



Improvement of Nordic Emission Models for Solvent Use in Selected Sectors

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Preface

This project “Improvement of Nordic Emission Models for Solvent Use in Selected Sectors” was funded by the Nordic Council of Ministers, Hav- og Luftgruppe. The project was initiated March 2008, a work-shop was held in May and in December 2008 the final report was delivered. All five Nordic countries were represented by the persons responsible for performing the national Non-Methane Volatile Organic Compound (NMVOC) emission inventories for solvent use:

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- Finland: *Kristina Saarinen*, Finnish Environment Institute (SYKE)
- Iceland: *Kristín Harðardóttir*, Environment Agency of Iceland
- Norway: *Marte O. Kittilsen and Nina Holmengen*, Statistics Norway
- Sweden: *Tina Skårman*, IVL Swedish Environmental Research Institute

Data and methodologies have been shared, compared and listed with the overall purpose to enable a harmonisation and facilitate revisions and improvements of NMVOC emission inventories for solvent use, made not only by the Nordic countries but also by related international organisations.

Summary

This project considers the NMVOC emission inventories for solvent use that are used by the five Nordic countries. The inventories are part of the reporting obligations to e.g. United Nations Framework Convention on Climate Change (UNFCCC), the European Commission and UNECE-Convention on Long-Range, Transboundary Air Pollution (CLRTAP). A general hurdle in collecting, comparing and reporting data is to handle the discrepancies in coding systems, i.e. the allocation of sources to industrial sectors and domestic use. In this project an attempt has been made to collect and compare all the major codes associated with emission reporting and registration of chemical substances that are used and processed as solvents in the Nordic countries. Emission factors have been presented for source categories and specific chemical substances, when possible.

As an example SNAP code 060101 (paint application, manufacture of automobiles) is shown below.

Id	SNAP/ CORINAIR	CRF	NFR	RAINS/ GAINS	NACE (Industrial use)	UCN (Use Categories)	Emission factor
1	060101	3A	3A	AUTO_P	34	M05	0.3

The table shows that SNAP 060101 corresponds to CRF and NFR code 3A and RAINS/GAINS code AUTO_P and NACE code 34. It is possible that one SNAP/CORINAIR code may correspond to more than one RAINS/GAINS or NACE code or vice versa. The id-number is representative of a unique combination of SNAP/CORINAIR, CRF, NFR, RAINS/GAINS and NACE codes. For the entire solvent sector 94 different id's have been identified and these are presented in the chapter "General linking of codes". UCN and emission factors are assigned for each id on a country specific level. In the example UCN code M05 corresponds to "paint application, manufacture of automobiles", and an emission factor of 0.3 is applicable for solvents used in this activity. A table with UCN and emission factors is presented for each country in the chapter "Country specific linking of codes and emission factors". For Denmark substance specific emission factors are presented in the chapter "Denmark".

Norway and Sweden have large parts of this linking of codes, activity data and emission factors already in their inventories, Denmark has parts of it and will implement further in the coming inventory with respect to inclusions/exclusions of substances, emission factors and linking of codes. Finland and Iceland do not have access to this kind of information and have designed their inventories on statistical data, reports by operators and information from surveys.

The purpose of this project has not been that each participating country should reach identical inventory methods, but rather that existing data was presented in the most transparent way in order to share, compare and improve data and methodologies.

The tables can be used for different purposes; since the source codes are very specific the activity data can be assigned to the correct sources. Emission factors may vary considerably from one source to another and the high degree of detail will facilitate specificity towards sources and substances. When activity data or an emission factor is known for one code it can be extrapolated to other code systems. When an emission factor is missing for a code, it is more probable to find an appropriate emission factor from other countries inventories or the literature, when all code systems can be considered. Furthermore the tables will provide a transparent way to identify data gaps where emphasis can be given in coming improvements. E.g. an effort should be made for accuracy of activity data for sources with high emissions or emission factors. Or accuracy should be sought for emission factors for sources with high activity values.

The tables cover the entire solvent use sector, however, special attention has been given to domestic use. NMVOC emissions from domestic use of solvents and solvent containing products are associated with high uncertainties, due to the diverse use and release patterns and the vast number of solvent containing products. In this report a suggestion for defining domestic use in terms of category codes has been presented and each country describes how emissions from domestic use are handled in their inventories. Some important discussions have been taken on how to classify solvent containing products, such as adhesives and thinners and solvents used in paints. An agreement has been reached and implemented in the general coding chapter. Discussions on emission factors for domestic use and paint application in general have been taken and the agreed emission factors are shown in the country specific tables. For Norway and Denmark, which consider emissions of substances, emission factors for specific substances have been assessed.

A future prospect is to elaborate further on other source categories related to the solvent inventory. Activities such as industrial application of paints and lacquers, printing industry, application of glues and adhesives and preservation of wood are important sources of NMVOC emissions and some will be strongly affected by coming regulations and emission reducing actions. When activity data and emission factors are determined more accurately and assigned to the correct source category this will improve the NMVOC emission inventories for solvent use and support the national policy makers in documenting the fulfilment of national emission goals.

1. Introduction

This project has been initiated by the entities of the five Nordic countries responsible for performing the national Non-Methane Volatile Organic Compound (NMVOC) emission inventories from use of solvents.

The Nordic Air Emission Expert Group concludes in the report (Review and harmonization of Nordic Air Emission Inventories, 2006) that the emission inventory methods for solvent use have important deficiencies, such as inappropriate emission factors or unrepresentative emission models as well as inaccurate activity data, which will strongly affect the inventories. This conclusion reflects the fact that there is a high complexity associated with solvent use in relation to the large number of user products and industrial activities that comprise solvent, the large number of different chemical substances with different volatilities that are used and the high diversity of use patterns and thus emission patterns that prevail. Emissions from solvent use are characterised by point sources from chemical industries and by diffuse emissions from private use and other industrial activities. To make a complete, transparent and accurate emission inventory from solvent use requires considerable data information, which in many cases is not available. The Nordic countries have developed methods that are detailed and in-depth with respect to following the guidelines and utilising the data that is available in the Nordic countries. In an international context the Nordic emission inventories from solvent use have a high standard not least through the presence of the Nordic product data base SPIN2000 (<http://195.215.251.229/DotNetNuke/default.aspx>). However there are still important issues that need be considered and the purpose of this project is to elaborate further on the aforementioned quality measures to reach and share the highest available level of knowledge in the five Nordic countries. In this project this is done through the following tasks:

- Share and compare knowledge on data and methodologies for the solvent sector within the Nordic countries
- Define a system for linking the different code systems for the solvent sector
- Define domestic solvent use in terms of use category codes
- Define emission factors for solvent sector with emphasis on domestic use
- Define substances, and their emission factors, that are used in the solvent sector with emphasis on domestic use
- Identify important data gaps

An important task within this project is to design a common format for linking the different coding systems that are used in emission inventory reporting. This will make comparison between countries more transparent and will facilitate the process of improving inventories and making recalculations for a country. At present there are discrepancies in the coding systems and the reporting requires considerable transformation between codes, which carries along potential misinterpretations and erroneous allocations to source categories.

A further purpose is to allocate emission factors to the specified codes and source categories. Emission factors related to solvent use can be very uncertain and often there is only limited information in the Guidebook. When all coding systems are taken into account the highest degree of differentiation is achieved and the emission factors will therefore also reach a high degree of specificity. It is not always possible to assign emission factors to every code, but the code linking will highlight where important data gaps are present and where emphasis can be given in the coming inventory period. Although a direct comparison between emission factors is made possible important differences may still prevail between countries for the same source codes and in such cases a comparison will be an inspiration and a starting point for further in-depth study of a given source code.

Furthermore when information exists for use of substances in source codes the detail of the inventory can be increased. Although substances may be used in the same source code, i.e. industrial process and/or use product, their emission factors may be different, due to their use in the process and their chemical properties. Some substances may be incorporated and fixed in a product whereas others may be used as solvents. For some countries data on substance level is not available due to confidentiality.

An important source of solvent use is domestic use of solvents and solvent containing products. Due to the high number of solvent containing products and great variety of use practices, there is a high variability of release patterns of solvents to the atmosphere. Domestic use is diffuse, i.e. the emissions are wide-spread and are not controlled by collection of solvent vapours and remains. Accordingly the assignment of emission factors to solvent use and use of solvent containing products has a high potential uncertainty.

In the report the methodologies and data sources are presented for each country with special attention to domestic use. In the code linking tables the entire solvent sector is considered and in the country specific chapters some countries deal with the substances that are used in the domestic use categories and their relative importance with respect to emission amounts.

2. Reporting obligations and code systems

NMVOC emissions inventories for solvent use are part of the national emission inventories, which are prepared and submitted by each Member Country to fulfil the national obligations to United Nations Framework Convention on Climate Change (UNFCCC), the European Commission, UNECE-Convention on Long-Range, Transboundary Air Pollution (CLRTAP) and in the future information on releases from diffusive sources (for example solvent use) shall be included in the reporting to UNECE-Aarhus Convention Protocol on Pollutant Release and Transfer Registers (PRTR). The NMVOC emission inventories from solvent use are also included in the greenhouse gas (GHG) emission inventories, which are employed for fulfilling the National Emission Ceilings (NEC).

The Task Force on Emission Inventories is responsible for developing and maintaining the EMEP/CORINAIR Emission Inventory Guidebook used for the estimation and reporting of national emissions. The Task Force also maintains the air pollution source-category nomenclatures NFR (Nomenclature For Reporting) and SNAP (Selected Nomenclature for Air Pollution). NFR formats are in accordance with the EMEP 2002 Reporting Guidelines and cover seven groups:

1. Energy
2. Industrial processes
3. Solvent and other product use
4. Agriculture
5. Land-use change and forestry
6. Waste
7. Other

The SNAP Nomenclature was originally developed for the 1985 EC CORINAIR emissions inventory (SNAP94) and has been revised a couple of times latest in 1997 (SNAP97) to ensure compatibility between EMEP/CORINAIR and IPCC was recently revised (SNAP2007) (<http://reports.eea.europa.eu/EMEPCORINAIR5/en/page015.html>).

The common reporting format (CRF) is an integral part of the national emission inventory submission. It is designed to ensure that Parties included in Annex I to the Convention (Annex I Parties) report quantitative data in a standardised format, and to facilitate the comparison of inventory data across Annex I Parties. The information provided in the CRF is aimed at enhancing the comparability and transparency of inventories by

facilitating, *inter alia*, activity data and emission factors cross-comparisons among Annex I Parties, and easy identification of possible mistakes, misunderstandings and omissions in the inventories (http://unfccc.int/files/meetings/cop_11/application/pdf/cop11_09_8_tables_of_the_common_reporting_format_for_luluc.pdf).

The Regional Air Pollution Information and Simulation (RAINS/GAINS) model developed by the International Institute for Applied Systems Analysis (IIASA) combines information on atmospheric emissions with a number of other economic, energy and environmental parameters. These air pollution related problems are considered in a multi-pollutant context, quantifying the contributions of, *inter alia*, NMVOCs. The source categories of the RAINS/GAINS model are not directly compatible with that of SNAP/CORINAIR or NFR. In several cases, the relation between RAINS/GAINS sectors and the other sectoral classification schemes can be established only for a primary sector, e.g., the sum of all RAINS/GAINS categories for power and district heating plants can only be compared with the sum of several SNAP entries. RAINS/GAINS contain a feature to aggregate/display emissions into the SNAP/CORINAIR level 1 as well as NFR level 1 and 2 (http://www.iiasa.ac.at/~rains/voc_review/voc_ir-00-51.pdf).

NACE code “Nomenclature Generale des Activites Economiques dans l’Union Europeenne” (General Name for Economic Activities in the European Union) is a pan-European classification system which groups organisations according to their business activities. It assigns a unique 5 or 6 digit code to each industry sector. The NACE code system is the European standard for industry classifications and was introduced in 1970. In 1990 a revised version became applicable. The current version from 2008 is based on “International Standard Industrial Classification of all economic activities (ISIC) of the United Nations. NACE industrial use codes are used by producers and manufacturers to register manufacture and preparation of substances to the product data bases in Finland, Norway, Sweden and Denmark (http://ec.europa.eu/environment/emas/pdf/general/nacecodes_en.pdf).

The set of technical functions, UCN (Use Categories Nordic), is a common list of use categories for the Product Registers in Norway, Sweden and Denmark. Notifying chemical substances and materials (products) to the Product Register involves stating information on the use of the substances, among others also what the product is used for (the technical function of the product). The list of use categories for Product Register notifications consists of a list of 5-character codes each listed with an explanation text. The list has been created to meet the demands of the industry, primarily from the notifiers of paints, printing inks and adhesives, for correct use description of their products. It has also been designed to meet the demands of the new EU-regulation of substances in which a distinction of biocides and agricultural pesticides has been introduced. Finally, it has been introduced as a common list of use categories in the Nordic countries in order to harmonise the registration of technical functions of the products in the

Product Registers of Norway, Sweden and Denmark. The list can be seen at: <http://www.arbejdstilsynet.dk/graphics/at/05-Information/04-Andre-informationsmaterialer/Produktregistret/Funktionskoder-alle.xls>.

3. General linking of codes

No existing linking of all codes has previously been agreed upon in an international context. In this chapter a list linking SNAP/CORINAIR, CRF, NFR, RAINS/GAINS and NACE industrial use is suggested for the solvent use sector. The table has been agreed by the experts responsible for performing the emission inventories for solvent use in the five Nordic countries.

It is designed for an ideal situation, assuming that all codes are used and that there are no country specific limitations in data availability. The id is a running number, comprising all possible combinations of codes. This unique id number, representing a specific combination of codes, is also found in the following chapter on country specific linking of codes and emission factors. The colouring of tables is for transparency to distinguish SNAP/CORINAIR categories 0601 to 0604.

