Emission factors: As determined by ERTAC (based on 2007 Freedonia data)

The District adopted EPA estimates for:

Wood furniture and fixtures, 2401020000 Miscellaneous manufacturing, 2401090000 Aircraft coatings, 2401075000

EPA assumed that no activity occurs in the District for:

Finished woods, 2401015000

Paper, foil and film, 2401030000

Metal cans, 2401040000

Miscellaneous finished metals, 2401050000

Large appliances, 2401060000

Electronic and electric coatings, 2401065000

Motor vehicles, 2401070000

Other transportation, 2401990000

Railroad coatings, 2401085000

Marine manufacturing, 2401080000

Metal furniture, 2401025000

Metal sheet, strip and coil, 2401045000

Machinery and equipment, 2401055000

3.5 Cold Cleaning

Degreasing, 2415000000

The District adopted EPA's estimates based on county employment adjustments.

3.6 Dry Cleaners

All processes, 2420000000

Calculations:

(# employees)*(emission factor) = emissions

Data Sources:

- Employee estimates: U.S. Department of Labor, Bureau of Labor Statistics,
 "Occupational Employment Statistics", found at
 http://www.bls.gov/oes/current/oes_dc.htm
- Emission factors: As determined by ERTAC

3.7 Graphic Arts

All processes, 2425000000

Calculation:

(# employees)*(emission factor) = emissions;

(emissions for all sources) minus (point source estimate to avoid double-counting) = area source estimate

Data Sources:

- Employee estimates: U.S. Department of Labor, Bureau of Labor Statistics,
 "Occupational Employment Statistics", found at
 http://www.bls.gov/oes/current/oes-dc.htm
- Emission factors: As determined by ERTAC

3.8 Commercial/Consumer Solvents

Personal care products (cosmetics, toiletries), 2460100000
Household cleaning products, 2460200000
Auto aftermarket, 2460400000
Coatings and related products, 2460500000
Adhesives and sealants, 2460600000
FIFRA-regulated products, 2460800000
Miscellaneous products (not otherwise covered), 2460900000

Calculations:

(# people living in the District)*(emission factor per person) = emissions

Data Sources:

- District population: The latest MWCOG Cooperative Forecast, found at http://www.mwcog.org/publications/departmental.asp?CLASSIFICATION_ID=6&SUBCLASSIFICATION_ID=27; and/or US Census Bureau QuickFacts for the District, found at http://quickfacts.census.gov/qfd/states/11000.html
- Emission factors: As determined by ERTAC (based on 2007 Freedonia data)

3.9 Asphalt Paving

Cutback asphalt, 2461021000 – The District assumes that the ban on cutback asphalt during ozone season except for roofing (20 DCMR § 709) means that little if any is used, so does not estimate emissions for this category Emulsified asphalt, 2461022000

The District adopted EPA's estimates based on data from a 2008 Asphalt Usage Study, purchased by EPA from the Asphalt Institute.

3.10 Pesticides and Fertilizers

Application, 2461800000

Calculation:

(# people living in the District)*(emission factor per person) = emissions

Data Sources:

- District population: The latest MWCOG Cooperative Forecast, found at http://www.mwcog.org/publications/departmental.asp?CLASSIFICATION_ID=6&
 SUBCLASSIFICATION_ID=27; and/or US Census Bureau QuickFacts for the District, found at http://quickfacts.census.gov/qfd/states/11000.html
- Emission factors: As determined by ERTAC (based on 2007 Freedonia data)

4.0 Waste & Miscellaneous

The District believes there is no activity in the District for the following categories:

Open burning, 2610000100, 2610000400, 2610030000, 2830000000

Cremation, 2810060100, 2810060200

EPA/ERTAC no longer estimates emissions for the following categories due to resource constraints:

Dental preparation and use, 2850001000
General laboratory activities, 2851001000
Lamp breakage/recycling, 2861000000, 2861000010
Swimming pools, 2862000000
(Not since before 2007): Bakeries, Breweries, Composting, Incineration, LUSTs, MSWLs

4.1 Road Dust

Paved roads, 2294000000 Unpaved roads, 2296000000

The District adopted EPA's estimates based on VMT and precipitation.

4.2 Commercial Cooking

Conveyorized charbroiling, 2302002100 Under-fired charbroiling, 2302002200 Deep fat frying, 2302003000 Flat griddle frying, 2302003100 Clamshell griddle frying, 2302003200

Calculation:

(# people living in the District)*(emission factor per person) = emissions

Data Sources:

- District population: The latest MWCOG Cooperative Forecast, found at <u>http://www.mwcog.org/publications/departmental.asp?CLASSIFICATION_ID=6& SUBCLASSIFICATION_ID=27</u>; and/or US Census Bureau QuickFacts for the District, found at http://quickfacts.census.gov/qfd/states/11000.html
- Emission factors: As determined by ERTAC

4.3 Construction Dust

General building construction (residential), 2311010000 Heavy construction (non-residential), 2311020000 Road construction, 2311030000

The District adopted EPA's estimates.

