2020 National Emissions Inventory Technical Support Document: Solvents – All Other Solvents

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32.1 Sector Descriptions and Overview

The solvent sector is a diverse collection of residential, commercial, institutional, and industrial sources of gas-phase organic emissions. Included in this sector are everyday items, such as cleaners, personal care products, adhesives, coatings, printing inks, and pesticides. These sources generate emissions through evaporative processes and include organics that fulfill product functions beyond acting as a traditional solvent (e.g., propellants, fragrances). As such, this sector is often described as the volatile chemical product (VCP) sector.

For the 2017 NEI, the magnitude of VOC emission estimates for this sector were largely based on national-level solvent usage reported by the Freedonia Group [ref 1]. The reader is referred to the 2017 TSD for more information on those methods. For the 2020 NEI, EPA has adopted emission factors generated using a new framework for most of this sector [ref 2].

The 2020 NEI added one new SCC to this sector (2460030999). In addition, emissions from agricultural pesticides (2461850000) are estimated using the new methodology. The table below notes all SCCs covered in this source category and the SCCs for which the EPA generates default emissions.

Table 32-1: Nonpoint solvent SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4	EPA
2401001000	Solvent Utilization	Surface Coating	Architectural Coatings	Total: All Solvent Types	X
2401005000	Solvent Utilization	Surface Coating	Auto Refinishing	Total: All Solvent Types	X
2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types	X
2401015000	Solvent Utilization	Surface Coating	Factory Finished Wood	Total: All Solvent Types	X
2401020000	Solvent Utilization	Surface Coating	Wood Furniture	Total: All Solvent Types	X
2401025000	Solvent Utilization	Surface Coating	Metal Furniture	Total: All Solvent Types	X
2401030000	Solvent Utilization	Surface Coating	Paper	Total: All Solvent Types	X
2401040000	Solvent Utilization	Surface Coating	Metal Cans	Total: All Solvent Types	X
2401055000	Solvent Utilization	Surface Coating	Machinery and Equipment	Total: All Solvent Types	X
2401060000	Solvent Utilization	Surface Coating	Large Appliances	Total: All Solvent Types	X

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4	EPA
2401065000	Solvent Utilization	Surface Coating	Electronics and Other Electrical	Total: All Solvent Types	X
2401070000	Solvent Utilization	Surface Coating	Motor Vehicles	Total: All Solvent Types	X
2401075000	Solvent Utilization	Surface Coating	Aircraft	Total: All Solvent Types	X
2401085000	Solvent Utilization	Surface Coating	Railroad	Total: All Solvent Types	X
2401080000	Solvent Utilization	Surface Coating	Marine	Total: All Solvent Types	X
2401090000	Solvent Utilization	Surface Coating	Misc. Manufacturing	Total: All Solvent Types	X
2401100000	Solvent Utilization	Surface Coating	Industrial Maintenance Coatings	Total: All Solvent Types	X
2401200000	Solvent Utilization	Surface Coating	Other Special Purpose Coatings	Total: All Solvent Types	X
2415000000	Solvent Utilization	Degreasing	All Processes/All Industries	Total: All Solvent Types	X
2425000000	Solvent Utilization	Graphic Arts	All Processes	Total: All Solvent Types	X
2460100000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	All Personal Care Products	Total: All Solvent Types	X
2460200000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	All Household Products	Total: All Solvent Types	X
2460400000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	All Automotive Aftermarket Products	Total: All Solvent Types	X
2460600000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	All Adhesives and Sealants	Total: All Solvent Types	X
2460800000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	All FIFRA Related Products	Total: All Solvent Types	X
2460500000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	All Coatings and Related Products	Total: All Solvent Types	X
2461850000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	All Processes	X
2460900000	Solvent Utilization	Misc. Non-industrial: Consumer and Commercial	Misc. Products	Total: All Solvent Types	X