Table 3.1 (General linking of codes, SNAP 0601xx)

id	SNAP/CORINAIR		CRF		RAINS/GAINS		NACE (Industrial use)				
	Code	Name of activity	2002	NFR	Extensions	Sector description I	Sector description II	Abbreviation	Ideally	Product/function/use category	Comments
1	060101	Manufacture of automobiles	3A	3A	3 A ii Industrial paint application	Industrial use of paints: Automobile production	Manufacture of automobiles	AUTO_P	34	Paints and varnishes	
2	060102	Car repairing	3A	3A	3 A ii Industrial paint application	Industrial use of paints: Vehicle refinishing	Vehicle refinishing	VEHR_P	50	Paints and varnishes	
3	060103	Construction and buildings (except 060107)	3A	3A	3 A i Decorative paint application	Non-industrial Use of paints: Architectural use of paints	Decorative paints	DECO_P/ARCH_P	45	Paints and varnishes	
4	060103	Construction and buildings (except 060107)	3A	3A	3 A i Decorative paint application	Non-industrial Use of paints: Architectural use of paints	Decorative paints	DECO_P/ARCH_P	51	Paints and varnishes	Unknown distribution of products sold between sectors where products are used
5	060104	Domestic use (except 060107)	3A	3A	3 A i Decorative paint application	Non-industrial Use of paints: Domestic use of paints	Decorative paints	DECO_P/DOM_P	52	Paints and varnishes	Unknown distribution of products sold between sectors where products are used
6	060104	Domestic use (except 060107)	3A	3A	3 A i Decorative paint application	Non-industrial Use of paints: Domestic use of paints	Decorative paints	DECO_P/DOM_P	Private households	Paints and varnishes	No NACE
7	060105	Coil coating	3A	3A	3 A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Coil coating (coating of aluminum and steel)	COIL	27	Paints and varnishes	
8	060106	Boat building	3A	3A	3 A ii Industrial paint application	Industrial use of paints: Other industrial use of paints			35.1	Paints and varnishes	
9	060107	Wood	3A	3A	3 A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Wood coating	WOOD_P	20	Paints and varnishes	
10	060107	Wood	3A	3A	3 A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Wood coating	WOOD_P	36.1	Paints and varnishes	

Table 3.2 (General linking of codes continued, SNAP 0601xx)

id	SNAP/CORINAIR		CRF		RAINS/GAINS		NACE (Industrial se)		Product/function/use category	Comments
	Code	Name of activity	2002	Extensions	Sector description I	Sector description II	Abbreviation	Ideally		
11	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT	01–19	Paints and varnishes	
12	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT	21–24.2	Paints and varnishes	
13	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT	24.4–26	Paints and varnishes	
14	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT	28–33	Paints and varnishes	
15	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT	35.2–35.5	Paints and varnishes	
16	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT	36.2–37	Paints and varnishes	
17	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry	IND_P_OT		Paints and varnishes	
18	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry (continuous processes)	IND_P_CNT		Paints and varnishes	
19	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – Protective coating	IND_P_PRC		Paints and varnishes	
20	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Industrial paint applications – General industry (plastic parts)	IND_P_PL		Paints and varnishes	
21	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Leather coating	LEATHER		Paints and varnishes	
22	060108	Other industrial paint application	3A	3A ii Industrial paint application	Industrial use of paints: Other industrial use of paints	Winding wire coating	WIRE		Paints and varnishes	
23	060109	Other non industrial paint application	3A	3A iii Other paint application				40–44	Paints and varnishes	
24	060109	Other non industrial paint application	3A	3A iii Other paint application				46–49	Paints and varnishes	
25	060109	Other non industrial paint application	3A	3A iii Other paint application				53–99	Paints and varnishes	

Table 3.3 (General linking of codes continued, SNAP 0602xx)

id	SNAP/CORINAIR		CRF		RAINS/GAINS		NACE (Industrial use)			Comments
	Code	Name of activity	2002	NFR	Extensions	Sector description I	Sector description II	Abbreviation	Ideally	
26	060201	Metal degreasing	3B	3B	3 B i Degreasing	Surface cleaning: Degreasing	Degreasing	DEGR	27-35, 37.1	Degreasers
27	060202	Dry cleaning	3B	3B	3 B ii Dry cleaning	Surface cleaning: Dry cleaning	Dry cleaning	DRY	93.01	Products that are likely to be used in dry cleaners used in NACE 93.01 (dry cleaners)
28	060203	Electronic components manufacturing	3B	3B	3 B iii Other (please specify)				29.71, 30-33	Cleaning products except degreasers
29	060204	Other industrial cleaning	3B	3B					1-26	Cleaning products
30	060204	Other industrial cleaning	3B	3B					28-29.6, 29.72	Cleaning products except degreasers
31	060204	Other industrial cleaning	3B	3B					34-35	Cleaning products except degreasers
32	060204	Other industrial cleaning	3B	3B					36-37.0, 37.2	Cleaning products

Table 3.4 (General linking of codes continued, SNAP 0603xx)

id	SNAP/CORINAIR		CRF		RAINS/GAINS		NACE (Industrial use)			Product/function/use category	Comments
	Code	Name of activity	2002	NFR	Extensions	Sector description I	Sector description II	Abbreviation	Ideally		
33	060301	Polyester processing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)		PNIS	24.16, 25.2	Raw materials and other products likely to be used as raw materials	
34	060302	Polyvinylchloride processing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)	Polyvinylchloride produceduction by suspension process	PVC_PR	24.16, 25.2	Raw materials and other products likely to be used as raw materials	
35	060303	Polyurethane foam processing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)		PNIS	24.16, 25.2	Raw materials and other products likely to be used as raw materials	
36	060304	Polystyrene foam processing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)	Polystyrene processing	PLSTYR_PR	24.16, 25.2	Raw materials and other products likely to be used as raw materials	
37	060305	Rubber processing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)	Synthetic rubber production	SYNTH_RUB	24.17, 25.13	Raw materials and other products likely to be used as raw materials	
38	060305	Rubber processing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)	Tyre production	TYRE	25.11–25.12	Raw materials and other products likely to be used as raw materials	
39	060306	Pharmaceutical products manufacturing	3C	3C		Solvent use in chemical industry; Pharmaceutical industry	Pharmaceutical industry	PHARMA	24.4	Raw materials and other products likely to be used as raw materials	
40	060307	Paints manufacturing	3C	3C		Solvent use in chemical industry; Products incorporating solvents	Products incorporating solvents	PIS	24.120, 24.301	Raw materials and other products likely to be used as raw materials	
41	060308	Inks manufacturing	3C	3C		Solvent use in chemical industry; Products incorporating solvents	Products incorporating solvents	PIS	24.302	Raw materials and other products likely to be used as raw materials	
42	060309	Glues manufacturing	3C	3C		Solvent use in chemical industry; Products incorporating solvents	Products incorporating solvents	PIS	24.62	Raw materials and other products likely to be used as raw materials	
43	060310	Asphalt blowing	3C	3C		Solvent use in chemical industry; Products incorporating solvents	Products incorporating solvents	PIS	26.8	Raw materials and other products likely to be used as raw materials	
44	060311	Adhesive, magnetic tapes, films & photo-graphs manufacturing	3C	3C		Solvent use in chemical industry; Products incorporating solvents	Products incorporating solvents	PIS	24.64–24.65	Raw materials and other products likely to be used as raw materials	
45	060312	Textile finishing	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)		PNIS	17	Raw materials and other products likely to be used as raw materials	
46	060313	Leather tanning	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)		PNIS	18, 19.0–19.2	Raw materials and other products likely to be used as raw materials	
47	060314	Other	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)	Manufacturing of shoes	SHOE	19.3	Raw materials and other products likely to be used as raw materials	
48	060314	Other	3C	3C		Solvent use in chemical industry; Products not incorporating solvents (excluding pharmaceuticals)		PNIS	24.11, 24.13–24.15, 24.18–24.2, 24.5–24.61, 26.63, 24.66–24.7	Raw materials and other products likely to be used as raw materials	

Table 3.5 (General linking of codes continued, SNAP 0604xx)

id	SNAP/ CORINAIR		RAINS/GAINS		NACE (Industrial use)			Comments			
	Code	Name of activity	CRF	NFR	2002	Extensions	Sector description I		Sector description II	Abbreviation	Ideally
49	060401	Glass wool enduction	3D	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	26.14, 26.8, 45.32	All products except adhesives, paints, varnishes and cleaning products
50	060402	Mineral wool enduction	3D	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	26.8, 45.32	All products except adhesives, paints, varnishes and cleaning products
51	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing, offset	PRT_OFFS	22	All products except adhesives, paints, varnishes and cleaning products
52	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Flexography and rotogravure in packaging	PRT_PACK	22	All products except adhesives, paints, varnishes and cleaning products
53	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Rotogravure in publication	PRT_PUB	22	All products except adhesives, paints, varnishes and cleaning products
54	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Screen printing	PRT_SCR	22	All products except adhesives, paints, varnishes and cleaning products
55	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Heatset-Offset	PRINT_OFFS	22	All products except adhesives, paints, varnishes and cleaning products
56	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Rotogravure in publication	PRINT_PUB	22	All products except adhesives, paints, varnishes and cleaning products
57	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Flexography in packaging	PRINT_PACK_FX	22	All products except adhesives, paints, varnishes and cleaning products
58	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Rotogravure in packaging	PRINT_PACK_RT	22	All products except adhesives, paints, varnishes and cleaning products
59	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Screen printing	PRINT_SCR	22	All products except adhesives, paints, varnishes and cleaning products
60	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Sheetfed-Offset	PRINT_SHEET	22	All products except adhesives, paints, varnishes and cleaning products
61	060403	Printing industry	3D	3D	3D	3 D i Printing	Printing industry	Printing; Coldset	PRINT_COLD	22	All products except adhesives, paints, varnishes and cleaning products

Table 3.6 (General linking of codes continued, SNAP 0604xx)

id	SNAP/ CORINAIR		CRF		NFR		RAINS/GAINS		NACE (Industrial use)			
	Code	Name of activity	2002	NFR	Extensions	Sector description I	Sector description II	Abbreviation	Ideally	Product/function/ use category	Comments	
62	060404	Fat, edible and not edible oil extraction	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Fat, edible and non-edible oil extraction	FATOIL	15-16	Extraction agents		
63	060405	Application of glues and adhesives	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Application of glues and adhesives	Industrial application of adhesives (use of high performance solvent based adhesives)	GLUE_INH	1-37	Adhesives		
64	060405	Application of glues and adhesives	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Application of glues and adhesives	Industrial application of adhesives (use of traditional solvent based adhesives)	GLUE_INT	1-37	Adhesives		
65	060405	Application of glues and adhesives	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Application of glues and adhesives	Industrial application of adhesives (tape manufacturing)	ADH_TAPE	1-37	Adhesives		
66	060405	Application of glues and adhesives	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Application of glues and adhesives	Industrial application of adhesives (other industrial use of adhesives, e.g., wood products)	ADH_OT_IND	1-37	Adhesives		
67	060406	Preservation of wood	3D	3D	3 D ii Preservation of wood	Other use of solvents in industry: Preservation of wood	Wood preservation (excluding creosote)	WOOD	20	Biocides, impregnation, raw materials and viscosity changers		
68	060406	Preservation of wood	3D	3D	3 D ii Preservation of wood	Other use of solvents in industry: Preservation of wood	Wood preservation (only creosote)	WOOD_CR	20	Biocides, impregnation, raw materials and viscosity changers		
69	060407	Underseal treatment and conservation of vehicles	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Treatment of Vehicles	Treatment of vehicles	VEHTR	50	Degreasers, rust inhibitors		

Table 3.7 (General linking of codes continued, SNAP 0604xx)

id	SNAP/ CORINAIR		CRF		2002		RAINS/GAINS		NACE (Industrial use)		Product/function/use category	Comments
	Code	Name of activity	3D	NFR	Extensions	Sector description I	Sector description II	Abbreviation	Ideally			
70	060408	Domestic solvent use (other than paint application)	3D	3D	3 D iii Domestic solvent use	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	Private households		All products except pharmaceuticals, paints and varnishes	No NACE
71	060408	Domestic solvent use (other than paint application)	3D	3D	3 D iii Domestic solvent use	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	50.5		All products except degreasers, rust inhibitors, pharmaceuticals, paints and varnishes	Unknown distribution of products sold between sectors where products are used
72	060408	Domestic solvent use (other than paint application)	3D	3D	3 D iii Domestic solvent use	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	52		All products except pharmaceuticals, paints and varnishes	Unknown distribution of products sold between sectors where products are used
73	060408	Domestic solvent use (other than paint application)	3D	3D	3 D iii Domestic solvent use	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	92.6–92.7		All products except pharmaceuticals, paints and varnishes	
74	060408	Domestic solvent use (other than paint application)	3D	3D	3 D iii Domestic solvent use	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	93.02, 93.05		All products except pharmaceuticals, paints and varnishes	
75	060409	Vehicles dewaxing	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Treatment of Vehicles	Treatment of vehicles	VEHTR	50			
76	060411	Domestic use of pharmaceutical products	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	Private households		Pharmaceuticals	No NACE
77	060411	Domestic use of pharmaceutical products	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Domestic solvent use (excluding paints)	Domestic use of solvents (other than paint)	DOM_OS	50, 52		Pharmaceuticals	

Table 3.8 (General linking of codes continued, SNAP 0604xx)

id	SNAP/CORINAIR		CRF		NFR		RAINS/GAINS		NACE (Industrial use)			Comments
	Code	Name of activity	3D	2002	Extensions	Sector description I	Sector description II	Abbreviation	Ideally	Product/function/use category		
78	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	1-10	All products except adhesives, paints, varnishes and cleaning products		
79	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	11	All products except adhesives, paints, varnishes and cleaning products, drilling agents (excluded) and raw materials		
80	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	12-14	All products except adhesives, paints, varnishes and cleaning products		
81	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	15-16	All products except extraction agents, adhesives, paints, varnishes and cleaning products		
82	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	17-19	All products except raw materials, adhesives, paints, varnishes and cleaning products		
83	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	20	All products except biocides, impregnation, raw materials and viscosity changers, as well as adhesives, paints, varnishes and cleaning products		
84	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	21	All products except adhesives, paints, varnishes and cleaning products		
85	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	23	All products except drilling agents, raw materials, adhesives, paints, varnishes and cleaning products		
86	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	24-25	All products except raw materials and other products likely to be used as raw materials, adhesives, paints, varnishes and cleaning products		
87	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	26.0-26.7	All products except adhesives, paints, varnishes and cleaning products		
88	060412	Other (preservation of seeds,...)	3D	3D	3 D iv Other including products containing HMs and POPs (Please specify)	Other use of solvents in industry: Other industrial use of solvents	Other industrial use of solvents	IND_OS	27-37	All products except adhesives, paints, varnishes and cleaning products		