4.4 Publicly Owned Treatment Works (POTWs)

Wastewater, 2630020000

Calculation:

(adjusted DC flow rate)*(emission factor) = emissions

Data Sources:

- o Adjusted DC flow rate: District of Columbia's Climate Action Plan data
- Emission factor: As determined by EPA

4.5 Fires

Structure fires (accidental), 2810030000 Structure fires (fire fighter training), 2810035000 Vehicle fires, 2810050000

Calculation:

(# of fires)*(fuel loading factor)*(emission factors) = emissions

Data Sources:

- # of fires: District of Columbia's Fire and EMS Department (DCFEMS)
- Fuel loading factor: EIIP (2000, 2001)
- Emission factors: As determined by ERTAC

5.0 Marine, Air, Rail (MAR)

The District has no large ocean-bearing marine vessels that go through ports ("marine") and no airports ("air"). Section 2.1 of this document discusses rail emissions ("rail").

- Any EPA commercial marine vessel (CMV) estimates would be part of the following SCCs: 2280002200 and 2280003200
- Any EPA airport estimates would be part of the following SCCs: 2275087000 (point) as well as 2275050011 and 227505012 (nonpoint)

CHAPTER 2: OZONE SEASON DAY EMISSIONS

Ozone season day emissions were estimated for CO, NO_x , and VOCs based on the following equation:

typical ozone season daily emissions =

(annual tons/yr)(2000 lb/ton)(SAF/peak ozone season as % of yr)

divided by

operating schedule as in (days/week)(weeks/year)

Seasonal adjustment factors (SAFs) for 2011 were developed and shared by the Maryland Department of the Environment (MDE). For SCCs where there was no SAF, an SAF was developed based on other MDE SAFs.

Appendix A: Area Source Emission Factors used by the District in 2011

				PM2.5-	PM-					
SCC	Source Category	СО	PM10-FIL	FIL	CON	NH3	NOx	SO2	VOC	units
2102002000	industrial coal	5	12	1.4	0.04	0.03	11	38	0.05	lb/ton
2102004000	industrial distillate oil	5	1	0.25	1.3	0.8	20	142	0.2	lb/million gal.
2102005000	industrial residual oil	5	10.68	6.96	1.5	0.8	55	157	0.28	lb/million gal.
										lb/million cu.
2102006000	industrial NG	84	0.13	0.11	0.32	3.2	100	0.6	5.5	Ft.
2102007000	industrial LPG	11.95	0.02	0.01	0.03	0.05	9.49	0.06	0.52	lb/Kgal
2102011000	industrial kerosene	4.82	0.96	0.24	1.25	0.77	19.29	137	0.19	lb/million gal.
2103002000	comm/inst coal	5	12	1.4	0.04	0.03	11	38	0.05	lb/ton
2103004000	comm/inst distillate oil	5	1.08	0.83	1.3	0.8	20	142	0.34	lb/million gal.
2103005000	comm/inst residual oil	5	10.68	6.96	1.5	0.8	55	353.25	1.13	lb/million gal.
										lb/million cu.
2103006000	comm/inst NG	84	0.2	0.11	0.32	3.2	100	0.6	5.5	Ft.
2103007000	comm/inst LPG	11.95	0.02	0.01	0.03	0.05	9.49	0.06	0.52	lb/Kgal
2103011000	comm/inst kerosene	4.8	1.04	0.8	1.3	0.8	19.3	142	0.672	lb/million gal.
2104002000	residential coal	275	6.24	3.84	0.04	2	9.1	31	10	lb/ton
2104004000	residential distillate oil	5	1.08	0.83	1.3	1	18	142	0.71	lb/million gal.
										lb/million cu.
2104006000	residential NG	40	0.2	0.11	0.32	20	94	0.6	5.5	Ft.
2104007000	residential LPG	3.8	0.02	0.01	0.03	0.05	13.4	0.06	0.52	lb/Kgal
(many)	RWC (2104008100 to 2104009000)	-	-	-	-	-	-	-	-	
			0.0097	0.97						
2285002006	railroads, line haul, class I (CSX)	0.0587	(PRI)	(PRI)	-	-	0.3285	0.0041	0.0170 (HC)	lb/gal
	railroads, line haul, passenger		0.0099	0.97						
2285002008	(Amtrak)	0.0587	(PRI)	(PRI)	-	-	0.3682	0.0041	0.0179 (HC)	lb/gal
	railroads, line haul, commuter		0.0099	0.97				0.0044	0.04=0.(1.0)	
2285002009	(MARC, VRE)	0.0587	(PRI)	(PRI)	-	-	0.3682	0.0041	0.0179 (HC)	lb/gal
2285002010	railroads vard locomatives	0.0894	0.0121	0.97			0.5044	0.036	ט טבטפ (חכ)	lb/gal
	railroads, yard locomotives	0.0894	(PRI)	(PRI)	-	-	0.3044	0.030	0.0506 (HC)	lb/gal
2294000000	road dust, paved	-	-	-	-	-	-	-	-	
2296000000	road dust, unpaved	-	-	-	-	-	-	-	-	