32.2 EPA-developed estimates

Solvent utilization emissions are largely based on estimates of national-level usage and allocated to the county-level using more geographically specific sources of data. Product usage of each SCC is preferentially estimated using economic statistics from the U.S. Census Bureau's Annual Survey of Manufacturers, commodity prices from the U.S. Department of Transportation's 2012 Commodity Flow Survey and the U.S. Census Bureau's Paint and Allied Products Survey, and producer price indices, which scale commodity prices (e.g., 2012) to target years (e.g., 2020) and are retrieved from the Federal Reserve Bank of St. Louis. If any of the datasets are unavailable, default usage estimates will be derived using functional solvent usage statistics reported by The Freedonia Group or sales quantities reported in a California Air Resources Board (CARB) California-specific survey [ref 3]. The composition of products will be estimated by generating composites from CARB surveys [refs 4,5,6,7,8] and profiles reported in the U.S. EPA's SPECIATE database [ref 9]. Emissions are subsequently estimated using a framework that considers product composition, timescales of product usage, and timescales of evaporation for individual components [ref 2].

In the following sections, details are provided related to the collection of activity data, allocation of national-level emission estimates to the county-level, calculation of emission factors, calculation of emissions, state-specific variations in emission factors due to assumed nonpoint VOC controls and point source subtraction.

32.2.1 Activity and Allocation Data

Activity data for solvent utilization is SCC-specific. For most SCCs, activity data is based on year-specific county-level population or employment data from the U.S. Census Bureau. Exceptions include county-level use estimates of active ingredients in agricultural pesticides from the United States Geological Survey [ref 10] (2461850000) and vehicular lane miles traveled on paved roads from the Federal Highway Administration [ref 11] and MOVES model (2401008000). All activity data reflects the most recently available dataset.

The eleven SCCs allocated from the national-level to the county-level using population are listed in the table below.

Table 32-2: Source Categories That Use Population Activity Data

SCC	Description
2401001000	Architectural Coatings
2401100000	Industrial Maintenance Coatings
2401200000	Other Special Purpose Coatings
2460100000	All Personal Care Products
2460200000	All Household Products
2460400000	All Automotive Aftermarket Products
2460600000	All Adhesives and Sealants
2460800000	All FIFRA Related Products
2460500000	All Coatings and Related Products

SCC	Description
2460900000	Misc. Products
2460030999	Lighter Fluid, Fire Starter, Other Fuels

The SCCs allocated from the national-level to the county-level using employment statistics from the U.S. Census Bureau's County Business Patterns are all typically industrial in nature and listed in the table below.

Table 32-3: Source Categories That Use Employment Activity Data

SCC	Description	NAICS
2401005000	Auto Refinishing	81112/, 4411//, 4412//
2401015000	Factory Finished Wood	321///
2401020000	Wood Furniture	337110, 337121, 337122, 337127*, 337211, 337212, 337215*
2401025000	Metal Furniture	337124, 337127*, 337214, 337215*
2401030000	Paper	322220
2401040000	Metal Cans	33243/
2401055000	Machinery and Equipment	333///
2401060000	Large Appliances	3352//
2401065000	Electronics and Other Electrical	331318, 3314//, 33592/, 335311
2401070000	Motor Vehicles	3361//, 3362//, 3363//, 3369//
2401075000	Aircraft	3364//
2401085000	Railroad	3365//
2401080000	Marine	3366//
2401090000	Misc. Manufacturing	339///
2415000000	Degreasing: All Processes/All Industrial	331///, 332///, 333///, 334///, 335///, 336///, 337///, 339///, 441///, 483///, 484///, 485///,
2425000000	Graphic Arts	32311/, 32221/, 32222/, 32223/, 322299
2420000000	Dry Cleaning	812320

* Employment data is split evenly between Wood Furniture and Metal Furniture

Emissions from agricultural pesticides (2461850000) are allocated from the national-level to the county-level using active ingredient application statistics from the United States Geological Survey. These statistics are reported at the county-level and the EPEST_HIGH_KG value in the associated dataset is utilized. The most recent dataset available is from 2017, and is used for the 2020 NEI. Due to data limitations, the USGS statistics do not contain active ingredient usage statistics for Alaska and Hawaii. For these jurisdictions, the mass of active ingredients applied in the conterminous United States was summed and divided by the total acres treated with pesticides, insecticide, and fungicide in the conterminous United States, as reported by the United States Department of Agriculture's Census of Agriculture [ref 12]. These usage factors (kg pesticide active ingredient usage per acre treated) were then applied to the Census of Agriculture's reporting of total acres treated per-county in Alaska and Hawaii.

