



Solvent Utilization:

Documentation for EPA's Nonpoint Emissions Estimation Tool

Solvent Tool Version 1.5



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Introduction

The use of solvents in a variety of industrial, commercial, and residential applications can result in significant emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). In some cases these emissions are captured in an area's point source inventory, but in many cases there are additional nonpoint source emissions that must be estimated. Because there are specific challenges associated with estimating nonpoint source emissions from solvent usage, the U.S. EPA in conjunction with Abt Associates developed a Microsoft® Access-based Solvent Emissions Tool to assist State, Local, and Tribal (S/L/T) agencies in estimating nonpoint emissions from solvents for the 2014 National Emission Inventory.

Because some solvent emissions are already tracked in the point source inventory, it is necessary to subtract these emissions from the total estimated emissions to avoid double counting. While it is preferred to subtract point source activity data, the activity data in the tool are based on population or employment, and S/L/T agencies are unlikely to have data on employment in point source facilities. It is more likely that Agencies will have point source emissions. Therefore, the Solvent Tool allows users to import either point source emissions or point source activity, which are then used to adjust the estimated solvent emissions to avoid double counting.

The tool also exports the final calculated inventory to a separate database file in EIS format so that S/L/T agencies can easily upload the results to the gateway environment.

Source Category Description

Examples of source categories for solvent usage include surface coating operations (where a paint or finish is applied to a manufactured product), or consumer and commercial cleaning product application. A complete list of SCCs in this category is included in Table 1.

Table 1. Activity Data Sources used for each SCC

Category Name	SCC	NAICS	Comments
Architectural Coatings	2401001000	N/A	Population based Category
Automobile Refinishing	2401005000	81112	
		4411	
		4412	
Traffic Paints	2401008000	N/A	Lane Miles coming from 2013 FHWA Data
Wood and Composition Flat Stock	2401015000	321	
Wood Furniture and Fixtures	2401020000	337110	
		337121	
		337122	
		337127	50% to this and 50% to metal furniture
		337129	
		337211	
		337212	
		337215	50% to this and 50% to metal furniture
		339111	50% to this and 50% to metal furniture

Category Name	SCC	NAICS	Comments
Metal Furniture	2401025000	337124	
		337127	50% to this and 50% to wood furniture
		337214	
		337215	50% to this and 50% to wood furniture
Paper, Film and Foil	2401030000	322220	
Metal Cans	2401040000	33243	
Misc. Finished Metals	2401050000		Consolidated with Miscellaneous Manufacturing
Machinery and Equipment	2401055000	3331	
		3332	
		3333	
		33341	
Appliances	2401060000	3352	
Electronic and Other Electrical Coatings	2401065000	331319	
		331422	
		331491	
		335921	
		335929	
		335311	
Motor Vehicles	2401070000	3361	
		3362	
		3363	
Aircraft	2401075000	3364	
Railroads	2401085000	3365	
Marine coatings	2401080000	3366	
		488390	
Misc. Manufacturing	2401090000	339	
		3369	
Industrial Maintenance Coatings	2401100000	N/A	Population based Category
Other Special Purpose Coatings	2401200000	N/A	Population based Category
Cleaning Products: Industrial and Institutional	2415000000	331	
		332	
		333	
		334	
		335	
		336	
		337	
		339	
		441	
		483	

Category Name	SCC	NAICS	Comments
		484	
		485	
		488	
		8111	
		8112	
Graphic Arts	2425000000	N/A	Population based Category
Personal Care Products (Cosmetics and Toiletries)	2460100000	N/A	Population based Category
Cleaning Products: Household	2460200000	N/A	Population based Category
Automotive Aftermarket (Transportation: Motor Vehicles)	2460400000	N/A	Population based Category
Adhesives and Sealants	2460600000	N/A	Population based Category
FIFRA Regulated Products	2460800000	N/A	Population based Category
Coatings and Related Products	2460500000	N/A	Population based Category
Misc. Products	2460900000	N/A	Population based Category
Dry Cleaning	2420000000	812320	Employment based Category

Activity Data

The tool uses three types of activity data to estimate emissions: population, lane miles (used for traffic markings), and employment data. Table 1 shows the type of activity data used for each category and provides the SCC. Employment data are listed by the North American Industrial Classification Standard (NAICS) code(s) that are used to determine county-level employment for the category.