Appendix A: Area Source Emission Factors used by the District in 2011

				PM2.5-	PM-					
SCC	Source Category	CO	PM10-FIL	FIL	CON	NH3	NOx	SO2	VOC	units
	comm cooking - conveyorized									
2302002100	charbroiling	0.0424	0.00016	0.00016	0.0496	-	-	-	0.0121	lb/person
22222222	comm cooking - underfired	0.405	0.004	0.004	0.0547				0.0445	
2302002200	charbroiling	0.135	0.001	0.001	0.3517	-	-	-	0.0415	lb/person
2302003000	comm cooking - deep fat frying	-	-	-	-	-	-	-	0.0126	lb/person
2302003100	comm cooking - flat griddle frying	0.0127	0.0003	0.0002	0.1028	-	-	-	0.0059	lb/person
	comm cooking - clamshell griddle			1.69E-	6.97E-					
2302003200	frying	0	1.98E-05	05	03	-	-	-	0.0002	lb/person
2311010000	construction - general, residential	-	-	-	-	-	-	-	-	
2311020000	construction - heavy, non-residential	-	-	-	-	-	-	-	-	
2311030000	construction - roads	-	-	-	-	-	-	-	-	
	surface coatings - architectural									
2401001000	coatings	-	-	-	-	-	-	-	1.88	lb/capita
2401005000	surface coatings - auto refinishing	-	-	-	-	-	-	-	-	
2401008000	surface coatings - traffic markings	-	-	-	-	-	-	-	22.1	lb/road miles
2401015000	surface coatings - finished woods	-	-	-	-	-	-	-	-	
2401020000	surface coatings - wood furniture	-	-	-	-	-	-	-	-	
2401025000	surface coatings - metal furniture	-	_	-	-	-	-	-	-	
2401030000	surface coatings - paper, foil, film	-	-	-	-	-	-	-	-	
2401040000	surface coatings - metal cans	-	-	-	-	-	-	-	-	
	surface coatings - sheet, strip, and									
2401045000	coil	-	-	-	-	-	-	-	-	
	surface coatings - misc finished									
2401050000	metals	-	-	-	-	-	-	-	-	
	surface coatings - machinery and									
2401055000	equipment	-	-	-	-	-	-	-	-	
2401060000	surface coatings - large appliances	-	-	-	-	-	-	-	-	
	surface coatings -									
2401065000	electronics/electrical	-	-	-	-	-	-	-	-	
2401070000	surface coatings - motor vehicles	-	-	-	-	-	-	-	-	

Appendix A: Area Source Emission Factors used by the District in 2011

				PM2.5-	PM-					
SCC	Source Category	СО	PM10-FIL	FIL	CON	NH3	NOx	SO2	VOC	units
2401075000	surface coatings - aircraft	-	-	-	-	-	-	-	-	
	surface coatings - marine									
2401080000	manufacturing	-	-	-	-	-	-	-	-	
2401085000	surface coatings - railroads	-	-	-	-	-	-	-	-	
	surface coatings - misc.									
2401090000	manufacturing	-	-	-	-	-	-	-	-	
	surface coatings - ind. maintenance									
2401100000	coatings	-	-	-	-	-	-	-	0.15	lb/person
2404200000	surface coatings - other special								0.064	11. /
2401200000	purpose ctngs	-	-	-	-	-	-	-	0.064	lb/person
2415000000	solvent degreasing (cold cleaning)	-	-	-	-	-	-	-	-	
2420000000	dry cleaning	-	-	-	-	-	-	-	10	lb/employee
2425000000	graphic arts	-	-	-	-	-	-	-	201	lb/employee
2460100000	cc products, cosmetics and toiletries	-	-	-	-	-	-	-	1.9	lb/person
2460200000	cc products, household	-	-	-	-	-	-	-	1.8	lb/person
2460400000	cc products, auto aftermarket	-	-	-	-	-	-	-	1.36	lb/person
	cc products, coatings and related									
2460500000	products	-	-	-	-	-	-	-	0.95	lb/person
2460600000	cc products, adhesives and sealants	-	-	-	-	-	-	-	0.57	lb/person
2460800000	cc products, FIFRA	-	-	-	-	-	-	-	1.78	lb/person
2460900000	cc products, misc.	-	-	-	-	-	-	-	0.07	lb/person
2461022000	emulsified asphalt	-	-	-	-	-	-	-	-	
2461800000	ag chemicals - pesticides	_	-	-	-	-	-	-	0.299	lb/person
2501011011	pfcs residential, permeation	-	_	_	-	-	_	-	-	
	pfcs residential, evap (incl. diurnal									
2501011012	losses)	-	-	-	-	-	-	-	-	
	pfcs residential, spilling during									
2501011013	transport	-	-	-	-	-	-	-	-	
	pfcs residential, refilling, vapor									
2501011014	displacement	-	-	-	-	-	-	-	-	