Emissions from traffic markings (2401008000) were previously allocated from the national-level to the state-level using data from the U.S. Department of Transportation's Federal Highway Administration, and from the state-level to the county-level using population data. For the 2020 NEI and beyond, national-level allocation methods for traffic markings utilize estimates of county-level paved vehicular miles traveled, which is consistent with the methods employed for asphalt paving. This update assumes application of traffic markings is correlated with pavement of roads.

Due to confidential business information concerns, the U.S. Census Bureau often withholds data in the County Business Patterns dataset. This is the case if a particular county has 2 or fewer establishments under a given North American Industrial Classification Standard (NAICS) code. In prior years, the County Business Patterns data reported the counties where data was withheld, along with dataset ranges for the withheld data (e.g., 20-99 employees). A gap-filling procedure was implemented using state-level data, which did not feature withheld data, to estimate employment counts in all counties.

Beginning in 2018, the Census Bureau stopped reporting dataset ranges for counties with withheld data. As such, the prior gap-filling methods required updating. For all post-2017 inventories, year-specific employment data from the County Business Patterns dataset is used to determine the total amount of withheld data in each state. The 2017 version of the County Business Patterns is then used to determine the counties for which withheld data exist and the data ranges for those counties, and it is to these counties that the difference between the state-level total employment and county-level total employment are allocated.

32.2.2 Emission Factors

Emissions factors are provided in the "Wagon Wheel Emission Factor Compendium" on the 2020 NEI Supporting Data and Summaries site.

The framework [ref 2] used to estimate emission factors from the nonpoint solvent sector considers:

1. The mass of chemical products used,
2. The composition of these chemical products,
3. The physiochemical properties of the chemical product constituents that govern volatilization, and
4. The timescale available for these constituents to evaporate.

This methodology resolves several issues in prior methods. First, prior methods did not account for fate-and-transport. Often, chemical products (e.g., personal care products) are quickly sequestered and thus unavailable for emission. Therefore, the speciation and magnitude of organics in emissions can differ from the speciation and magnitude of organics in the composition of products from which they volatilize. To consider fate-and-transport, the new methodology accounts for the evaporation timescale of the individual components within products and the use timescale available for evaporation (i.e., the elapsed time between application and any explicit removal process). Second, prior methods only quantified mass usage of chemicals that function as solvents. Sources in this sector include organics that evaporate and fulfill product functions beyond acting as a traditional solvent (e.g., isobutane as propellants, monoterpenes as fragrances). The new methodology attempts to quantify all organic mass that evaporates on relevant timescales. Third, prior methods assumed all mass usage and subsequent evaporation consisted of organics classified as regulatory VOCs. Evaporative organics from chemical products include many organics that are exempt compounds (e.g., acetone, siloxanes) and their proportions much be accounted for to accurately estimate regulatory VOC emissions.

Sector-relevant usage estimates are based on national-level data, including data from the U.S. Census Bureau's Annual Survey of Manufacturers, commodity prices from the U.S. Department of Transportation's 2012 Commodity Flow Survey and the U.S. Census Bureau's Paint and Allied Products Survey, and producer price indices from the Federal Reserve Bank of St. Louis. Derivation of product usage is as follows:

$$U = {(S \times 1000)} \Big/ \left(CP \times \left({PPI_{2019}}/{PPI_x}\right) \times Pop\right) \tag{1}$$

Where:

U	=	Annual usage in kg person^{-1} year^{-1}.
S	=	Annual Survey of Manufacturers shipment value in \$1000 year^{-1}.
CP	=	Commodity Price from the U.S. Department of Transportation's 2012 Commodity Flow Survey or the U.S. Census Bureau's Paint and Allied Products Survey in kg year^{-1}.
PPI_{2020}	=	Producer Price Index from the Federal Reserve Bank of St. Louis for the appropriate NAICS code in 2019 (unitless).
PPI_x	=	Producer Price Index from the Federal Reserve Bank of St. Louis for the appropriate NAICS code in "Price Year" (unitless).
Pop	=	National-level population count from the U.S. Census Bureau.