Table 3.9 (General linking of codes continued, SNAP 0605xx)

id	SNAP/CORINAIR		CRF	NFR	2002	Extensions	RAINS/GAINS		NACE (Industrial use)		Product/function/use category	Comments
	Name of activity	Code					Sector description I	Sector description II	Abbreviation	Ideally		
89	060508	Other	3D	3D					38–45.31, 45.33–49		All products except paints and varnishes	
90	060508	Other	3D	3D					50.0–50.4		All products except degreasers, rust inhibitors, pharmaceuticals, paints and varnishes	
91	060508	Other	3D	3D					53–92.5		All products except paints and varnishes	
92	060508	Other	3D	3D					93.0		All products except those used in NACE 93.01, paints and varnishes	
93	060508	Other	3D	3D					93.03–93.04		All products except paints and varnishes	
94	060508	Other	3D	3D					94–99		All products except paints and varnishes	

4. Country specific linking of codes and emission factors

In this chapter each country presents the use category codes (UCN) and emission factors that correspond to the general linking of codes, described in the previous chapter. For Norway, Sweden and Denmark the NACE and UCN codes are used in the national registration system for solvents and solvent containing products and are applied in the emission inventories. Finland and Iceland use statistical data or data from the reports by operators and information from surveys. The id number refers to the general code linking described in the previous sector. For some countries the listed relationships and emission factors are to a high degree implemented in the current method, whereas for others there will be improvements in the coming inventories.

4.1 Norway

Table 4.1.1 (Norway, linking of codes, SNAP 0601xx)

id	Source code (Norway only)	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
1	3A.21	34	Paints and varnishes	M05	0.3		
2	3A.22	50	Paints and varnishes	M05	0.95		
3	3A.11	45, 51–52, private households and public	Paints and varnishes	M05	0.95		Not all products allocated in “private households and public” are used in private households, but distribution to other sectors unknown
4	3A.11	45, 51–52, private households and public	Paints and varnishes	M05	0.95		Not all products allocated in “private households and public” are used in private households, but distribution to other sectors unknown
5	3A.12	45, 51–52, private households and public	Paints and varnishes	M05	0.95		Not all products allocated in “private households and public” are used in private households, but distribution to other sectors unknown
6	3A.12	45, 51–52, private households and public	Paints and varnishes	M05	0.95		Not all products allocated in “private households and public” are used in private households, but distribution to other sectors unknown
7–16	3A.23	1–24.2, 24.4–33, 35–37	Paints and varnishes	M05	0.3		
17–22	3A.23				-		
23–25	3A.3	40–44, 46–49, 53–99	Paints and varnishes	M05	0.95		

Table 4.1.2 (Norway, linking of codes continued, SNAP 0602xx)

id	Source code (Norway only)	NACE (industrial use)	Product/ function/use category description	UCN – Prod- uct/function/use category codes	EF 2006	EF 2006 – raw material	Comments
26	3B.1	27–35, 37.1	Degreasers	R10100	0.24		
27	3B.2	93.0 (product specific)	Products that are likely to be used in dry cleaners used in NACE 93.01 (dry cleaners)	A55100–A60100, B15120, B15140, B15330, B25200, B35200, D20300, F05990, G10400, I05100, I05300, I05500, K20100, M10300, O15100, O25100–O25500, P05100, R10100, R10150, R10350, R10400, R10500–R10600, R10800–R10990, R20200, R30000–R30999, S25100–S25500	0.57		
28	3B.31	28–35	Cleaning products except de- greasers	R10110–R10999	0.0123		
29	3B.32	1–26	Cleaning products	R10	0.0123		
30	3B.32	28–35	Cleaning products except degrea- sers	R10110–R10999	0.0123		
31	3B.32	28–35	Cleaning products except degrea- sers	R10110–R10999	0.0123		
32	3B.32	36–37.0,37.2	Cleaning products	R10	0.0123		

Table 4.1.3 (Norway, linking of codes continued, SNAP 0603xx)

id	Source code (Norway only)	NACE (industrial use)	Product/function/use category description	UCN - Product/function/use category codes	EF 2006	EF 2006 - raw material	Comments
33	3C.31	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	H15400, K35200, K35200, O15100, P15900, R30000-R30999, S42200, M05000-M05999, A40200-A40300, B20300, B25300, E03100		0.001	
34	3C.32	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	
35	3C.33	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	
36	3C.34	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	CAS 100-42-5 (styrene) in Solvents (O15) included
37	3C.35	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	
38	3C.35	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	
39	3C.2	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	
40	3C.11	17-19, 24.0 (product specific), 24.2-24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above		0.001	

To be continued

id	Source code (Norway only)	NACE (industrial use)	Prod- uct/function/use category description	UCN - Prod- uct/function/use category codes	EF 2006	EF 2006 - raw material	Comments
<i>Continued</i>							
41	3C.12	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		
42	3C.13	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		
43		17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)		As above	0.001		Possibly reported elsewhere
44	3C.14	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		
45	3C.36	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		
46	3C.37	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		
47	3C.38	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		
48	3C.38	17–19, 24.0 (product spe- cific), 24.2–24.7, 25, public (CAS 100-42-5 in O15)	Raw materials and other products likely to be used as raw materials	As above	0.001		

Table 4.1.4 (Norway, linking of codes continued, SNAP 0604xx)

id	Source code (Norway only)	NACE (industrial use)	Product/function /use category description	UCN – Prod- uct/function/use category codes	EF 2006	EF 2006 – raw material	Comments
49	3D.45	26.14, 26.8, 45.32	All products except adhesives, paints, varnishes and cleaning products		0.05		
50	3D.45	26.8, 45.32	All products except adhesives, paints, varnishes and cleaning products		0.05		
51–61	3D.1	22	All products except adhesives, paints, varnishes and cleaning products		0,55		

Table 4.1.5 (Norway, linking of codes continued, SNAP 0604xx)

id	Source code (Norway only)	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
62	3D.43	15–16	Extraction agents	E05100	0.25		
63	3D.41	1–37	Adhesives	L10	0.25		
64	3D.41	1–37	Adhesives	L10			
65	3D.41	1–37	Adhesives	L10	0.25		0.25
66	3D.41	1–37	Adhesives	L10	0.25		
67	3D.2	20	Biocides, impregnation, raw materials and viscosity changers	B15, B16, I05, R30, V154	0,15		
68	3D.2	20	Biocides, impregnation, raw materials and viscosity changers	B15, B16, I05, R30, V154	0,15		Possibly reported elsewhere
69	3D.42	50	Degreasers, rust inhibitors	R10100, R20	0.95		
70	3D.3	Private-households – see comment	All products except pharmaceuticals, paints and varnishes		0.95		Except CAS 100-42–5 (styrene) in Solvents (O15). For other products allocated in “private households and public” that are not used in private households, distribution to other sectors unknown. May need to be supplement model for cosmetics (including propane/butane in spray cans).
71	3D.3	50.5	All products except degreasers, rust inhibitors, pharmaceuticals, paints and varnishes		0.95		
72	3D.3	52	All products except pharmaceuticals, paints and varnishes		0.95		
73	3D.3	92.6–92.7	All products except pharmaceuticals, paints and varnishes		0.95		
74	3D.3	93.02, 93.05	All products except pharmaceuticals, paints and varnishes		0.95		
75	3D.42	50	Rust inhibitors	R20	0.95		
76	3D.44	Private households	Pharmaceuticals	L20	-		Not all products allocated in “private households and public” are used in private households, but distribution to other sectors unknown
77	3D.44	50, 52	Pharmaceuticals	L20	-		

Table 4.1.6 (Norway, linking of codes continued, SNAP 0604xx and SNAP 0605xx)

id	Source code (Norway only)	NACE (industrial use)	Product/function/use category description	UCN – Prod- uct/function/ use category codes	EF 2006	EF 2006 – raw material	Comments
78	3D.45	1–10	All products except adhesives, paints, varnishes and cleaning products		0.05		
79	3D.45	11	All products except adhesives, paints, varnishes and cleaning products, drilling agents (excluded) and raw materials		0.05		
80	3D.45	12–14	All products except adhesives, paints, varnishes and cleaning products		0.05		
81	3D.45	15–16	All products except extraction agents, adhesives, paints, varnishes and cleaning products		0.05		
82	3D.45	17–19	All products except raw materials, adhesives, paints, varnishes and cleaning products		0.05		
83	3D.45	20	All products except biocides, impregnation, raw materials and viscosity changers, as well as adhesives, paints, varnishes and cleaning products		0.05		
84	3D.45	21	All products except adhesives, paints, varnishes and cleaning products		0.05		
85	3D.45	23	All products except drilling agents, raw materials, adhesives, paints, varnishes and cleaning products		0.05		
86	3D.45	24–25	All products except raw materials and other products likely to be used as raw materials, adhesives, paints, varnishes and cleaning products		0.05		
87	3D.45	26.0–26.7	All products except adhesives, paints, varnishes and cleaning products		0.05		
88	3D.45	27–37	All products except adhesives, paints, varnishes and cleaning products		0.05		
89	3D.46	38–45.31, 45.33–49	All products except paints and varnishes		0.79		
90	3D.46	50.0–50.4	All products except degreasers, rust inhibitors, pharmaceuticals, paints and varnishes		0.79		
91	3D.46	53–92.5	All products except paints and varnishes		0.79		
92	3D.46	93.0	All products except those used in NACE 93.01, paints and varnishes		0.79		
93	3D.46	93.03– 93.04	All products except paints and varnishes		0.79		
94	3D.46	94–99	All products except paints and varnishes		0.79		

4.2 Denmark

Emission factors are not given in this table since they vary considerably between substances even for the same source category. However, for domestic use SNAP 060104 (Paint Application: Domestic Use except 060107) (id=5 and 6), SNAP 060408 (Other: Domestic Use other than paints) (id=70 to 74) and SNAP 060411 (Other: Domestic Use of Pharmaceutical Products) (id=76 and 77) emission factors are given on a substance level. These can be found in chapter “Denmark”, table 8.

Table 4.2.1 (Denmark, linking of codes, SNAP 0601xx)

id	NACE (Industrial use)	Product/function/ use category description	UCN – Product/function/use category codes	EF 2008	EF 2006 – raw material	Comments
1	34		B2010, F25, I1010, M0500, M05000, M0505, M0515, M0520, M0530, M0560, M0570, M0599, M10, O1500, R2000, R20200, R2090			
2	50		B2010, F25, I1010, M0500, M05000, M0505, M0515, M0520, M0530, M0560, M0570, M0599, M10, O1500, R2000, R20200, R2090			
3	45, 51		B2010, F25, G30, M0500, M05000, M0505, M0515, M0520, M0530, M0550, M0560, M0567, M0595, M0599, M10, O1500			
4						
5	52, 95		B2010, F25, G30, M0500, M05000, M0505, M0515, M0520, M0530, M0550, M0560, M0567, M0595, M0599, M10, O1500	See Table 8		NACE industrial category 95 does not cover all domestic use in DK registration to SPIN
6	DOM		D15	See Table 8		D1500 Propellants for aerosols are only used in households and are therefore manually assigned to household use only
7	27		B2010, F25, G05, I1010, M0500, M05000, M0505, M0515, M0520, M0530, M0560, M0570, M0599, M10, O1500, R2000, R20200, R2090			According to guidebook coil coating is the application of paint to continuous metal (steel, copper, aluminium) strip. The painted metals are used in the manufacture of kitchenware (non-stick pans, white goods) and for building cladding

To be continued

id	NACE (industrial use)	Product/function/ use category description	UCN – Product/function/use category codes	EF 2008	EF 2006 – raw material	Comments
<i>Continued</i>						
8	35.1		B2010, F25, I1010, M0500, M05000, M0505, M0510, M0515, M0520, M0530, M0540, M0550, M0560, M0570, M0590, M0599, M10, O1500, R2000, R20200, R2090			
9	20, 36.1		B2010, F25, G30, M0500, M05000, M0505, M0510, M0515, M0520, M0530, M0540, M0550, M0560, M0567, M0595, M0599, M10, O1500			
10						
11	All other combina- tions of NACE industrial use and use category codes, defined as SNAP 0601xx (paint), than stated for SNAP 060101 to 060107 and 060109		Use category codes defined as SNAP 0601xx (paint): B2010, B45, D15, F25, G05, G15, G30, I1010, M05, M10, O1500, R2000, R20200, R2090			
12–22						
23	40–44, 46–49, 53–99		B2010, F25, G30, I1010, M0500, M05000, M0505, M0510, M0515, M0520, M0530, M0540, M0550, M0560, M0570, M0599, M10, O1500, R2000, R20200, R2090			
24–25						

Table 4.2.2 (Denmark, linking of codes continued, SNAP 0602xx)

id	NACE (industrial use)	Product/function/ use category description	UCN – Product/function/ use category codes	EF 2008	EF 2006 – raw material	Comments
26	27, 28, 29.1, 29.2, 29.3, 29.4, 29.5, 29.6, 29.72, 37.1		R1010			Maintenance and manufacturing of metal products (EMEP/CORINAIR guidebook)
27	93.1					NACE use category code does not exist specifically for dry cleaning. Therefore when SPIN delivers the NACE industrial category 93.1 the amount is assigned to dry cleaning (only) SNAP 060202
28	29.70, 29.71, 30, 31.60, 31.62, 32		E07, R1010, R1020, R1095, R30400			
29	All other combinations of NACE industrial use and use category codes, defined as SNAP 0602xx (degreasing and dry cleaning), than stated for SNAP 060201 to 060202 and 060203		Use category codes defined as SNAP 0602xx (degreasing and dry cleaning): E07, R1010, R1029, R1033, R30400			
30–32						