Population data are collected from the US Census Bureau's population estimates for July 1, 2013 (U.S. Census Bureau 2015a).

For traffic paints, the Federal Highway Administration provides county-level lane miles as a part of their HPMS data (FHWA 2015). The most recent data set available at the time of compilation is for data year 2013.

Employment data are allocated to each county using County Business Patterns (CBP) employment data for 2013 (the most recent data available at the time of compilation) (U.S. Census Bureau 2015b). Due to concerns with releasing confidential business information, CBP withholds values for a given county/NAICS code if it would be possible to identify data for individual facilities. In such cases, the Census reports a letter code, representing a particular employment size range. The following procedure is used to estimate data for withheld counties/NAICS codes (Divita 2008).

1. County-level employment for counties with reported values are totaled by state for the applicable NAICS code.
2. The value from step 1 is subtracted from the state employment value for the NAICS code.
3. Each of the withheld counties is assigned an initial employment estimate reflecting the midpoint of the CBP range code (e.g., code A, which reflects 1-19 employees, is assigned an estimate of 10 employees).

4. The initial employment estimates from step 3 are then summed to the state level.
5. The value from step 2 is divided by the value from step 4 to yield an adjustment factor to apply to the initial employment estimates to yield employment values that will sum to the state employment total for the applicable NAICS code.
6. The final county-level employment values are estimated by multiplying the initial employment estimates from step 3 by the step 5 adjustment factors.

Control Factors

For several categories, air pollution regulations exist that regulate the solvent content of products which can be sold. These solvent content limits are taken into account where appropriate by modifying emission factors rather than developing control efficiency information.

In particular, the tool assumes that states listed in Table 4 limit VOC emissions from architectural coatings (2401001000) and industrial surface coatings (2401100000). Therefore the emission factor is lower for these SCCs in these states.

Emission Factors

Emission factors were developed and reviewed by an ERTAC advisory panel composed of state and EPA personnel. The emission factors are based on national-level estimates of solvent usage from the Freedonia Group (2013). The national-level estimates were divided by national-level population, employment in various sectors, and road lane miles (Table 1) to develop emission factors based on emissions per person, employee, or lane mile, depending on the source category.

Table 2 lists the SCC, pollutant, and emission factors that were developed for categories that have the same factor throughout the country. As mentioned in the control factors section above, the emission factors for the architectural coatings and industrial surface coating categories are adjusted to account for regulations that limit VOC emissions from solvents in certain states. Table 3 lists the categories with their uncontrolled and controlled emission factors and Table 4 lists the states for which controlled emission factors were applied.

Note that with version 1.4 of the tool, two separate editions were released: one with an emissions factor for Graphic Arts based on employment and one based on population. Both emissions factors use Freedonia data as the source of solvent information.

Sample Calculations

Emissions are calculated in the tool for each county using emission factors and activity as:

$$E_{x,p} = A_x \times EF_{x,p} \quad (1)$$

where:

$E_{x,p}$ = annual emissions for category x and pollutant p;

A_x = activity data (population, employment, or lane miles) associated with category x; and

$EF_{x,p}$ = emission factor for category x and pollutant p.

Example:

Using architectural coatings in Allegheny County, PA as an example:

According to the US Census Bureau, population on July 1, 2013 is 1,232,953. The emission factor for VOC is 1.88 lb./person.

$$\begin{aligned} E_{\text{VOC}} &= 1,223,338 \text{ people} \times 1.88 \text{ lb. VOC/person} \\ &= 2,317,952 \text{ lb. VOC} \\ &= 1,159 \text{ tons VOC} \end{aligned}$$

Point Source Emissions Adjustment

To ensure that solvent emissions are not double-counted in the point source inventory, it is also necessary to subtract point source inventory solvent emissions from the solvent emissions estimates from population or employment data. Equation 2 illustrates the approach to performing point source subtractions.

$$N_{x,p} = T_{x,p} - P_{x,p} \quad (2)$$

Where:

- $N_{x,p}$ = nonpoint solvent emissions for category x and pollutant p;
- $T_{x,p}$ = total estimated solvent emissions for category x and pollutant p; and
- $P_{x,p}$ = point source solvent emissions for category x and pollutant p.