Due to data limitations, usage estimates for three SCCs follow different methods. Miscellaneous products (2460900000) and lighter fluid (2460030999) usage estimates are retrieved from sales quantities reported in a California-specific survey [ref 3], and dry-cleaning (2420000000) usage estimates are retrieved from a report published by The Freedonia Group [ref 1].

To translate from usage to emissions, fate-and-transport is considered. Here, fate-and-transport is a function of the predicted evaporation timescale of each compound and the assigned use timescale of each product category. The evaporation timescale is the compound specific, characteristic timescale of emission from a surface layer and is calculated using previously published methods [ref 13,14]. This timescale is defined as a relationship between the mass of a compound applied and the rate of its emission, which can be expressed by:

$$Evaporation\ Timescale\ [hr] = {M_{applied}}/{R_{emission}} = {K_{OA} \times d}/{v_e} \tag{2}$$

Where:

K_{OA}	=	The octanol-air partitioning coefficient of the compound.
d	=	The assumed depth of the applied product layer.
v_e	=	The mass transfer coefficient of the compound from the surface layer into the bulk air, which is a function of aerodynamic and boundary layer resistances.

A compound's K_{OA} it is the ratio of an organic chemical's concentration in octanol to the organic chemical's concentration in air at equilibrium. It is often used to quantify the partitioning behavior of an organic compound between air and a matrix. As experimental values of KOA are sparse, modeled estimates from the QSAR model OPERA [ref 15] are used and are retrieved from the U.S. EPA's CompTox Chemistry Dashboard. In addition, each product category is assigned an indoor usage fraction (see Table below). This assignment enables the mass transfer coefficient to vary between indoor and outdoor conditions. Typically, the mass transfer coefficent indoors is smaller than the mass transfer coefficient outdoors due to more stagnant atmospheric conditions, and the newest version of the modeling framework reflects these dynamics. Indoor product usage utilizes a v_e of 5 m hr^{-1}, and the remaining outdoor portion is assigned a v_e of 30 m/hr [ref 13,14]. Median values for *d* [0.1 mm] from Khare and Gentner (2018) [ref 13] are applied for both indoors and outdoors.

Table 32-4: Fraction of application assumed to occur indoors per SCC.

SCC	Description	Assumed Indoor Emission [fraction]
2401001000	Architectural Coatings	0.50
2401005000	Auto Refinishing	0.50
2401008000	Traffic Markings	0.50
2401015000	Factory Finished Wood	0.50
2401020000	Wood Furniture	0.50
2401025000	Metal Furniture	0.50
2401030000	Paper	0.50
2401040000	Metal Cans	0.50
2401055000	Machinery and Equipment	0.50
2401060000	Large Appliances	0.50
2401065000	Electronic and Other Electrical	0.50
2401070000	Motor Vehicles	0.50
2401075000	Aircraft	0.50
2401085000	Railroad	0.50
2401080000	Marine	0.50
2401090000	Misc. Manufacturing	0.50
2401100000	Industrial Maintenance Coatings	0.50
2401200000	Other Special Purpose Coatings	0.50
2415000000	Degreasing: All Processes/All Industries	1.00
2425000000	Graphic Arts	0.50
2460100000	All Personal Care Products	*
2460200000	All Household Products	1.00
2460400000	All Automotive Aftermarket Products	0.00
2460600000	All Adhesives and Sealants	1.00
2460800000	All FIFRA Related Products	0.00
2460500000	All Coatings and Related Products	0.50
2461850000	Agriculture Pesticides	0.00
2460900000	Misc. Products	1.00
2420000000	Dry Cleaning	0.50

