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CHAPTER 3  
SOLVENT AND OTHER  
PRODUCT USE

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## 3 SOLVENT AND OTHER PRODUCT USE

### 3.1 Overview

Solvents and related compounds are important for greenhouse gas (GHG) and other emission inventories because they are a significant source of emissions of non-methane volatile organic compounds (NMVOCs). No other GHGs are emitted in significant amounts from the use of solvents and related compounds, which include chemical cleaning substances used in dry cleaning, printing, metal degreasing, and a variety of industrial applications as well as household use. Also included in this category are paints, lacquers, thinners and related materials used in coatings in a variety of industrial, commercial and household applications. Table 3-1 lists some of the potentially important subcategories included under this source category.

This category also includes evaporative emissions of greenhouse gases arising from other types of product use. This included, for example, N<sub>2</sub>O emissions from medical use. Emissions arising from the use of hydrofluorocarbons (HFCs) in applications like refrigeration, air conditioning, fire extinguishers, solvents foam-blowing, cooling and aerosols should be reported in Industrial Processes under category 2F.

All of the substances included here contain significant amounts of NMVOC. Emissions are produced through evaporation of the volatile chemicals when these products are exposed to air. Non-methane volatile organic compounds (NMVOCs) are often emitted in significant quantities from evaporation during the variety of dispersed activities discussed above. These emissions are sometimes referred to as "area" sources because they occur in large numbers of small dispersed applications, rather than from large centralised industrial processes (or "point" sources).

Solvent and other product use is treated as a separate category in detailed inventory procedures (e.g., CORINAIR) because the nature of this area source requires a somewhat different approach to emissions estimation than that used for calculating other emissions categories. The IPCC *Guidelines* treats the category separately for this reason.

### 3.2 NMVOC Emissions from Solvent and Other Product Use

NMVOC emissions estimates are characterised by high uncertainty. This is especially true for the solvent use source category on a global scale. The contribution of this source category is believed to be quite significant. A preliminary analysis estimated total global NMVOC release from solvent use to be about 11 per cent of total NMVOC emissions (Watson, et al., 1991).

Based on national GHG emissions inventories, NMVOC emissions from these sources can represent a much larger share of the total NMVOC emissions for some countries. NMVOC from solvent use represents 31 per cent of the total NMVOC emissions for both Italy and Denmark. (ENEA, 1991, Fenger et al., 1990) The Netherlands estimates solvent use to account for 25 per cent, and both Finland and the United States estimate emissions to be 24 per cent of their total NMVOC emissions (van den Born et al., 1991, Boström et al., 1992, US EPA, 1991). By contrast, emissions from solvent use in Nigeria were only 3 per cent of the total NMVOC (Obioh et al., 1992).

#### 3.2.1 Estimating Emissions

The wide variations in national emissions from solvent and other product use highlight the differences in their use between countries and some of the difficulties associated with accurately estimating emissions from these sources.

There are two basic approaches to estimation of emissions from Solvent and Other Product Use, which depend on the availability of data on the activities producing emissions and the emission factors.

- 1 Production-based** - In some cases, solvent or coating use is associated with centralised industrial production activities, such as automobile and ship production, textile manufacture, paper coating, chemical products manufacture, etc. In these cases it is generally possible to develop NMVOC emission factors based on unit of product output. These are based on the amount of paint, solvents, or other chemically volatile products consumed per unit of production of the final products. Once reasonable factors are developed it is straightforward to estimate annual emissions based on production data which are generally available on an annual basis for most countries. Industrial production data is also compiled and published by international organisations (e.g., United Nations, 1992) and these data can be used to supplement locally available data.
- 2 Consumption-based** - In many applications of paints, solvents and similar products, the end uses are too small-scale, diverse, and dispersed to be tracked directly. Therefore emissions estimates are generally based on total consumption (i.e., sales) of the solvents, paints, etc. used in these applications. The assumption is that once these products are sold to end users, they are applied and emissions produced relatively rapidly. For most surface coating and general solvent use, this approach is used. Emission factors are developed based on the likely ultimate release of NMVOC to the atmosphere per unit of product consumed. These emission factors can then be applied to sales data for the specific solvent or paint products.

The IPCC/OECD joint programme has not produced any original work on estimation of NMVOCs from the use of these products. This is for two reasons. First, NMVOC is a greenhouse gas (actually a class of gases) covered under the programme, but it has been



assigned a lower priority for national experts just initiating greenhouse gas inventory work. Most methods development work within the IPCC/OECD programme has focused on providing methods and default information for the first priority gases - CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O, which are direct greenhouse gases. Second, NMVOCs are among the gases already under heavy scrutiny in national and international inventory programmes because of their role as local and regional air pollutants. Hence there is a large and growing body of literature containing guidance on estimation procedures and emission factors for NMVOCs from a number of source categories, including from solvents and other products.

National experts who are already familiar with these procedures and have emissions data available or under development, should report these data to the IPCC/OECD programme, as discussed in *Volume 1: Reporting Instructions*.

Other experts needing information should consult the existing major references such as:

- Default Emission Factor Handbook (EEATF, 1992);
- US EPA's Compilation of Air Pollutant Emissions Factors (AP-42) (US EPA, 1985) and Supplement F (AP-42) (US EPA, 1993);
- Criteria Pollutant Emission Factors for the 1985 NAPAP Emissions Inventory (Stockton and Stelling, 1987).
- Proceedings of the TNO/EURASAP Workshop (TNO Inst. of Environmental Sciences, 1993).
- EMER/CORINAIR (1996) Joint Emission Inventory Guidebook (1st edition).

### 3.2.2 Uncertainties

Because NMVOC emission controls vary widely throughout the world, it is important for national experts to account for the level of emission control application in their country. Also, there may be significant differences among countries regarding the processes and equipment used. These differences can affect the level of NMVOC emissions. Finally, because estimates based on consumption data provide only an approximation of the activities associated with the manufacture of all products within a particular subcategory, there is a degree of uncertainty in the estimates (Watson, et al., 1991).

Surface coating (e.g., painting) operations	Applications of paints, lacquer, enamel and primer to cans, wood products, metal parts, buildings, etc. Use of thinning solvents.
Paper coating operations	Coating operations, mixing and use of thinning solvents.
Printing and Publishing	Press operations, lithography, use of thinning solvents.
General Solvent Use	Vapour degreasing, dry cleaning, textile manufacture, household solvent use.
Production of Automobiles and Trucks	Surface coating, cleaning/degreasing operations.
Ship building	Surface coating, cleaning/degreasing operations.
Chemical Products Manufacture and Processing	Solvents are used in a variety of applications in the manufacturing of chemicals and chemical products.

### 3.3 References

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