Table 4.2.3 (Denmark, linking of codes continued, SNAP 0603xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2008	EF 2006 – raw material	Comments
33	24.16, 25.2					
34	24.16, 25.2		B35, H1540, R30800			For plastic processing (SNAP 060301 to 060304) the same NACE industrial categories apply, and all uses are summed in 060302. Same NACE use categories apply
35	24.16, 25.2					
36	24.16, 25.2					
37	24.17, 25.10, 25.13		B35, R30300			SNAP 060305 is collected here
38	25.11, 25.12					
39	24.4		R30600			
40	24.12, 24.30		B35, F0510, F05110, F0520, F05250, F05400, F05990, H1530, M08, T20			Paints and inks manufacturing have same NACE industrial categories (24.12 and 24.30) but different NACE use categories
41	24.12, 24.30		F0500, F10300, F10400, H1545			Paints and inks manufacturing have same NACE industrial categories (24.12 and 24.30) but different NACE use categories
42	24.62		B35, H1520			
43	26.8		R30990			Manufacture of other non-metallic mineral products. Air blown asphalts are used in the production of asphalt roofing products. Air blowing may be conducted at oil refineries, asphalt processing plants and asphalt roofing plants
44	24.64, 24.65		B35, F1020, F32, F3500, F3510			
45	17		B25, I0530, R30990			
46	18.1, 19.1, 19.2		G10, I0510			
47	51					Included in SNAP 060314 (other)

To be continued

id	NACE (industrial use)	Product/function/ use category description	UCN – Product/function/use category codes	EF 2008	EF 2006 – raw material	Comments
Continued						
48	All other combinations of NACE industrial use and use category codes, defined as SNAP 0603xx (chemical products), than stated for SNAP 060301 to 060313		Use category codes defined as SNAP 0603xx (chemical products): 1138, A10, A20, A25, A30, B25, B35, B40, B65, D05, E10, E15, E20, F05, F10, F32, F3500, F3510, F45, F50, G10, G12, G35, H15, I0510, I0530, K05, K15, K20, K25, L05, M08, O15000, O2510, O2520, O25200, O2530, O2540, O2550, O27, O40, P05, P15, R03, R05, R1005, R30000, R30100, R30200, R30300, R30500, R30600, R30700, R30800, R30900, R30990, S15, S42, S60, S8000, T20, V05, V10, V15, V20			

Table 4.2.4 (Denmark, linking of codes continued, SNAP 0604xx)

id	NACE (industrial use)	Product/function/ use category description	UCN – Product/function/use category codes	EF 2008	EF 2006 – raw material	Comments
49	26.14, 26.8, 45.32		I1500, I1520, U0500			
50	26.8, 45.32		I1500, I1520, U0500			
51	22.1, 22.2		F30, F35200, F35300, F3540, R1020, R1095, S0720, S1010, S1060, T1000, T1090, T1500, T1530, T1540, T1550, T1570, T1580, T1590, S07, S10, T10, T15,			SNAP 060403 is collected here
52–61	22.1, 22.2					

Table 4.2.5 (Denmark, linking of codes continued, SNAP 0604xx)

id	NACE (industrial use)	Product/function/ use category description	UCN – Product/function/use category codes	EF 2008	EF 2006 – raw material	Comments
62	15.4		E05			
63	17, 18, 19, 20, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36		B20000, B2020, B2030, L10			SNAP 060405 is collected here
64	17, 18, 19, 20, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36					
65	no NACE code for tape manufacturing					
66	17, 18, 19, 20, 21, 22, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36					
67	20		B1543, I0540			SNAP 060406 is collected here
68	20					
69	50.2, 50.4		M1550, R2010			According to EMEP/CORINAIR original equipment manufacture is included in 060101, and aftermarket repair is included in 060102. Underseal treatment is only carried out in very small scale in Europe on modern cars.
70	DOM			See Table 8		The code DOM is defined to identify domestic use (other than 50.5, 52, 95) for NACE use categories that are ONLY domestic use.
71	50.5		B60	See Table 8		

To be continued

id	NACE (industrial use)	Product/function/ use category description	UCN – Prod- uct/function/use category codes	EF 2008	EF 2006 – raw material	Comments
<i>Continued</i>						
72	52, 95		A0530, A40, B15000, B1530, B1541, B18100, B20000, B2020, B2030, B50, D2000, F30, H05, H20, I0500, I0550, I1500, I1520, K3010, K3025, K3030, K3500, K35000, K3510, K3590, K52, L10, M1540, O2500, O25000, P10, R1000, R10000, R10130, R1015, R1016, R1018, R1025, R1035, R1037, R1040, R1045, R1050, R1060, R1070, R1080, R1097, R10980, R1099, R10990, R2010, S0500, S0510, S25, U05000, U0510, U0520, U0530, U05340, U05350, U0540	See Table 8		
73				See Table 8		
74				See Table 8		
75	50.1, 50.3		M1550, R2010			Approximately zero (EMEP/CORINAIR guidebook)
76	52.3, 95		L20	See Table 8		
77				See Table 8		

Table 4.2.6 (Denmark, linking of codes continued, SNAP 0604xx and SNAP 0605xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
78	All other combinations of NACE industrial use and use category codes, defined as SNAP 0604xx (other use), than stated for SNAP 060401 to 060411		Use category codes defined as SNAP 0604xx (other use): A05, A35, A40, A45, A50, A55, A60, B15, B16, B18, B2000, B2020, B2030, B30, B50, B55, B60, D20, D25, E03, E05, F12, F15, F20, F30, F35200, F35300, F3540, F40, G40, H05, H10, H20, I0500, I05200, I0540, I05450, I0550, I1020, I15, K30, K35, K40, K45, K52, K55, K60, L10, L15, L20, M15, O05, O10, O15100, O2500, O25000, O30, P01, P10, R1000, R10000, R10130, R1015, R1016, R1018, R1020, R1025, R10340, R1035, R1037, R1040, R1045, R1050, R1060, R1070, R1080, R1095, R1097, R10980, R1099, R10990, R15, R2010, S05, S07, S10, S25, S30, S35, S40, S45, S50, S65, S70, S75, S80100, T05, T10, T15, U05			
79–94						

4.3 Finland

The Finnish method is not based on NACE and use category codes (UCN); therefore information is given only with respect to emission factors in relation to the general coding.

Table 4.3.1 (Finland, linking of codes, SNAP 0601xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
1–25				Not available		Included as emission data from the reports by operators and information from surveys

Table 4.3.2 (Finland, linking of codes continued, SNAP 0602xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
26–32				Not available		Included as emission data from the reports by operators and information from surveys

Table 4.3.3 (Finland, linking of codes continued, SNAP 0603xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
33–42				Not available		Included as emission data from the reports by operators and information from surveys
43				NE		NE
44–48				Not available		Included as emission data from the reports by operators

Table 4.3.4 (Finland, linking of codes continued, SNAP 0604xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
49–62				Not available		Included as emission data from the reports by operators
63				NE	NE	
64–66				Not available		Included as emission data from the reports by operators
67				100 kg/t	yes	
68				Not available		Included as emission data from the reports by operators
69				NE	NE	
70–77				Not available		Only emission data reported by industrial associations included
78				80 g/t	yes	
79–94				Not available		Only emission data reported by industrial associations included

4.4 Sweden

Table 4.4.1 (Sweden, linking of codes, SNAP 0601xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 - raw material	Comments
1	34	Paints and varnishes	M05	0.3	-	Reported as 3A_paint application ind.use
2	50	Paints and varnishes	M05	0.95	-	Reported as 3A_paint application dom. use
3	01, 02, 05, 45, 50, 52, 55, 60, 61,62, 63, 64, 70, 71, 72, 73,74), 75, 80, 85, 90, 91, 92, 93	Paints and varnishes	M05	0.95	-	Reported as 3A_paint application dom. use
4	51	-	-	-	-	Not included in the Swedish inventory
5	01, 02, 05, 45, 50, 52, 55, 60, 61,62, 63, 64, 70, 71, 72, 73,74), 75, 80, 85, 90, 91, 92, 93	Paints and varnishes	M05	0.95	-	Reported as 3A_paint application dom. use
6	01, 02, 05, 45, 50, 52, 55, 60, 61,62, 63, 64, 70, 71, 72, 73,74), 75, 80, 85, 90, 91, 92, 93	Paints and varnishes	M05	0.95	-	Reported as 3A_paint application dom. use
7–16	10-15, 17-36, 40–41	Paints and varnishes	M05	0.3	-	Reported as 3A_paint application ind.use
17–22	-	-	-	-	-	-
23–25	-	-	-	-	-	IE. Included in 3A_paint application dom. use resp. 3A_paint application ind.use

Table 4.4.2 (Sweden, linking of codes continued, SNAP 0602xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
26	29–33, 36, 34–35	Degreasers	R10100	0.95 (29–33, 36) 0.2 (34–35)		IE. NACE 27, 28, 28.5 reported as CRF 2C. NACE 29–33 and 36 reported as 3D_other>_other_other. NACE 34–35 reported as 3C Other – Car manufacturing
27	93.01	Products that are likely to be used in dry cleaners used in NACE 93.01 (dry cleaners)	A55100, A60100, B15120, B15140, B15330, B25200, B35200, B45100, D20300, F05990, G10400, I05100, I05300, K20100, M10300, O15100, O25300, O25400, P05100, R10100, R10150, R10350, R10400, R10500, R10600, R10800, R10970, R10980, R10990, R20200, S25100, S25500	0.57	-	Reported as 2B
28	31	Cleaning products except degreasers	R10600, R10970, R109990	0.95	-	IE. NACE 31. Reported as 3D Other – Other – Other solvent use
29–32	1,2,5, 20,29–33, 35–36	Cleaning products except degreasers	R10, except R10700	0.95	-	IE. NACE 1,2,5, 20,29–33, 35–36 Reported as 3D Other – Other – Other solvent use

Table 4.4.3 (Sweden, linking of codes continued, SNAP 0603xx)

id	NACE (industrial use)	Product/ function/ use category description	UCN – Product/function/ use category codes	EF 2006	EF 2006 – raw material	Comments
33–36	24.16, 25.2	-	-	-	-	Reported in CRF-code 2B5. Reported emissions based on environmental report data.
37	25.1	Products that are likely to be used in the rubber industry used in NACE 25.1	B18100, B20100, B20200, B20300, B35100, B35200, F05100, F05110, F05250, F05990, F12100, F40100, F45100, F45200, F45300, G05400, G35100, H10100, H15400, H15500, I05500, K15100, K20100, K35200, K40100, L10101, L10110, L10201, L10202, L10210, L10220, L10301, L10302, L10310, L10320, L10501, L10510, L10601, L10610, M10300, M15400, O15100, O25400, O25500, O27900, P05100, P10500, P15100, P15200, P15500, P15900, R10100, R10150, R10350, R10400, R10990, R30300, R30400, R30800, R30990, S10100, S15100, S40200, S40500, S42900, S45110, S45200, S45250, S45300, S60100, S60200, S65100, T10200, T10900, T20100, U05100, U05200, U05300, U05350, U05400, V10100, V15100, V15500, V20100	0.25	0.001	Reported as 3C Other – Rubber industry
38	25.1	Products that are likely to be used in the rubber industry used in NACE 25.1	As above	0.25	0.001	Reported as 3C Other – Rubber industry
39	24.4	-	-	-	-	Reported in CRF-code 2B5. Reported emissions based on environmental report data.

To be continued

id	NACE (industrial use)	Product/ function/ use category description	UCN – Product/function/ use category codes	EF 2006	EF 2006 – raw material	Comments
<i>Continued</i>						
40	24.12, 24.30	Products that are likely to be used in paint industry used in NACE 24.12, 24.30	V15400, A40300, A50100, A55100, B15120, B15310, B15315, B15320, B15330, B15340, B15350, B15360, B15370, B15720, B16120, B20100, B20200, B20300, B35100, B35200, B45100, B65100, D05100, D15100, E05100, E07400, F05100, F05110, F05250, F05990, F10700, F12100, F35200, F40100, F45300, F50300, G05400, G12300, G12900, G30100, G30200, H15100, H15400, H15500, I05400, I05500, K20100, K25100, K35200, L05100, L05200, L05250, L05300, L10102, L10120, L10201, L10210, L10301, L10310, L10601, M08100, M10100, M10300, M15100, M15500, O15100, O25100, O25200, O25300, O25400, O25500, O27100, O27900, P05100, P10500, P15100, P15200, P15400, P15500, P15900, R10100, R10150, R10350, R10370, R10500, R10700, R10970, R10990, R20200, R20900, R30300, R30500, R30800, R30990, S10100, S25990, S40500, S42300, S42900, S45110, S45250, S60100, S60150, S60200, S65100, T20100, U05100, U05200, U05350, U05400, V15100, V15500, V20100, X1331	0.0025	0.001	Reported as 3C Other – Paint industry
41	24.660	-	-	-	-	Reported in CRF- code 2B5. Re- ported emissions based on environ- mental report data.
42	24.62	-	-	-	-	Reported in CRF- code 2B5. Re- ported emissions based on environ- mental report data.
43	26.8	-	-	-	-	Reported in CRF- code 2A5. Re- ported emissions based on data from the industry.
44	24.64	-	-	-	-	Reported in CRF- code 2B5. Re- ported emissions based on environ- mental report data.