SCC	Description	Assumed Indoor Emission [fraction]
2460030999	Lighter Fluid, Fire Starter, Other Fuels	0.00

*** Emissions for Personal Care Products are calculated separately for short-use products and daily-use products. The final emission factor reflects a summation of both emission categories. Within the emissions modeling, a 1.00 indoor emission fraction is assumed for short-use products and a 0.50 indoor emission fraction is assumed for daily-use products.**

Emissions are then determined by comparing the calculated evaporation timescale for each component with the assigned use timescale for the product category from which the component resides. The use timescale is the timescale available for a product category to evaporate and is based on the length of its direct use phase. If the use timescale for the product category is greater than the evaporation timescale of an organic ingredient, the compound is assumed to be emitted. Else, the compound is assumed to be retained in the product or other condensed phase and permanently sequestered. Overall, organic emissions (E) for the complete sector are calculated as a summation over all organic compounds, *i*, and product categories, *j*, as follows:

$$E = \sum_{i,j} \begin{cases} 0 & if\ Use\ Timescale_j < Evaporation\ Timescale_i \\ U_j \times f_{E_j} \times f_{S_{i,j}} \times \left(1 - f_{C_j}\right) & if\ Use\ Timescale_j \geq Evaporation\ Timescale_i \end{cases} \quad (3)$$

Where:

U = Product usage.

f_E = Evaporative organic fraction

f_S = Fraction of an organic compound in the evaporative organics portion of a product category.

f_C = Fraction of emissions that feature post-use controls on a mass basis.

32.2.3 Controls

There are two methods for controlling organic emissions from the nonpoint solvent utilization sector. The first method involves product reformulation, where existing VOC ingredients are substituted with exempt organic compounds (e.g., acetone) or the VOC mass content of products is lowered. Regulations are often set to limit the VOC content of chemical products, with California typically setting the most stringent limits in the country [ref 17]. To reflect local regulations, the 2017 NEI made additional reductions to consumer solvent, architectural coating, and industrial maintenance coating SCCs for several states. The consumer solvent reductions were calculated using a phased approach developed in an Ozone Transport Commission (OTC) report where each marginal reduction reflect fractional changes to California Air Resource Board's (ARB) VOC inventory for consumer products. As ARB's most recent consumer and commercial product survey, which reports the VOC content and composition of products, is used in the underlying methodology, the fractional reductions to consumer products through product reformulation over time are implicitly captured. Therefore, it is assumed that these phased controls are represented, and further reductions are not necessary. However, application of emission factors whose derivation use the VOC content and composition of products from ARB's most recent survey to all states would artificially reduce emissions where area source VOC rules relevant to the solvent sector have not been adopted.

To account for emission variations for relevant consumer solvent SCCs, supplemental data from the OTC report are paired with information from ARB's most recent survey to quantify the VOC content of products prior to rule adoption. These pre-rule VOC content values are then used to generate emission factor multipliers for relevant SCCs and have been applied to generate the relevant emission factors for this sector. For example, ARB's most recent survey reports 10.14 tons per day of Brake Cleaner sales. The OTC documentation reports a 3.7 tons per day reduction in VOC emissions due to the adoption of a VOC limit of 10%, by weight. Therefore, the VOC limit prior to the rule adoption was 46.5%, by weight, which is derived using the following equation:

$$P_{VOCr} = S \times \left(VOC_{wt\%i} - VOC_{wt\%f}\right) \quad (1)$$

Where:

P_{VOCr} = Daily VOC emission reduction for a given product.
S = Daily sales of a given product.
$VOCwt\%i$ = Initial VOC weight %.
$VOCwt\%f$ = Final VOC weight %.

Similar VOC content updates were applied to multipurpose solvents, paint thinners, disinfectants, floor polish, windshield washer fluids, construction adhesives, and all other products considered in the OTC documentation [ref 16]. The updated VOC content values for all listed products were then applied to the derivation of the VOC content for all relevant product categories in the new emissions framework. Following this procedure, products are aggregated into relevant categories (e.g., household cleaners) and emission factor multipliers were generated (see table below).