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				PM2.5-	PM-					
SCC	Source Category	СО	PM10-FIL	FIL	CON	NH3	NOx	SO2	voc	units
2501011015	pfcs residential, refilling, spillage	-	-	-	1	-	-	-	-	
2501012011	pfcs commercial, permeation	-	-	-	-	-	-	-	-	
	pfcs commercial, evap (incl. diurnal									
2501012012	losses)	-	-	-	-	-	-	-	-	
2504042042	pfcs commercial, spilling during									
2501012013	transport pfcs commercial, refilling, vapor	-	-	-	-	-	-	-	-	
2501012014	displacement	_	_	_	_	_	_	_	_	
2501012015	pfcs commercial, refilling, spillage	_	_	-	_	_	_	_	_	
	gas distrib., stage I, bulk terminals,									
2501050120	evap losses	-	-	-	-	-	-	-	-	
	gas distrib., stage I, bulk plants, evap									
2501055120	losses	-	-	-	-	-	-	-	-	
2250460054	gas distrib., st I, unloading									
2250160051	submerged filling	-	-	-	-	-	-	-	-	
2250160052	gas distrib., st I, unloading splash filling	_	_	_	_	_	_	_	_	
2230100032	gas distrib., st I, unldng blncd								0.0003,	
2501060053	submerged	_	-	-	-	-	_	_	0.0073	lb/gallon
	gas distrib., stage II, refueling at gas									
2501060100	service stations	-	-	-	-	-	-	-	1.716	g/gallon
	gas distrib., stage I, underground									
2501060201	tanks, breathing and emptying	-	-	-	-	-	-	-	1	lb/Kgal
2501080050	aviation gas, stage I	-	-	-	-	-	-	-	19.3	lb/Kgal
2501080100	aviation gas, stage II	-	-	-	-	-	-	-	0.0136	lb/gal
	aviation gas, underground tank									
2501080201	breathing/emptying	-	-	_		-	-	_	5.3	lb/Kgal
	gas distribution, stage I, trucks (in									
2505030120	transit)	-	-	-	-	-	-	-	0.06	lb/Kgal
2505040120	gas distribution, pipeline	-	-	-	-	-	-	-	-	

Appendix A: Area Source Emission Factors used by the District in 2011

				PM2.5-	PM-					
SCC	Source Category	СО	PM10-FIL	FIL	CON	NH3	NOx	SO2	voc	units
2610000100	open burning, yard leaves	-	-	-	-	-	-	-	-	
2610000400	open burning, yard brush	-	-	-	-	-	-	-	-	
2610000500	open burning, land clearing	-	-	-	-	-	-	-	-	
2610030000	open burning, household waste	-	-	-	-	-	-	-	-	
2630020000	POTWs	-	-	-	-	-	-	-	0.44	lb/million gal.
2810015000	fires - prescribed	-	-	-	-	-	-	-	-	
2810030000	fires - structure, accidential	60	10.8	-	-	-	1.4	-	11	lb/ton
2810035000	fires - structure, training	60	10.8	-	-	-	1.4	-	11	lb/ton
2810050000	fires - vehicles		100	100	-	-	4	-	32	lb/ton
2810060100	cremation, human	-	-	-	-	-	-	-	-	
2810060200	cremation, animal	-	-	-	-	-	-	-	-	
2850001000	(misc mercury sectors)	-	-	-	-	-	-	-	-	
2851001000	(misc mercury sectors)	-	-	-	-	-	-	-	-	
2861000000	(misc mercury sectors)	-	-	-	-	-	-	-	-	
2861000010	(misc mercury sectors)	-	-	-	-	-	-	-	-	