Table 4.4.4 (Sweden, linking of codes continued, SNAP 0603xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
45	17	Products that are likely to be used in textile industry used in NACE 17	A55100, A60100, B15370, B20100, B20200, B20300, B25200, B30100, B35100, B35200, B45100, F05110, F05250, F05990, F10100, F10700, F12100, F40100, G12300, H10100, H15400, H15500, I05200, I05300, I05500, I15100, K25100, L05300, L10101, L10110, L10201, L10202, L10210, L10220, L10401, L10410, M08100, O25100, O25200, O25300, O25400, O25500, O27100, O27900, O40200, P05100, P10990, P15300, P15500, P15900, R05100, R10100, R10370, R10500, R10970, R10980, R10990, R20200, R30300, R30800, R30990, S10100, S15200, S25500, S45110, S45200, S45250, S45300, S60200, T10900, V15100, V15500	0.1	0.1	Reported as 3D Other – Other – Textile finishing
46	18, 19	Products that are likely to be used in textile industry used in NACE 18, 19	A55100, A60100, B15330, B15710, B20100, B20200, B20300, B35200, F05100, F05110, F05250, F05990, F10700, F12100, F32400, F45300, G10100, G10300, G10400, G10990, G12300, G12900, H15400, H15500, I05100, I05300, I05500, K35200, L10101, L10102, L10110, L10120, L10201, L10202, L10210, L10501, L10510, L10601, L10610, M10100, M15400, O15100, O25300, O25400, O25500, O27100, O27900, P05100, P10150, P15100, P15500, P15900, R10100, R10150, R10350, R10400, R10970, R10990, R30300, R30800, R30990, S15200, S45110, U05350, U05400, V15100, V15500,	0.004	0.001	Reported as 3D Other – Other – Leather industry
47	34–35	Products except paint and varnishes used in car manufacturing industry	All products except M05	0.2	0.001	Reported as 3C Other – Car manufacturing
48	-	-	-	-	-	-

Table 4.4.5 (Sweden, linking of codes continued, SNAP 0604xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
49	26.14	-	-	-		Reported in CRF-code 2A7. Reported emissions based on environmental report data.
50	26.82	-	-	-		Reported in CRF-code 2A7. Reported emissions based on environmental report data.
51	22	All products except paints reported in 3A	A40300, A45100, A50100, A55100, A60100, B15142, B15350, B20100, B35100, B35200, E07400, E07400, F05250, F05990, F10100, F10400, F10700, F12100, F32200, F32300, F32600, F32990, F35200, F35300, F35400, F40100, F45300, G35100, H10100, H15500, K25100, K45100, K45200, K45600, K60100, K60350, L10101, L10110, L10201, L10202, L10210, L10220, L10301, L10310, L10401, L10410, L10601, L10610, M08100, M10100, M10200, M10300, M10990, M15100, M15400, M15500, O15100, O25100, O25300, O25400, O25500, O27100, O27900, P05100, P15200, P15900, R10100, R10150, R10250, R10330, R10350, R10500, R10700, R10970, R10990, R15100, R20200, R20900, R30500, R30800, R30990, S10100, S40500, S42600, S45110, S45150, S45200, S45300, S60100, S60150, S60200, T10900, T15111-T15654, T20100, V05100, V10100, V15500, X1331	0.55	0.001	Reported as 3D Other – Other – Printing industry
52–61	22	All products except paints reported in 3A	As above	0.55	0.001	Reported as 3D Other – Other – Printing industry

Table 4.4.6 (Sweden, linking of codes continued, SNAP 0604xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Prouct/ function/use category codes	EF 2006	EF 2006 – raw material	Comments
62	-	-	-	-	-	-
63–66	17–19, 22, 24.30, 25.1, 34	Adhesives	L10			IE. Reported separately for respectively industry (see above)
67–68	20	Biocides, impregnation,	B15, B16, I054, I055, V15400	0.15	-	Reported as 3D Other – Other – Preservation of woods
69	50	All products except paints and var- nishes, anti-freeze		0.95		Not reported separately. NACE 50 reported as 3D Other – Other – Other solvent use
70	01, 02, 05, 16, 24.62, 29–36, 40, 41.45, 50, 52, 55, 60- 64, 70–75, 80, 85, 90– 93	All products except paints and var- nishes, anti-freeze		0.95	0.95	Reported as 3D Other – Other – Other solvent use
71	50.5	All products except paints and var- nishes, anti-freeze		0.95		Not reported separately. NACE 50.5 reported as 3D Other – Other – Other solvent use
72	52	All products except paints and var- nishes, anti-freeze		0.95		Not reported separately. NACE 52 reported as 3D Other – Other – Other solvent use
73	92.6-92.7	All products except paints and var- nishes, anti-freeze		0.95		Not reported separately. NACE 92.6-92.7 re- ported as 3D Other – Other – Other solvent use
74	93.05	All products except paints and var- nishes, anti-freeze		0.95		Not reported separately. NACE 93.05 reported as 3D Other – Other – Other solvent use
75	50	All products except paints and var- nishes, anti-freeze		0.95		Not reported separately. NACE 50 reported as 3D Other – Other – Other solvent use
76–77	01, 50, 52, 85, 92.6	Pharmaceuticals	L20	0.95		Not reported separately. NACE 01, 50, 52, 85, 92,6 reported as 3D Other – Other – Other solvent use

Table 4.4.7 (Sweden, linking of codes continued, SNAP 0604xx and SNAP 0605xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
78	01	All products except paints,		0.95		Reported as 3D Other – Other – Other solvent use
79–88	-	-	-	-	-	-
89	01–02, 17, 29–32, 34,35, 40, 41, 45, 50, 52, 60–64, 70–75, 85, 90–93	Products used for anti-freeze	A401–A403, K551	0.1	0.001	Reported as 3D Other – Other – Anti-freeze
90–94	-	-	-	-	-	-

4.5 Iceland

The Icelandic method is not based on NACE and use category codes (UCN); therefore information is given only with respect to emission factors in relation to the general coding.

Table 4.5.1 (Iceland, linking of codes, SNAP 0601xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
1–25				Not available		Reported as 3A paint application

Table 4.5.2 (Iceland, linking of codes continued, SNAP 0602xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
26–32				Not available		Reported as 3B Degreasing and dry cleaning

Table 4.5.3 (Iceland, linking of codes continued, SNAP 0603xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/function/use category codes	EF 2006	EF 2006 – raw material	Comments
33–36				Not available		Not reported separately
37–39				NE		NE
40–46				Not available		Not reported separately
47–48				NE		NE

Table 4.5.4 (Iceland, linking of codes continued, SNAP 0604xx)

id	NACE (industrial use)	Product/function/use category description	UCN – Product/ function/use category codes	EF 2006	EF 2006 – raw material	Comments
49–94				Not available		Reported as 3D Other

5. Norway

5.1 Introduction

The Norwegian NMVOC emission calculations are currently undergoing major changes, as the data source for the calculations has been changed. Previously, statistics on exports, imports and production was used, while the data source now is the Norwegian Product Register. These changes will become operative from the data year 2007. The results and conclusions from the NMR project have been consecutively incorporated in the Norwegian model development.

5.2 The Norwegian emission model for solvent use

Our general model is a simplified version of the detailed method described in chapter 6 of the EMEP/CORINAIR Guidebook 2006 (European Environmental Agency, 2006). It represents a mass balance *per substance*, where emissions are calculated by multiplying relevant activity data with an emission factor, according to the equation:

$$\begin{aligned} \text{consumption} &= \text{production} + \text{import-export} \\ \text{emission} &= \text{consumption} \times \text{emission factor (fraction emitted)} \end{aligned}$$

$$\text{total emission} = \text{sum of all emissions}$$

Some emissions generated by the use of declared products may be delayed, relative to the time of declaration. Firstly, the data from the Product Register contain no information on whether products are used the year of registration or stored for later use (so-called hold up). Therefore it is assumed that *all products are used the same year as they are registered*. Secondly, substances are not assumed to accumulate in long-lived products. In other words, it is assumed that *all emissions generated by the use of a given product during its lifetime take place in the same year as the product is declared* to the Product Register. In sum, this leads to emission estimates that do not fully reflect the actual emissions taking place in a given year. However, this systematic overestimation for a given year probably more or less compensates for emissions due to previously accumulated amounts not being included in the estimate figures. Using this method, the emissions will be overestimated for substances with increasing usage, and underestimated for substances with decreasing usage.

Despite data and model limitations, it is believed that the resulting emission estimates are a relatively good indicator of the trend in the emissions of substances caused by products use.

5.2.1 Substance list

Although reporting requirements refer to solvents, no official definition of solvents exists. Furthermore, solvents cannot be easily identified in the product codes of the Product Register. Since the aim of the LRTAP is to reduce the emissions of NMVOC, and data from the Product Register can be extracted for individual substances, the data selection was based on a substance list containing as many NMVOC not reported elsewhere as possible. The substance list used in the Swedish NMVOC inventory (Skårman et al. 2006) was used as a basis for the compilation of the Norwegian NMVOC list. The substance list used by Sweden is based on the definition stated in the UNECE Guidelines (European Commission, 1999). As Norwegian industry differs somewhat from the industry in Sweden, due to the importance of the oil industry, the substance list was supplemented by NMVOC reported in the UKs National Atmospheric Emissions Inventory (NAEI, 2000). However, not all NMVOC on the NAEI list are supplied with a CAS number. Hence, the supplement from NAEI was limited to the substances with given CAS numbers. The resulting list was comprised by 658 substances. Of these, 366 were found in the Product Register for the period 2005–2007. Creosote was not defined as a NMVOC and therefore not included. In addition, five substances were found to be hydrofluorocarbons (HFCs) for which emissions are reported in other parts of the emissions inventory (IPPC 2F).

5.2.2 Activity data

The Norwegian Product Register was chosen as the primary data source. The Product Register is the Norwegian government's central register on chemical products that are subject to duty of declaration¹ and labelling, such as paint, adhesives and cleaning products (Kraft and Follestad 2007). The Product register was considered to be a data source that could easily provide activity data of relatively high quality, with much appurtenant information and fairly good coverage of emission sources.

Around 15,000 declarations of products are updated annually (Kraft and Follestad 2007). One declaration can include several products with the same content but different uses. Furthermore, the same product may be declared more than once if imported by several importers (rarely more than three). Thus, 15,000 declarations correspond to about 40,000 products be-

¹ Cosmetics and health care products are examples of products not subject to the duty of declaration.

ing declared. A total of 3,000–4,000 declarations are omitted each year, as products leave the market. Nevertheless, the total number of declarations increases by about 500 every year, indicating an increasing number of products on the market and/or reflecting changes in the regulations.

The Product Register has been deemed of sufficient quality from 2005, while the previous model has sufficient quality until 2000. After adjusting for differences in level between the two models, the period 2001–2004 was filled by linear interpolation.

5.2.3 Data completeness

The duty of declaration to the Product Register does not apply to all solvent-containing products. Firstly, some product groups are not covered by the regulations. Secondly, other product groups are covered only when the solvent content is above a certain level, so unless these solvent-containing products have been declared due to regulations concerning other ingredients than the solvent, these NMVOC quantities are not included in the activity data.

For the sake of coverage, data on nine point sources is added to the emissions estimates of NFR 3C. The Norwegian Pollution Control Authority provides the point source data. All point sources of NMVOC from the use of solvents that are included in either NFR 3 or NFR 2 belong to the industrial sector “Manufacture of chemicals and chemical products” (NACE 24). In order to avoid double counting, NMVOC used as raw material in this sector are excluded from the emission estimates.

Cosmetics are not subject to the duty of declaration and suspected to possibly contain considerable amounts of NMVOCs. Estimates obtained as described above revealed that emissions from such products were significant. Thus, a supplementary time-series of NMVOC emissions from cosmetics was produced. The method used for this satellite model is similar to the method used for the previous NMVOC model in the Norwegian inventory.

It is considered unlikely that other products containing only small amounts of solvents, i.e. not subject to declaration, and at the same time not covered by regulations on other ingredients, represent a large source of NMVOC emissions. It is however important to be aware of this limitation of the data source, especially if the use of solvent-containing products not liable for declaration increases substantially. In such cases data from the trade and manufacture statistics can be included. Water-based paint can contain some organic solvents, but the solvent content is below the limit for the duty of declaration and labelling to apply, but the consumption volumes are so large that these products might constitute a considerable source of NMVOC emissions. However, as of now, these emissions are considered minor, compared to the estimates for other product groups included in the Product Register data.

Changes to the regulations for classification and labelling will lead to changes in the coverage of the Product Register. For instance, the duty to label solvent-containing products was repealed in 2005. The effect of this specific regulatory change on the coverage of the Product Register is believed to be limited, as most of the products in question are subject to the duty of labelling for other reasons, such as flammability (Kraft *pers. com.*).

5.2.4 Emission factors

Emission factors are specific for combinations of product type and industrial sector. The source of the emission factor values for volatile organic compounds is the Swedish model for estimating NMVOC emissions from solvent and other product use (Skårman et al 2006). It is assumed that the factors developed for Sweden are representative for Norwegian conditions, as we at present have no reasons to believe that product types, patterns of use, or abatement measures differ significantly between the two countries. However, a few adjustments had to be made:

- In the Swedish model, a series of industrial sectors are excluded from the calculations, in order to avoid double counting. As fewer industrial sectors report emissions of NMVOC to the Norwegian inventory, fewer exclusions from the solvent model is necessary. It was assumed that the emission factors given to industries included in the Swedish model were representative for similar industries include in the Norwegian model.
- The emission factor for ensilage means was set specifically based on expert judgment.
- The emission factor for anti-freezing agents from the Swedish model was used for professional land, water and air transport (NACE 60–62), but was set lower for other industrial sectors and private households.
- For each emission source category, two emission factors are applied, one for NVOCs used as raw materials and one for other uses. However, there are two problems concerning the identification of raw material:
 - a) Some products are declared with a product code for raw material, although they are not used as raw material. This is solved by combining the product type codes for raw materials with a list of VOC that are considered “true” raw materials (Fischer et al 2005). Hence, the emission factors for raw materials are only applied to products declared as raw materials when in combination with these substances.
 - b) Some products that are used as raw materials are declared as other product types. This is solved by applying the emission factor for raw materials to other product types assumed to be used as raw materials other sectors.

