2.D.3.a - Domestic Solvent Use, including Fungicides

Short description

~ NFR-Code	~ Name of Category	~ Method	~ AD	~ EF	~ Key Category	1
= 2.D.3.a	= Domestic Solvent Use (including fungicides)	= T2	= NS	= CS	= **L & T**: NMVOC	

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This source category comprises NMVOC emissions from the use of solvent-based products in domestic applications excluding paints and lacquers. (The latter products are included in source category 2.D.3.d).

The following product groups are taken into consideration:

i) Domestic solvent use

- **Soaps**
- **Laundry detergents, dishwashing detergents and cleaning products** (fabric softeners; universal detergents; washing agents; auxiliary washing preparations; dishwashing liquids; detergents for dishwashers; floor detergents; carpet shampooers; car cleaning shampoos; glass cleaners; WC cleaners)
- **Care products for footwear, leather articles, furniture, floors and cars**
- **Polishing agents** (for metal)
- **Deodorizers** (for rooms and others)
- **Perfumes** (including after shaves; eau de toilette, perfumes)
- **Cosmetic and make-up preparations** (make-up; hand care products; nail care products; pedicure products; face cleanser; suntan lotions; face and body care products and others)
- **Shampoos and hair care products** (shampoos; preparations for permanent waving or straightening; hair sprays; lotions and brilliantines; toning shampoos; hair colouring products; hair bleaching and other)
- **Other personal care products** (shaving creams; personal deodorants and antiperspirants; bath essences; depilatories, deodorants, preparations for intimate hygiene and other)
- **Antifreeze agents for cars**

ii) Domestic use of pharmaceutical products

'NMVOC' is defined in keeping with the VOC definition found in the EC solvents directive. For purposes of the definition of solvents, the term 'solvent use' is also defined in keeping with the EC solvents directive.

Method

General procedure

NMVOC emissions are calculated in keeping with a product-consumption-oriented approach.

In this approach, solvent-based products or solvents are allocated to the source category, and then the relevant NMVOC emissions are calculated from those solvent quantities via specific emission factors. Thus, the use of this method is possible with the following valid input figures for each product group:

- Quantities of VOC-containing (pre-) products and agents used in the report year,
- The VOC concentrations in these products (substances and preparations),
- The relevant application and emission conditions (or the resulting specific emission factor).

The quantity of the solvent-based (pre-)product corresponds to the domestic consumption which is the sum of domestic production plus import minus export.

NMVOC Emission = domestic consumption of a certain product * solvent content * specific emission factor

The calculated NMVOC emissions of different product groups for a source category are then aggregated.

The product / substance quantities used are determined at the product-group level with the help of production and foreign-trade statistics. Where possible, the so-determined domestic-consumption quantities are then further verified via cross-checking with industry statistics.

Specific information

Calculation of domestic consumption was based on:

- the German production statistics and external trade statistics for the subgroup "Domestic solvent use".
- turnover values of pharmaceuticals produced in Germany for the subgroup "Domestic use of pharmaceutical products",

Solvent contents for this product group corresponds to personal information from industrial associations and German literature [1].

For alcohol-based cleaning detergents an emission factor of 3% was assumed for calculations [2]. For all other products of this source category (e.g. hair spray, after shave, perfumes), an emission factor of 95% was applied.

Discussion of emission trends

General information

Since 1990, so the data, NMVOC emissions from use of solvents and solvent-containing products in general have decreased by nearly 38%. The main emissions reductions have been achieved in the years since 1999. This successful reduction has occurred especially as a result of regulatory provisions such as the 31st Ordinance on the execution of the Federal Immissions Control Act (Ordinance on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain facilities – 31. BImSchV) [3], the 2nd such ordinance (Ordinance on the limitation of emissions of highly volatile halogenated organic compounds – 2. BImSchV) [4] and the TA Luft.

Specific information

Until 1999, data of the present source categories 2.D.3.a, 2.D.3.h and 2.D.3.i were treated as one source group. Since 2000, a more detailed data collection enables to follow the development of source group 2.D.3.a, which accounts for about 10 – 12% of total NMVOC emissions from solvent-based products (Figures 1-2).

gallery size="medium" : 2D3a.png gallery **Figure 1:** Development of NMVOC emissions from source group 2.D.3.a since 1990.

Only a slight decrease in the overall NMVOC emissions can be observed since 2000. Table 1 lists four product groups that cause major emissions in category 2.D.3.a: hair sprays, antifreeze agents for cars, eau de toilette and pharmaceutical products.