The first step in the point source subtraction procedure is to identify how each solvent nonpoint source classification code (SCC) links to associated solvent point SCCs. The Solvent Emissions Tool includes a crosswalk to perform that linkage.

Another issue that must be considered is the geographic resolution at which point source subtractions should be performed. In most cases, S/L/T agencies should have access to point source solvent emissions data (or below) the county level. However, if an agency only has this data at the state level, the tool can distribute the state-level emissions to the county level based on the proportion of population or employment (depending on the SCC) in the county. The Solvent Emissions Tool is designed to prioritize county-level data over state-level data, so where county-level data exists, the tool will perform county-level subtractions before using state-level data.

If an agency has county- or state-level point source *activity* data, this can be used in the place of emissions data in the point source subtraction procedure. The procedure follows the same steps, except that the point source activity data are subtracted from the total activity data before the emissions are calculated.

In the case of the Solvent Tool, activity data is in units of employment. **Note that care must be taken to avoid double counting activity data. For example, if a facility reports emissions to multiple SCCs in the template, the employees from that facility should only be counted once.**

References

Divita, 2008: Divita, Frank, E.H. Pechan & Associates, Inc., memorandum to Roy Huntley, U.S. Environmental Protection Agency, “County Business Patterns Calculations,” December 4, 2008.

Federal Highway Administration (FHWA). 2015. Highway Statistics 2013. Available at <http://www.fhwa.dot.gov/policyinformation/statistics.cfm>. Accessed April 2015.

Freedonia Group, The. 2013. Solvents to 2018. Study 2357.

U.S. Census Bureau, 2015a. 2013 *Population Estimates*, Washington, DC. Available at <http://www.census.gov/popest/> Accessed August 2015.

U.S. Census Bureau, 2015b. 2013 *County Business Patterns*, Available at <http://www.census.gov/econ/cbp/> Accessed August 2015.

Table 2. National Emission Factors. Note that with version 1.4 of the tool, two separate editions were released: one with an emissions factor for Graphic Arts based on employment and one based on population. Both emissions factors use Freedonia data as the source of solvent information.

SCC	Source	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator	Calculation Material Code	Reference
2401008000	Traffic Paints	VOC	10.1	LB	MILE	225	Freedonia 2013
2460600000	Adhesives and sealants	VOC	0.57	LB	EACH	762	EPA EIIP
2460400000	Automotive aftermarket emissions	VOC	1.36	LB	EACH	762	EPA EIIP
2460200000	Cleaning products	VOC	2.2	LB	EACH	762	Freedonia 2013
2460500000	Cons. Solvents: Coatings and Related Products	VOC	0.95	LB	EACH	762	EPA EIIP
2460800000	Cons. Solvents: FIFRA Regulated Products	VOC	1.78	LB	EACH	762	EPA EIIP
2460900000	Cons. Solvents: Misc. Products	VOC	0.07	LB	EACH	762	EPA EIIP
2460100000	Cons. Solvents: Personal Care Products (Cosmetics and Toiletries)	VOC	2	LB	EACH	762	Freedonia 2013
2425000000	Graphic Arts	VOC	3.7	LB	EACH	762	Freedonia 2013
2425000000	Graphic Arts	VOC	1747	LB	EACH	992	Freedonia 2013
2401200000	Surface Coating: Other Special Purpose Coatings	VOC	0.006	LB	EACH	762	Freedonia 2013
2401075000	Surface Coating: Aircraft	VOC	14	LB	EACH	992	Freedonia 2013
2401005000	Automobile Refinishing	VOC	87	LB	EACH	992	Freedonia 2013
2415000000	Degreasing	VOC	37	LB	EACH	992	NEI 2011
2420000000	Dry Cleaning	VOC	10	LB	EACH	992	NEI 2011
2401015000	Surface Coating: Wood Products Manufacturing	VOC	48	LB	EACH	992	Freedonia 2013
2401090000	Surface Coating: Misc. Manufacturing	VOC	78	LB	EACH	992	Freedonia 2013
2401060000	Surface Coating: Appliances	VOC	184	LB	EACH	992	Freedonia 2013
2401030000	Surface Coating: Paper, Film and Foil	VOC	415	LB	EACH	992	Freedonia 2013
2401085000	Surface Coating: Railroads	VOC	180	LB	EACH	992	Freedonia 2013
2401020000	Surface Coating: Wood Furniture and Fixtures	VOC	437	LB	EACH	992	Freedonia 2013