In accordance with the Swedish model, emission factors were set to 0 for products that are assumed to be completely converted. Quantities that have not been registered to industrial sector or product type are given emission factor 0.95 (maximum). The emission factor matrix is designed so that information on individual substances can be integrated. i.e. that factors can be made product, industrial sector and substance specific.

5.2.5 Source allocation

NMVOC emissions are allocated to 11 different source categories, as far as possible following the source definitions given in the GAINS model. These 11 categories can be aggregated into the source categories for which emissions must be reported under LRTAP (NRF codes with extension) and UNFCCC (CRF codes). The matrix of the product and industrial sector specific emission factors was used as a basis for the source allocation matrix. The product and industrial sector code combinations were compared to the source descriptions of the GAINS model given in the Interim report from 2000 (Klimont et al 2000). A few adjustments were made to the allocations in the Swedish model, in most cases equivalent to the adjustments to the emission factor matrix.

In order to avoid double counting, substance quantities that can be assumed to cause NMVOC emissions that are reported elsewhere are excluded from the source allocation of emissions. These quantities were identified by industrial sector and product code. It was assumed that only emissions due to the use of these specified products are reported in other source categories.

5.3 Domestic solvent use

The declarations in the Norwegian Product Register do include an estimate from the declarants on the fraction of a product that is sold to private households. However, as this project concludes, a large proportion of products declared used in NACE 52, 50.5, 92.6 and 93.02–93.05 should also be allocated to SNAP code 060408/ NFR source code 3D.3. The specific combinations allocated in the Norwegian inventory are shown in table 5. This may give an overestimation of the use in private households of some substances, while others may wrongly be allocated elsewhere. The most important products allocated to domestic solvent use are cleaning agents (R10), anti-freezing agents (A40), biocides (B15), and solvents (O15), while the most dominant substances are ethanol (cas number 64-17-5) and ethylene glycol (cas number 107-21-1).

Table 5. NACE and product combinations allocated to SNAP code 060408

NACE	Product
Private households (no NACE): PR PRIVATE OR GENERAL APPLICATION(S)	All products except pharmaceuticals, paints and varnishes
Private households (no NACE): PR.1 PRIVATE APPLICATION	All products except pharmaceuticals, paints and varnishes
Private households (no NACE): PR.2 GENERAL APPLICATION	All products except pharmaceuticals, paints and varnishes
50.5	All products except degreasers, rust inhibitors, pharmaceuticals, paints and varnishes
52	All products except pharmaceuticals, paints and varnishes
92.6–92.7	All products except pharmaceuticals, paints and varnishes
93.02, 93.05	All products except pharmaceuticals, paints and varnishes

5.4 Improvements and revisions

This project coincided in time with the development of a new model for Norwegian NMVOC emissions, and we contributed to the project with a suggestion of links between SNAP/NFR/CRF/NACE codes and a list of suggested emission factors. No major changes in the links of codes are planned as a result of this project. There have been some minor changes in the allocations, and this has been continuously incorporated in our model.

The project has focused on emissions from private households, and has addressed some important challenges considering the excerpts of private households in the emission estimates, both considering what combinations of NACE codes and products to include and what emission factors to use. As a result of this project styrene (cas number 100-42-5) declared to private and public use was allocated to a different SNAP code in the Norwegian inventory.

This project has been a good guide in defining what product- and NACE combinations to allocate to SNAP code 060408 (domestic use), and the conclusion has been that not only the proportion declared to use in private households, but also a large proportion of products declared used in NACE 52, 50.5, 92.6 and 93.02–05 is used of members of the public in their homes. As of now, Norway allocates more product types declared in these NACEs to SNAP code 060408 than Denmark does. As a result of the discussions between the Nordic countries we will consider moving some product types (e.g. process regulators (P15), anti-condensation agents (K25) and raw materials (R30) to other SNAP codes.

The discussions between the Nordic countries have been fruitful in aiding the determination of emission factors. The Norwegian emission model has thus already included the results from this project, where a

consensus was reached. Some questions have however arisen where no consensus was reached, but which calls for further revision of the emission factors used in the Norwegian inventory. There has been a rewarding discussion regarding the emission factors of NMVOC from domestic solvent use. The EMEP/CORINAIR guidelines states that “The proportion of solvent contained in a product which is actually emitted to the atmosphere will vary depending upon the manner in which it is used. The US and UK surveys assumed 100% NMVOC emitted to atmosphere except in the case of products which are either used diluted in water (i.e. dishwasher detergents, fabric detergents, bleach etc.) in which case 1% was generally assumed or products which are removed with water after performing their function (i.e. shampoos, soaps, toothpaste, household cleaners etc.) which were assigned factors between 5% and 50% NMVOC emitted to atmosphere” (European Environmental Agency, 2006). In the Norwegian emission model we have assumed a high emission factor for this group (95 per cent). We will continue the evaluation and revision of our emission factors based on discussions between the Nordic countries in the NMR project.

6. Denmark

6.1 Introduction

Until 2002 the Danish solvent emission inventory was based on questionnaires, which were sent to selected industries and sectors requiring information on solvent use. In 2003 it was decided to implement a method that is more complete, accurate and transparent with respect to including the total amount of used solvent, attributing emissions to industrial sectors and households and establishing a reliable model that is easily updated on a yearly basis.

6.2 The Danish emission model for solvent use

6.2.1 Substance list

Since 2003 the detailed method described in the EMEP/CORINAIR Guidebook 2006 has been used. This represents a chemicals approach where all substances representing more than 95% of the total NMVOC emission are inventoried.

The definitions of solvents and VOC that are used in the Danish inventory (Illerup et al., 2007) are as defined in the solvent directive (European Commission, 1999) of the EU legislation: “Organic solvent shall mean any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticiser, or as a preservative”. VOCs are defined as follows: “Volatile organic compound shall mean any organic compound having at 293,15 K a vapour pressure of 0,01 kPa or more, or having a corresponding volatility under the particular condition of use”.

This implies that some substances, e.g. ethylenglycol, that have vapour pressures just around 0.01 kPa at 20 °C, may only be defined as VOCs at use conditions with higher temperature. However, use conditions under elevated temperature are typically found in industrial processes. Here the capture of solvent fumes is often efficient, thus resulting in small emissions.

The Danish list of substances comprises 39 substances or substance groups representing more than 95% of the total NMVOC emission from solvent use.

6.2.2 Activity data

For each substance a mass balance is formulated:

$$\textit{Consumption} = \textit{production} + \textit{import} - \textit{export} - \textit{destruction/disposal} - \textit{hold-up}$$

Production, import and export amounts are collected from Statistics Denmark, which contains detailed statistical information on the Danish society (StatBank Denmark, 2008). Manufacturing and trading industries are committed to reporting production and trade figures to the Danish Customs & Tax Authorities in accordance with the Combined Nomenclature. Import and export figures are available on a monthly basis from 1995 to present and contain trade information with 272 countries worldwide. Production figures are reported quarterly as “industrial commodity statistics by commodity group and unit”, from 1995 to present.

Destruction and disposal of solvents lower the NMVOC emissions. In principle this amount must be estimated for each NMVOC in all industrial activity and for all uses of NMVOC containing products. At present the solvent inventory only considers destruction and disposal for a limited number of NMVOCs. For some NMVOCs it is inherent in the emission factor, and for others the reduction is specifically calculated from information obtained from the industry or literature.

Hold-up is the difference in the amount in stock in the beginning and at the end of the year of inventory. No information on solvents in stock has been obtained from industries, Furthermore, the inventory spans over several years so there will be an offset in the use and production, import, export balance over time.

In some industries the solvents are consumed in the process, e.g. in the graphics and plastic industry, whereas in the production of paints and lacquers the solvents are still present in the final product. These products can either be exported or used in the country. In order not to double count consumption amounts of NMVOCs it is important to keep track of total solvent use, solvents not used in products and use of solvent containing products. Furthermore some substances may be represented as individual substances and also in substance groups, e.g. “o-xylene”, “mixture of xylenes” and “xylene”. Some substances are better inventoried as a group of NMVOCs rather than individual NMVOCs, due to missing information on use or emission for the individual NMVOCs. The Danish inventory considers single NMVOCs, with a few exceptions.

6.2.3 Emission factors

For each substance the emission is calculated by multiplying the consumption by the fraction emitted (emission factor), according to:

$$\text{Emission} = \text{consumption} * \text{emission factor}$$

The present Danish method uses emission factors that represent specific industrial activities, such as processing of polystyrene, dry cleaning etc. or that represent use categories, such as paints and detergents. Some substances have been assigned emission factors according to their water solubility. Higher hydrophobicity yields higher emission factors, since a lower amount ends in waste water, e.g. ethanol (hydrophilic) and turpentine (hydrophobic).

Emission factors are categorised in four groups in ascending order: (1) Lowest emission factors in the chemical industry, e.g. laquer and paint manufacturing, due to emission reducing abatement techniques and destruction of solvent containing waste, (2) Other industrial processes, e.g. graphic industry, have higher emission factors, (3) Non-industrial use, e.g. auto repair and construction, have even higher emission factors, (4) Diffuse use of solvent containing products, e.g. painting, where practically all the NMVOC present in the products will be released during or after use.

For a given substance the consumed amount can thus be attributed with two or more emission factors; one emission factor representing the emissions occurring at a producing or processing plant and one emission factor representing the emissions during use of a solvent containing product. If the substance is used in more processes and/or is present in several products more emission factors are assigned to the respective substance amounts.

6.2.4 Source allocation

The Danish Working Environment Authority (DWEA, Arbejdstilsynet) is administrating the registrations of substances and products to the Danish product register. All manufacturers and importers of products for occupational and commercial use are obliged to register. The following products are comprised in the registration agreement: Substances and materials that are classified as dangerous according to the regulations set up by the Danish EPA. Substances and materials that are listed with a limit value on the DWEA "limit value list". Materials, containing 1% or more of a substance, which is listed on the DWEA "limit value list". Materials, containing 1% or more of a substance, which are classified as hazardous to humans or the environment according to the Danish EPA rules on classification. There are the following important exceptions for products, which does not need to be registered: Products exclusively for private use. Pharmaceuticals ready for

use. Cosmetic products. The Danish product register does therefore not comprise a complete amount of used substances.

Emissions of single substances must also be attributed to sectors and households. The Nordic SPIN database (SPIN, 2008) comprises information on substance consumption in industrial categories and product use categories defined according to the NACE and UCN systems. The relative distribution from SPIN on industrial categories and use categories are used to distribute the consumed amount.

6.3 Domestic use

Although there is no obligation to register products exclusively used for private (domestic) use in Denmark, domestic use can be considered by assessing the UCN categories. The linking of UCN categories and domestic use can be seen in table 8 for the following SNAP categories, which are attributed to domestic use:

- SNAP 060104 (Paint Application: Domestic Use except 060107) (id=5 and 6)
- SNAP 060408 (Other: Domestic Use other than paints) (id=70 to 74)
- SNAP 060411 (Other: Domestic Use of Pharmaceutical Products) (id=76 and 77)

The id numbers refer to a unique row number in the general linking table and in the country specific table. In table 6 these domestic SNAP and UCN categories are linked with the substances that are found to comprise >95% of the emissions for the 2006 solvent emission inventory. For each substance the emission factors are stated.

Table 6. Emission factors for substances that comprise >95% of the emissions for Danish 2006 solvent emission inventory.

	propane, butane	iso- propylalcohol	ethanol	formaldehyde	turpentine	methanol	methyl methacrylate	naphthalene	xylene	acetone	phenol	toluene	acyclic aldehydes
The following use categories have been allocated to SNAP 060104 (Paint Application: Domestic Use except 060107) (id=5 and 6)													
B2010	Binding agents for paints, adhesives etc.												
D15	Propellants (for aerosols) 0.98												
F25	Thinners (for paints, lacquers, adhesives)												
G30	Flooring materials (Floor paints)												
M05	Paint, lacquers and varnishes												
M10	Paint, lacquer and varnishes removers												
O15	Solvents												
The following use categories have been allocated to SNAP 060408 (Other: Domestic Use other than paints) (id=70 to 74)													
A0530	Air cleaners and anti-odour agents												
A40	Anti-freezing agents												
B15	Pesticides for non agricultural uses												
B18100	Car care products												
B20	Binding agents												
B50	Fire extinguishing agents												
B60	Fuel additives												
D20	Odour agents (not cosmetic products)												
F30	Thinners (for other materials than paints, lacquers, adhesives etc.)												
H05	Skin care products (see also Cosmetics)												
H20	Hair shampoo												
I05	Impregnation/proofing												
I15	Insulating materials												
K30	Conserving agents (additives)												
K35	Construction materials (building materials)												
K52	Cosmetics												
L10	Adhesives												
M1540	Rust removers												
O25	Surface-active agents (surfactants, detergents)												
P10	Polishing agents												
R10	Cleaning/washing agents												
R2010	Underseal materials, incl. cavity seals												
S05	Sanitation agents												
S25	Rinsing agents												
U05	Filling materials												
The following use categories have been allocated to SNAP 060411 (Other: Domestic Use of Pharmaceutical Products) (id=76 and 77)													
L20	Pharmaceuticals												