Table 1: Product groups primarily contributing to NMVOC emissions

~ Major emissions from ...	~ 2005	~ 2006	~ 2007	~ 2008	~ 2009	~ 2010	~ 2011	~ 2012	~ 2014	~ 2016	~ 2017
Hair spraysfootnote The changes in emission quantities of hair sprays are based on changes in domestic consumptions. The solvent content and the emission factors remained stable. footnote	9%	7%	10%	25%	19%	12%	14%	19%	15%	12%	10%
Antifreeze agents for cars	21%	31%	29%	21%	25%	40%	28%	18%	21%	22%	24%
Eau de Toilette	9%	10%	11%	3%	7%	9%	11%	17%	12%	12%	11%
Domestic use of pharma-ceutical products	6%	10%	10%	11%	10%	9%	10%	10%	10%	12%	12%

The table presents the share of emissions on total emissions of this source group. These four product groups comprise together 44 – 69% of total emissions depending on the considered year.

As emission factors and solvent contents largely remained robust since 2000, domestic consumption of products caused visible changes in NMVOC emissions. For instance, the amount of used 'antifreeze agents for cars' per year primarily depends on the weather situation of the specific year. As antifreeze agents have one of the highest domestic consumption values of the category 'domestic solvent use', they significantly influence the final value of emitted NMVOC of this category. The increase in emissions in 2010 can be majorly explained by a long-lasting cold season and the need for antifreeze agents.

Table 2: Product groups primarily contributing to emissions and their relative development since 2005

~ Major emissions from ...	~ 2005	~ 2006	~ 2007	~ 2008	~ 2009	~ 2010	~ 2011	~ 2012	~ 2014	~ 2016	~ 2017
Hair sprays footnote The changes in emission quantities of hair sprays are based on changes in domestic consumptions. The solvent content and the emission factors remained stable. footnote	100%	83%	114%	291%	239%	189%	183%	252%	219%	188%	164%
Antifreeze agents for cars	100%	145%	146%	100%	133%	271%	156%	97%	126%	139%	155%
Eau de Toilette	100%	119%	138%	33%footnote The change in emission quantities of toilet waters in 2008 is based on a significant reduction in domestic consumption for this year. The solvent content and the emission factors remained stable. footnote	98%	146%	156%	228%	185%	189%	180%
Domestic use of pharma-ceutical products	100%	182%	191%	191%	206%	216%	212%	209%	219%	286%	299%

The domestic consumption and hence NMVOC emissions decreased for few product groups, such as personal deodorants, antiperspirants and car surface protectants, compared to the year 2005.

However, domestic consumption and hence NMVOC emissions increased for many product groups, such as soaps, hair sprays, eau de toilette and pharmaceutical products in the same period. Therefore, the emission trend for the complete NFR category is raising in Germany for the period 2005 until 2015.

Uncertainties

Uncertainties for emissions for each product were obtained by error propagation and refer to the 95% confidence interval.

Domestic Consumption:

For all values based on the official statistics, a relative uncertainty of ±10% was applied. (An exception is the complex value for 'antifreeze agents for cars' at ±20%.) Solvent content: For each product, a relative error at ±15% was applied, but not exceeding 100% or falling below 0%. Emission factors: For each product, a relative error at ±15% was applied, but not exceeding 100% or falling below 0%. (An exception is the value for 'antifreeze agents for cars' at ±25% based on expert estimation.)

Hence the overall uncertainty of emissions caused by application of products of this source group is 40% with exception of 'antifreeze agents for cars' at 60%.

Recalculations

There are no recalculations.

Planned improvements

At the moment, no category-specific improvements are planned.

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bibliography : 1: Berner, P.: Maßnahmen zur Minderung der Emissionen flüchtiger organischer Verbindungen aus der Lackanwendung - Vergleich zwischen Abluftreinigung und primären Maßnahmen am Beispiel Baden-Württembergs, Stuttgart: Institut für Energiewirtschaft und Rationelle Energieanwendung, Universität Stuttgart, Forschungsbericht Band 42, 1996 - Dissertation, Stuttgart, 1996 : 2 : Wooley, J., Nazaroff, W.N., Hodgon, A.T.: Release of ethanol to the atmosphere during use of consumer cleaning products, J. Air Waste Manage. Assoc. 40, 1114-1120, Berkeley, California, 1990. : 3 : 31. BImSchV: Ordinance on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain facilities; https://www.gesetze-im-internet.de/bimschv_31/index.html : 4: 2. BImSchV: Ordinance on the limitation of emissions of highly volatile halogenated organic compounds; https://www.gesetze-im-internet.de/bimschv_2_1990/index.html bibliography

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[1] (bibcite 1)
[2] (bibcite 2)
[3] (bibcite 3)
[4] (bibcite 4)