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SCC	Source	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator	Calculation Material Code	Reference
2401065000	Surface Coating: Electronic and Other Electrical Coatings	VOC	30	LB	EACH	992	Freedonia 2013
2401040000	Surface Coating: Metal Cans	VOC	2493	LB	EACH	992	Freedonia 2013
2401070000	Surface Coating: Motor Vehicles	VOC	168	LB	EACH	992	Freedonia 2013
2401055000	Surface Coating: Machinery and Equipment	VOC	44	LB	EACH	992	Freedonia 2013
2401080000	Surface Coating: Marine coatings	VOC	200	LB	EACH	992	Freedonia 2013
2401025000	Surface Coating: Metal Furniture	VOC	537	LB	EACH	992	Freedonia 2013

Table 3. Emission Factors which vary based on presence of controls

SCC	Pollutant Code	Factor Numeric Value Uncontrolled	Factor Numeric Value Controlled	Factor Unit Numerator	Factor Unit Denominator	Calculation Material Code	Reference
2401001000	95476	0.0135	0.0108	LB	EACH	762	NEI 2011
2401001000	100414	0.0148	0.0119	LB	EACH	762	NEI 2011
2401001000	106423	0.0136	0.0110	LB	EACH	762	NEI 2011
2401001000	108101	0.0927	0.0745	LB	EACH	762	NEI 2011
2401001000	108383	0.0306	0.0246	LB	EACH	762	NEI 2011
2401001000	108883	0.2925	0.2350	LB	EACH	762	NEI 2011
2401001000	110543	0.5530	0.4443	LB	EACH	762	NEI 2011
2401001000	121448	0.0011	0.0009	LB	EACH	762	NEI 2011
2401001000	540885	0.0585	0.0470	LB	EACH	762	NEI 2011
2401001000	VOC	2.3400	1.8800	LB	EACH	762	NEI 2011
2401100000	95476	0.0035	0.0009	LB	EACH	762	NEI 2011
2401100000	100414	0.0038	0.0009	LB	EACH	762	NEI 2011
2401100000	106423	0.0035	0.0009	LB	EACH	762	NEI 2011
2401100000	108101	0.0239	0.0059	LB	EACH	762	NEI 2011
2401100000	108383	0.0079	0.0020	LB	EACH	762	NEI 2011
2401100000	108883	0.0754	0.0188	LB	EACH	762	NEI 2011
2401100000	110543	0.1425	0.0355	LB	EACH	762	NEI 2011
2401100000	121448	0.0003	0.0001	LB	EACH	762	NEI 2011
2401100000	540885	0.0151	0.0037	LB	EACH	762	NEI 2011
2401100000	VOC	0.6031	0.1500	LB	EACH	762	NEI 2011

Table 4. States to which controlled emission factors are applied

State FIPS	Abbreviation
04	AZ
06	CA
09	CT
10	DE
11	DC
23	ME
24	MD
25	MA
33	NH
34	NJ
36	NY
42	PA
44	RI
48	TX
50	VT
51	VA