Table 32-5: Post-use control assumptions and emission factor inflation percentages.

SCC	Description	Post-Use Control Assumption [fraction]	Emission Factor Multiplier for Uncontrolled States
2401001000	Architectural Coatings	0.00	1.340
2401005000	Auto Refinishing	0.00	--
2401008000	Traffic Markings	0.00	--
2401015000	Factory Finished Wood	0.00	--
2401020000	Wood Furniture	0.00	--
2401025000	Metal Furniture	0.00	--
2401030000	Paper	0.00	--
2401040000	Metal Cans	0.00	--
2401055000	Machinery and Equipment	0.00	--
2401060000	Large Appliances	0.00	--
2401065000	Electronic and Other Electrical	0.00	--
2401070000	Motor Vehicles	0.00	--
2401075000	Aircraft	0.00	--
2401085000	Railroad	0.00	--
2401080000	Marine	0.00	--

SCC	Description	Post-Use Control Assumption [fraction]	Emission Factor Multiplier for Uncontrolled States
2401090000	Misc. Manufacturing	0.00	--
2401100000	Industrial Maintenance Coatings	0.00	1.340
2401200000	Other Special Purpose Coatings	0.00	--
2415000000	Degreasing: All Processes/All Industries	0.00	--
2425000000	Graphic Arts	0.00	--
2460100000	All Personal Care Products	0.00	1.003
2460200000	All Household Products	0.00	1.079
2460400000	All Automotive Aftermarket Products	0.00	3.548
2460600000	All Adhesives and Sealants	0.00	1.380
2460800000	All FIFRA Related Products	0.00	--
2460500000	All Coatings and Related Products	*	2.025
2461850000	Agriculture Pesticides	0.00	--
2460900000	Misc. Products	0.00	--
2420000000	Dry Cleaning	0.00	--
2460030999	Lighter Fluid, Fire Starter, Other Fuels	0.90**	--

*** Emissions for All Coating and Related Products are calculated separately for aerosol coatings and allied paint products (e.g., paint thinners, clean up solvents, multipurpose solvents, etc.). The final emission factor reflects a summation of both emission categories. Within the emissions modeling, a 0.33 post-use control factor is applied to allied paint products to reflect disposal of clean up solvents and paint thinners.**

**** Emissions for Lighter Fluid, Fire Starter, Other Fuels are assumed to feature 90% destruction via in-use combustion.**

Uncontrolled emission factors for architectural coatings and industrial maintenance coatings are quantified using the prior ratio of controlled to uncontrolled emissions, which were based on estimates from the Eastern Regional Technical Advisory Committee. In the 2017 NEI, architectural and industrial maintenance coatings generated 2.03 lb/capita in states with applicable area source VOC rules and 2.72 lb/capita in states without rules. The resulting 1.340 scaling factor (2.72 / 2.03) is used to generate the uncontrolled emission factor shown above.

The second pathway for controlling organic emissions from the solvent utilization sector involves post-use controls. These methods include add-on controls, manufacturing process modifications, and disposal techniques. A post-use control assumption is applied in the derivation of two SCCs: 2460500000 and 2460030999 (see table above). Since adoption of additional post-use control technologies vary widely in space and time, assigning blanket post-use controls beyond these two SCCs is not considered here. In lieu of these blanket assumptions, the Solvent Tool allows users to adjust emissions factors to account for controls, if needed.

The states for which area source VOC rules and controlled emissions factors will be applied are shown below.

Table 32-6: States with area source VOC rules relevant to the solvent sector.