Continued

		cyclo- hexanone	1-butanol	cyanates	butanoles	butanones	Triethyl- amine	tetrachloro- ethylene	ethylen- glycol	propylen- glycol	glycol-ethers	styrene	pentane	acrylic acid
The following use categories have been allocated to SNAP 060104 (Paint Application: Domestic Use except 060107) (id=5 and 6)														
B2010	Binding agents for paints, adhesives etc.													
D15	Propellants (for aerosols)													
G20	Thinners (for paints, lacquers, adhesives)			0.95	0.95	0.95			0.05	0.95	0.95	0.95		
G30	Flooring materials (Floor paints)	0.95	0.95	0.95	0.95	0.95			0.05	0.95	0.95	0.95		0.5
M05	Paint, lacquers and varnishes	0.95	0.95	0.95	0.95	0.95			0.05	0.95	0.95	0.95		0.5
M10	Paint, lacquer and varnishes removers	0.95	0.95	0.95	0.95	0.95		0.8	0.05	0.95	0.95	0.95		0.5
O15	Solvents	0.95	0.95	0.95	0.95	0.95			0.05	0.95	0.95	0.95		0.5
The following use categories have been allocated to SNAP 060408 (Other: Domestic Use other than paints) (id=70 to 74)														
A0530	Air cleaners and anti-odour agents													
A40	Anti-freezing agents					0.8			0.05	0.25		0.03		0.01
B15	Pesticides for non agricultural uses	0.75	0.25	0.25	0.8	0.8			0.05	0.25	0.6			
B18100	Car care products													
B20	Binding agents	0.75	0.25	0.5	0.25	0.8	0.5		0.05	0.25	0.6	0.03		0.01
B50	Fire extinguishing agents								0.05		0.6			
B60	Fuel additives									0.25				
D20	Odour agents (not cosmetic products)													
F30	Thinners (for other materials than paints, lacquers, adhesives etc.)									0.25	0.6			
H05	Skin care products (see also Cosmetics)													
H20	Hair shampoo													
I05	Impregnation/ proofing		0.25		0.25	0.8			0.05	0.25	0.6	0.03		0.01
I15	Insulating materials			0.5					0.05	0.25	0.6	0.03	0.98	
K30	Conserving agents (additives)													
K35	Construction materials (building materials)	0.75	0.25	0.5	0.8	0.8			0.05	0.25	0.6	0.03		
K52	Cosmetics									0.25	0.03			
L10	Adhesives	0.75	0.25	0.5	0.8	0.8			0.05	0.25	0.6	0.03	0.98	0.01
M1540	Rust removers													
O25	Surface-active agents (surfactants, detergents)	0.75	0.25						0.05	0.25	0.6	0.03		0.01
P10	Polishing agents	0.25	0.25			0.8			0.05	0.25	0.6	0.03	0.98	0.01
R10	Cleaning/washing agents	0.75	0.25		0.25	0.8		0.8	0.05	0.25	0.6	0.03	0.98	0.01
R2010	Underseal materials, incl. cavity seals													
S05	Sanitation agents									0.25	0.6			
S25	Rinsing agents									0.25				
U05	Filling materials	0.75	0.25	0.5	0.8	0.8	0.5		0.05	0.25	0.6	0.03		0.01
The following use categories have been allocated to SNAP 060411 (Other: Domestic Use of Pharmaceutical Products) (id=76 and 77)														
L20	Pharmaceuticals													

Only SNAP categories for domestic use are listed and combined with UCN categories. Empty cells mean that the substance is not registered in the corresponding UCN category. The linking of SNAP and UCN categories are found from table 4.2.1-4.2.6 (Denmark, linking of codes)

6.4 Planned improvements

This project has led to a new method for utilising the information in the product databases. In the 2008 inventory of 2007 emissions the revised emission factors, listed in table 6.3.1, for specific substances in domestic use have been implemented. The linking of NACE and UCN and SNAP codes as stated in tables 3.1–3.9 and 4.2.1–4.2.6 will give a more correct allocation of use amounts to the source categories and will be implemented in the methodology in the coming inventories. This will affect all sectors associated with solvent use.

7. Finland

7.1 Introduction

The Finnish solvent sector inventory is based on emission data, activity data and emission factors received from various sources, all specific to the respective source categories. Until now it has not been possible to develop a calculation system based on the national product register but options to move this way are explored, depending on how data collection to the product register will be developed in the future.

7.2 Allocation of household emissions in the Finnish inventory

The following categories regarding solvent use emissions from households are included in the inventory:

- Domestic use of paints (SNAP 060104, NFR 3A)
- Domestic solvent use (SNAP 060408, NFR 3D)

The shares of domestic releases in the solvent use sector are estimated as follows:

- Domestic use of solvent paints equals to 30% of NMVOC emissions in NFR 3A (Association for Finnish Paint Industry)
- Domestic solvent use equals to 50% of NMVOC emissions in NFR 3D (Finnish Environment Institute)

7.3 General explanation of the Finnish solvent use sector emission inventory

The Finnish emission inventory includes the following sources under NFR reporting category 3A Paint application:

- Emission data for decorative paint application is included in the inventory for the following categories:
- Construction and buildings (SNAP 060103) The data includes NMVOC emissions that are calculated on basis of information

received from surveys to operators that produce the paints and emission data calculated by the Association for Finnish Paint Industry.

- Domestic use of paints (SNAP 060104) The data includes NMVOC emissions that are calculated on basis of information received from surveys to operators that produce the paints and emission data calculated by the Association for Finnish Paint Industry

Emission data for industrial paint application is included in the inventory. The NMVOC emission data is received from the annual emission reports by the operators and surveys to the operators:

- Manufacture of automobiles (SNAP 060101), Car repairing (SNAP 060102), Boat building (SNAP 060106)
- Coil coating of aluminium and steel (SNAP 060105) and Wood coating (SNAP 060107)
- Other industrial paint application (SNAP 060108): includes emissions from plants that report NMVOCs in their annual reports (e.g. vehicles and furniture manufacturing and other manufacturing processes that paint their products)

Emission data for other non-industrial paint application (SNAP 060109). The following categories are not included in the inventory:

- SNAP 060108: Protective coating, plastic parts in the industry, and winding wire coating

The Finnish emission inventory includes the following sources under NFR reporting category 3B Degreasing and Dry Cleaning :

- Emission data for surface cleaning is included in the inventory for the following sectors. The emissions are based on annual emission reports by the industry and calculated data based on customs statistics
 - a) Degreasing (SNAP 060201) and Dry cleaning (SNAP 060202)
 - b) Solvent use in cleaning activities in electronic components manufacturing (SNAP 060203)
 - c) Other industrial cleaning (SNAP 060204), e.g. airplane defrosting

The Finnish emission inventory includes the following sources under NFR reporting category 3C Paint manufacturing:

- Emission data from solvent use in chemical industry is included in the inventory for the following sectors. The emissions are based on annual emission reports by the industry and information received from questionnaires to operators:

- a) Paint manufacturing (SNAP 060307) and Inks manufacturing (SNAP 060308)
- b) Glues manufacturing (SNAP 060309) and Adhesive, magnetic tapes, films and photographs manufacturing (SNAP 060311)
- c) Pharmaceutical products manufacturing (SNAP 060306)
- d) Polyester processing (SNAP 060301)
- e) Polyvinylchloride processing (SNAP 060302), polyurethane foam processing (SNAP 060303), polystyrene foam processing (SNAP 060304), rubber processing (SNAP 060305),
- f) Textile finishing (SNAP 060312) and leather tanning (SNAP 060313) and leather coating (SNAP 060108)
- g) Other (SNAP 060314), includes e.g. plastic producers

The following categories are not included in the inventory:

- Asphalt blowing (SNAP 060310) due to lack of data

The Finnish emission inventory includes the following sources under NFR reporting category 3D Other product use:

- Emission data from solvent use in the printing industry (SNAP 060403) included in the inventory based on data reported by the operators in their annual emission reports and from information from surveys to operators
- Emission data from preservation of wood (SNAP 060406) is included in the inventory based on statistical data and calculations at the inventory agency. The emission factor applied in the calculation is 100 kg NMVOC/tonne of wood.
- Emission data domestic solvent use (SNAP 060408) is included in the inventory based on emission data estimated by Finnish Technochemical Association. The estimates are at the moment outdated.
- Fat, edible and not edible oil extraction (SNAP 060404) is included in the inventory based on data reported by the operators in their annual emission reports and from information from surveys to operators
- Glass wool enduction (SNAP 060401)) and mineral wool induction (SNAP 060402) included in the inventory based on data reported by the operators
- Other (SNAP 060412) category includes e.g. pesticide use, preservation of seeds (calculations based on statistical data) and some industrial plants

The following categories are not included in the inventory:

- Application of glues and adhesives (SNAP 060405) due to lack of activity data
- Underseal treatment and conservation of vehicles (SNAP 060407) due to lack of activity data
- Domestic use of pharmaceutical products (SNAP 060411) is not included in the inventory because no method has been developed
- Vehicles dewaxing (SNAP 060409) is not included in the inventory.

8. Sweden

8.1 Introduction

During 2002, a SMED study was carried out (Kindbom et al., 2003), aiming at compiling time series of emissions of NMVOC in Sweden for all sectors included in the international reporting. In this study the estimated emissions of NMVOC from the sector “Solvent and Other Product Use” was based on information from various sources. For example data reported in companies’ environmental reports, data from the Products Register at the Swedish Chemicals Agency, as well as information from experts or trade organisations were included. The major part of the estimated emissions was however based on earlier national reports, investigations and estimations of national NMVOC emissions. The time series for the sector Solvent and Other Product Use presented in the SMED report of 2002 are still to be considered as reliable. One of the main conclusions in the study of 2002 was that emissions from the sector “Solvent and Other Product Use” needed further attention, primarily concerning developing methods and finding sources of background data, in order to facilitate and make it possible to perform consistent annual updates of national emission data in the future.

In 2005 a new method for estimating emissions from Solvent and Other Product Use was developed by SMED (Skårman et al., 2006) in cooperation with the Swedish Chemicals Agency. The method is more complete, accurate and transparent and data can easily be updated on a yearly basis.

8.2 The Swedish emission model for solvent use

The Swedish method is consumption-based with a product related approach. All primary data is derived from the Products Register at the Swedish Chemicals Agency.

8.2.1 Substance list

Substances in the Products Register defined as NMVOCs and in quantities over 100 tonnes has been compiled for the years 1992–2006. The following definition of NMVOC has been used:

“*Volatile organic compound (VOC)* shall mean any organic compound having at 293.15 K a vapour pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use. For the purpose of this Directive, the fraction of creosote which exceeds this value of vapour pressure at 293.15° K shall be considered a VOC.” (European Commission, 1999)

The threshold of 100 tonnes is based on the fact that substances found in the Products Register in quantities less than 100 tonnes are equivalent to 0.03 % of the total solvent sales of 400,000 tonnes. A manual selection has been made in order to select each substance with a vapour pressure of 0.01 kPa or more at 293.15° K according to the definition of VOC (see definition above). The substance list, used when compiling data for submission 2009, contains 360 substances defined as NMVOC. The list includes CAS-number, name, molecular formula and carbon content for each substance. In some cases a mixture of substances are included in the substance list and for these the carbon content has been estimated by the Chemicals Agency as 85% of NMVOC, based on information in the Products Register. In cases when the carbon content not can be derived from the Products Register, the default value given in the 2006 IPCC guidelines (IPCC, 2006), 60% has been used.

8.2.2 Activity data

The sold amount of solvents and solvent based products (*production + import – export*) is derived from the Products Register at the Swedish Chemicals Agency. The substance list has been used to extract quantities of NMVOC and C in substances found in the Products Register. Due to confidentiality data can not be delivered on substance level. The data extractions include for each year:

- The intended use of the product, the type of product (product code)
- Industry to which the product is sold (industry category/NACE)
- Quantity of NMVOC
- Quantity of C

The extractions from the Products Register for 1992–2006 have been used in order to compile a connection diagram with all combinations of “product codes” and “industry categories”. For all combinations, decisions whether to include or exclude from reporting are based on expert judgements in order to avoid double-counting. If the combination should be included, its specific CRF code has been decided. Furthermore, it has

to be determined if the product is used as raw material or not. The quantities of NMVOC used as raw material in processes have been identified and treated separately from the remaining quantities for each CRF code, because most of the solvents used as raw material will not be emitted. An Excel macro has been written in order to compile time series with quantities of NMVOC and C for each sub-code within CRF sector 3.

In order to avoid double-counting of reported emissions within other sectors an expert judgement has been made on both industry category and product function. The industries that are excluded in the extractions from the Products Register are considered to be reported in CRF 1, 2 or 6. The judgements made for industry categories are presented in table 8.1 and table 8.2. All industrial activities reported in CRF-codes other than CRF 3, are excluded in the extractions from the Products Register. This judgement is made regardless of presence of NMVOC emissions for the activity.

The judgements made for product codes are shown in table 8.3. All products burned when used are excluded in the extractions from Products Register, though CO₂ may emit. But since the reported emissions of CO₂ are to be based on emitted NMVOC, the product is excluded for both gases.

Table 8.2. Industry categories excluded in the extractions from the Products Register except for CRF 3A (Paint application) and CRF-code used for reporting the activity.

Industry category	Industry code	CRF 3A*	Reported in CRF-code
Petroleum refineries, lubricants-, asphalt- and coal products industries	7	X	1B2a iv, 2A5, 2A6
Mining and quarrying	C	X	2A7
Manufacture of food products and beverages	D15	X	2D2
Manufacture of pulp, paper and paper products	D21	X	2D1
Manufacture of coke, refined petroleum products and nuclear fuels	D23	X	1B1B
Manufacture of chemicals and chemical products	D24 (except for paint industry)	X	2B5
Manufacture of plastic products	D25.2	X	2B5
Manufacture of other non-metallic mineral products	D26	X	2A7
Manufacture of basic metals	D27	X	2C
Manufacture of fabricated metal products, except machinery and equipment	D28	X	2C
Recycling	D37	X	6

*Product codes for paint begin with M05.

Table 8.2. Industry categories always excluded in the extractions from the Products Register.

Industry category	Industry code	Always excluded
Other industrial production	11	X
Wholesale trade and commission trade, except of motor vehicles and motorcycles	G51	X
Trade with goods	G	X

Table 8.3. Product codes that are excluded in the extractions from the Products Register.

Product functions	Product code	Explanation
Motor fuels	B55100	Reported in CRF 1
Ignition gas	B55150	Reported in CRF 1
Heating fuels	B55200	Reported in CRF 1
Fuels, other	B55300	Reported in CRF 1
Anti-knocking agents	B60100	Reported in CRF 1
Fuel additives	B60200	Reported in CRF 1
EP-additives	E20100	Burned and not emitted
Road paving materials	K35500	Reported in CRF 2A
Construction materials, other	K35900	Reported in CRF 2A
Flux agents for soldering	L15100	Burned and not emitted
Soldering metals	L15200	Burned and not emitted
Soldering agents, other	L15990	Burned and not emitted
Gunpowder	S50100	Burned and not emitted
Pyrotechnical products	S50200	Burned and not emitted
Explosives, other	S50900	Burned and not emitted
Flux agents for welding	S75100	Burned and not emitted
Electrodes (welding)	S75200	Burned and not emitted
Welding product, other	S75400	Burned and not emitted

8.2.3 Emission factors

Country specific emission factors are developed for each reported activity within each CRF/NFR code. The emission factors have been developed in order to adjust to the old time series 1988–2001 (Kindbom et al., 2003) and are also taking into account the application techniques, reported emissions presented in legal environmental reports for specific industries, as well as other pathways of release (e.g. waste or water). As an example, in industries where most of the solvents are used in water solutions, an emission factor of 10% is used. For emissions to air two emission factors have been developed for each activity; one for solvents used as raw material and one for the remaining quantities. The emission factors for raw material have been set very low, since most of the solvents will end up in products and will hence not be emitted during production. The emission factors are presented in chapter “Country specific linking of codes and emission factors, Sweden”.

8.2.4 Calculation of emissions

The emissions from solvent use are calculated according to the equation:

$$E = AD \times EF$$

Where E = emission, AD = activity data (production + import – export) and EF = emission factor

Emission of CO_2 has been calculated with the following equation:

$$\text{Emission } (CO_2) = C_{\text{quantity}} \times \text{Emission Factor} \times \frac{44.0098}{12.0011}$$

C_{quantity} is the carbon quantity in NMVOC quantity. 44.0098 and 12.0011 are the molecular weights of CO_2 and C, respectively.

8.3 Domestic use

The Swedish allocation, based on industry category (NACE) and product code level, is given in chapter “Country specific linking of codes and emission factors, Sweden”. Sweden does not compile and report data on detailed SNAP or GAINS level today and consequently domestic use is not estimated separately in the Swedish inventory. Due to confidentiality, data from the Swedish Products Register can not be delivered on substance level. Hence it can not be derived from the model what substances are included or dominating for domestic use in Sweden.

Domestic use is included in the estimates for NFR 3A1 (CRF 3A) and NFR 3D3 (CRF 3D5). Below follows a summarised review of the Swedish allocation on NFR category level concerning domestic use.

SNAP 060104 (Paint Application: Domestic Use except 060107) (id=5 and 6) is compiled and reported as NFR 3A1 “decorative coating application”. In the estimates for NFR 3A1 NACE 01, 02, 05, 45, 50, 52, 55, 60–64, 70–75 and all products that begins with product code M05 (paints and varnishes) are included in the estimates. When calculating the emissions of NMVOC and CO_2 for NFR 3A1 an emission factor of 0.95 is used. “Other coating application” (NFR 3A3) is reported as included in 3A1.

SNAP 060408 (Other: Domestic Use other than paints) (id=70 to 74) is compiled and reported as NFR 3D3 “Other product use”. For NFR 3D3 all products except paints and varnishes for NACE 01, 02, 05, 16, 24.62, 29–36, 40, 41, 45, 50, 52, 55, 60–64, 70–75, 80, 85 and 90–93 are included in the estimates. When calculating the emissions an emission factor of 0.95 is used, except for anti-freeze products where the emission factor is set to 0.1. Today Sweden does not report emissions from household use separately as NFR 3D2 “Domestic solvent use including fungicides”.

Instead the emissions originating from household use are included in NFR 3D3 “Other product use”.

SNAP 060411 (Other: Domestic Use of Pharmaceutical Products) (id=76 and 77) is compiled and reported as NFR 3D3 “Other product use”. In the estimates for NFR 3D3 NACE 01, 50, 52, 85 and 92.6 and all products that begin with product code L20 (pharmaceuticals) are included in the estimates. When calculating the emissions an emission factor of 0.95 is used.

8.4 Suggested future improvements

IVL Swedish Environmental Institute can not implement any improvements in the current model before the Swedish EPA has approved and ordered the suggested changes. Below follows suggested future improvements for the Swedish inventory concerning domestic use.

In the project it has been learned that products that are available for private households are given a special marker, PR, in the Swedish products register. Today this marker is not included in the extractions obtained from the Swedish Chemicals Agency. By including the special marker, PR, in the extractions from the Products Registers the Swedish reporting on emissions from private household use could be improved. According to the Swedish Chemicals Agency, around 15% of all products found in the products registers are available for private consumers.

The Swedish inventory could be further improved by using the agreed definitions, see chapter “General linking of codes”, for domestic use:

- SNAP 060104 “Domestic use”, included in NFR 3A1 “Decorative paint application”, is equivalent to paints and varnishes used by NACE 52 and by private households (PR).
- SNAP 060408 “Other: Domestic Use other than paints”, included in NFR 3D2 “Domestic solvent use including fungicides”, correspond to all products except pharmaceuticals, paints and varnishes used by NACE 50.5, 52, 92.6–92.7, 93.02, 93.05 and by private households (PR).
- SNAP 060411 “Other: Domestic Use of Pharmaceutical Products”, included in NFR 3D iv “Other including products containing HMs and POPs”, is equivalent to all pharmaceuticals used by NACE 50, 52, and pharmaceuticals products that are available for private households (PR).

The Swedish inventory, concerning domestic use, could also be improved if the main substances used in SNAP 060104, 060408 and 060411 are identified on an aggregated level. This study needs to be done in cooperation with the Swedish Chemicals Agency. Data on substance level linked

to industry- and product code can not be obtained directly from Swedish Chemicals Agency due to confidentiality. The aim of this study is to evaluate the currently used country specific emission factors with respect to the emission factors suggested by Denmark and Norway for specific substances in this project.

9. Iceland

9.1 Introduction

The use of solvents leads to emissions of non-methane volatile organic compounds (NMVOC) which is regarded as an indirect greenhouse gas. The NMVOC emissions will over a period of time oxidize to CO₂ in the atmosphere. This is included in the total greenhouse gas emissions reported to UNFCCC.

The Icelandic inventory is based on imports data from Statistics Iceland. No production takes place in Iceland and there is no export of solvents.

Solvent and other product use contributes a small amount to greenhouse gas emission in Iceland. Share of total emission was 0.2% in 2006, but has varied from 0.3% to 0.5% in the years 1990 to 2005.

9.2 Emission Factors

No country specific emission factors have been developed as it has been assumed that 100% NMVOC is emitted to the atmosphere.

9.3 Activity data

Statistics of Iceland is the primary data source. A list of imported solvents has been selected and a survey based data used to segregate solvent use according to CRF codes.

Conversion of NMVOC to CO₂ has been estimated with the following equation:

$$\text{CO}_2 \text{ emission} = 0.85 \times \text{NMVOC}_{\text{emission}} \times 44/12$$

Where 0.85 is the carbon content of the NMVOCs

Other emissions reported under the sector solvent and other product use are due to use of N₂O, mainly for medical purposes, and also, to a smaller extent, for car racing. Data on sold amounts are collected directly by the Environment Agency.

9.4 Domestic use

Following SNAP category the Domestic use is as follows:

- 060104 Domestic use
- 060408 Domestic solvent use (other than paint application)
- 060411 Domestic use of pharmaceutical products

Domestic use is very complex and the EMEP/CORINAIR guidebook states that it is difficult or even impossible to separate total sales into domestic and industrial amounts.

The emission of NMVOCs from household use in Iceland has not been assessed, as there is no Product Registry in operation.

9.5 Planned improvements

This project has led to some improvement on the basic on NMVOC emission. Imported raw material and products that lead to NMVOC emission has been identified and emission factors have been set to some extent.

Suggested improvements are as follows:

- An adequate list of raw material and products leading to NMVOC emission needs to be generated.
- Surveys to clarify emission from different sources, including the domestic use.
- Appropriate emission factors needs to be identified for specific substances.

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11. Sammenfatning på dansk

Dette projekt omhandler de fem Nordiske landes NMVOC emissionsopgørelserne for anvendelse af opløsningsmidler. Opgørelserne er en del af rapporteringsforpligtelserne til United Nations Framework Convention on Climate Change (UNFCCC), European Commission og UNECE-Convention on Long-Range, Transboundary Air Pollution (CLRTAP). Et generelt problem ved dataindsamling, sammenligning og rapportering er at håndtere de forskellige codesystemer, dvs. hvorledes de forskellige industrielle kilder og husholdninger er tilskrevet koder. I dette projekt er de væsentligste koder, der anvendes til rapportering til ovennævnte konventioner og koder som anvendes nationalt i registreringen af kemiske stoffer og produkter med kemiske stoffer, samlet og sammenlignet. Emissionsfaktorer er vist for de forskellige kombinationer af koder og enkelt stoffer, hvor det er muligt.

Som eksempel er SNAP kode 060101 (paint application, manufacture of automobiles) vist:

id	SNAP/ CORINAIR	CRF	NFR	RAINS/ GAINS	NACE (Industrial use)	UCN (Use Categories)	Emissions faktor
1	060101	3A	3A	AUTO_P	34	M05	0.3

Tabellen viser, at SNAP 060101 svarer til CRF og NFR kode 3A, RAINS/GAINS kode AUTO_P og NACE kode 34. Det er muligt at én SNAP/CORINAIR kode svarer til mere end én RAINS/GAINS eller NACE kode eller vice versa. id-nummeret repræsenterer en unik kombination af SNAP/CORINAIR, CRF, NFR, RAINS/GAINS og NACE koder. For hele solvent sektoren er der defineret 94 forskellige id-numre og disse er vist i kapitlet „General linking of codes“. Hvert land har knyttet UCN koder og emissions faktorer til de enkelte id-numre. I eksemplet svarer UCN kode M05 til „paint application, manufacture of automobiles“, med en emissions faktor på 0.3 for anvendelse af opløsningsmidler. En tabel med UCN koder og emissions faktorer er vist for hvert land i kapitlet „Country specific linking of codes and emission factors“. For Danmark er der vist stofsifikke emissions faktorer i kapitlet „Denmark“.

Norge og Sverige har implementeret store dele af kodekoblingerne, aktivitetsdata og emissionsfaktorer i deres emissionsopgørelser, Danmark har implementeret dele og vil tilføje yderligere i de kommende opgørelser, specielt med hensyn til in- og ekskludering af kemiske stoffer, emissionsfaktorer og kodekoblinger. Finland og Island har ikke adgang til informationer vedrørende kodeinddelinger og har lavet deres opgørelser ud fra statistiske data, rapporter fra industrier og informationer fra diverse

opgørelser. Emissionsfaktorerne vil blive implementeret i det omfang, det er muligt.

Formålet med dette projekt har ikke været at alle lande skal anvende samme metode, men snarere at eksisterende data præsenteres på en transparent måde, deles og sammenlignes, således at de eksisterende metoder og data kan forbedres og ændres på den mest hensigtsmæssige måde.

Tabellerne kan anvendes til forskellige formål; da koderne er meget specifikke, er der større mulighed for at aktivitetsdata kan tilskrives de korrekte kilder. Emissionsfaktorer kan variere betydeligt fra en kilde til en anden og den høje detaljeringsgrad muliggør at emissionsfaktorerne kan tilskrives de korrekte kilder, produkter og stoffer. Når aktivitetsdata eller emissionsfaktorer kendes for en kode kan de ekstrapoleres til andre koder. Når en emissionsfaktor mangler for en kode er det mere sandsynligt at finde en passende emissionsfaktor fra andre landes opgørelser eller litteraturen, når alle kodesystemer indgår. Desuden giver tabellerne mulighed for at identificere manglende data, hvor fokus kan gives i kommende opgørelser. F.eks. kan der lægges vægt på præcisionen af aktivitetsdata for kilder med høje emissioner eller emissionsfaktorer. Eller, det er hensigtsmæssigt at øge præcisionen for emissionsfaktorer for kilder med høje aktivitetsdata.

Tabellerne dækker hele sektoren for anvendelse af opløsningsmidler, men fokus er imidlertid på anvendelse i husholdninger. NMVOC emissioner fra husholdningers anvendelse af opløsningsmidler er behæftet med stor usikkerhed på grund af de meget forskelligartede anvendelses- og emissionsmønstre og de mange forskellige produkter, der indeholder opløsningsmidler. I denne rapport er foreslået en definition af koderne for anvendelse i husholdninger og hvert land beskriver hvordan emissioner fra husholdninger håndteres i deres opgørelser. Nogle vigtige diskussioner er ført mht. hvordan produkter med opløsningsmidler skal kodeinddeles, det gælder f.eks. klæbemidler, lim, fortyndere og opløsningsmidler i maling. Enighed er nået og resultaterne er implementeret i tabellerne. Diskussioner vedrørende emissionsfaktorer for husholdningsprodukter og maling generelt har ført til enighed omkring de emissionsfaktorer der er i tabellerne. For Norge og Danmark, hvor opgørelserne er på stofniveau, er emissionsfaktorer for enkeltstoffer vurderet og angivet.

Et fremtidigt perspektiv er, at forbedre andre kildekategorier i anvendelsen af opløsningsmidler. Aktiviteter som industriel anvendelse af maling og lak, grafisk industri, anvendelse af klæbemidler og lim og træbeskyttelse er vigtige kilder til NMVOC emissioner og nogle vil blive væsentligt påvirket af de nuværende og kommende reguleringer og emissionsreducerende tiltag. Når aktivitetsdata og emissionsfaktorer bestemmes mere eksakt og tilskrives de korrekte kildekoder vil dette forbedre NMVOC emissionsopgørelserne for anvendelse af opløsningsmidler og støtte de nationale beslutningstagere mht. dokumentation af overholdelse af emissionslofter.