State	Consumer Solvents	Architectural /Industrial Maintenance Coatings
AZ		X
CA	X	X
CO	X	X
CT	X	X
DE	X	X
DC	X	X
ME	X	X
MD	X	X
MA	X	X
NH	X	X
NJ	X	X
NY	X	X
PA	X	X
RI	X	X
TX		X
UT	X	X
VT		X
VA	X	X

32.2.4 Emissions

Total VOC emissions from solvent utilization are calculated by multiplying the activity data for the source category by the calculated emissions factor for that category.

$$E_{VOCc,s} = A_{c,s} \times EF_{VOC,s} \qquad (1)$$

Where:

$E_{VOC,c,s}$ = Annual VOC emissions in county *c* for source category *s*, in tons per year.
$A_{c,s}$ = Activity data for county *c* associated with source category *s.*
$EF_{VOC,s}$ = Calculated VOC emissions factor for source category *s.*

Speciation factors for these sources are provided on the 2020 NEI Supporting Data and Summaries site. HAP emissionss are estimated using the VOC emissions and HAP speciation factors. This step is completed after the point source subtraction step discussed in section H. It should be noted that if a speciation profile normalized to Total Organic Gas (TOG) is used for HAP-augmentation, the TOG/VOC ratio must first be applied to the Speciation Factor.

$$E_{p,c,s} = E_{VOC,c,s} \times SF_{p,s} \qquad (13)$$

Where:

$E_{p,c,s}$	=	Annual emissions of HAP *p* county *c* for source category *s*, in tons per year.
$E_{VOC,c,s}$	=	Annual VOC emissions in county *c* for source category *s*, in tons per year.
$SF_{p,s}$	=	Speciation factor for HAP *p* for source category *s*.

32.2.5 Point Source Subtraction

Since emissions from solvent utilization occur from both point and nonpoint SCCs, point source subtraction is required to ensure emissions from this sector are not double-counted. To accomplish this task, nonpoint SCCs must be mapped to corresponding point SCCs. This crosswalk can be found on the Nonpoint Methods Advisory (NOMAD) Sharepoint.

Point source subtraction for this sector should be completed at the county level using *uncontrolled* point source emissions. As such, assumptions related to the control efficiency of the point sources must be made. Often, the point source emission estimates submitted to the NEI feature 80-90% control efficiencies. *Uncontrolled* point source emission calculations will be calculated, as necessary, using the submitted point source emissions, engineering judgement, and an assumed control efficiency.

The net calculation of nonpoint emissions following point source subtraction is as follows:

$$NP_{s,c} = TE_{s,c} \times PS_{s,c} \qquad (2)$$

Where:

$NP_{s,c}$	=	Nonpoint source solvent emissions in county *c* for source category *s*, in tons per year.
$TE_{s,c}$	=	Total solvent emissions *s* in county *c* for source category *s*, in tons per year.
$PS_{s,c}$	=	Point source solvent emissions in county *c* for source category *s*, in tons per year.

If point source subtraction results in negative emissions, the Solvent Tool will zero out emissions for that source category in that county. HAP emissions are speciated from the estimated nonpoint source VOC emissions following point source subtraction.

32.2.6 Sample Calculations

Sample calculations for VOC emissions from adhesives and sealants solvent utilization are included in the table below. The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

Table 32-7: Sample calculations for All Adhesives and Sealants

Eq. #	Equation	Values	Result
5	$E_C = EF_{SCC} \times P_C$	$1.84\ {}^{lb}/_{capita} \times 66{,}000\ people$	60.72 tons of VOC

32.2.7 Improvements/Changes in the 2020 NEI

Substantial methodological changes to estimate emissions from this sector was made for the 2020 NEI.

The reader is directed to the previously cited reference [ref 2] for additional details on the emission factor generation methods. In addition, agricultural pesticide (2461850000) emissions are now generated using the updated methods and are not estimated via a separate tool.

32.2.8 Puerto Rico and U.S. Virgin Islands

For all SCCs that utilize population and employment statistics, emissions from Puerto Rico and the U.S. Virgin Islands are calculated using the same methodology described above. For agricultural pesticides and traffic markings, emissions are estimated using per-capita activity data from representative counties in Florida (Broward County and Monroe County for Puerto Rico and the U.S. Virgin Islands, respectively).

32.3 References

1. The Freedonia Group: Solvents, Industry Study #3429, The Freedonia Group, Cleveland, OH, 2016.
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