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**Use and emissions of hazardous substances in  
Norway, 2002-2006**

Based on data from the Norwegian Product  
Register

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*Reports* This series contains statistical analyses and method and model descriptions from the different research and statistics areas. Results of various single surveys are also published here, usually with supplementary comments and analyses.

© Statistics Norway, June 2008 When using material from this publication, Statistics Norway shall be quoted as the source.,  ISBN 978-82-537-7389-6 Trykt versjon ISBN 978-82-537-7390-2 Elektronisk versjon ISSN 0806-2056  <b>Emne</b> 01.04 og 01.90  Trykk: Statistisk sentralbyrå	<b>Standardtegn i tabeller</b> Tall kan ikke forekomme Oppgave mangler Oppgave mangler foreløpig Tall kan ikke offentligjøres Null Mindre enn 0,5 av den brukte enheten Mindre enn 0,05 av den brukte enheten Foreløpige tall Brudd i den loddrette serien Brudd i den vannrette serien Desimalskilletegn	<b>Symbol</b> . .. ... : - 0 0,0 * —   ,
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## Abstract

Increased awareness of the effects of hazardous substances on human health and the environment has led to a growing demand for information regarding use and release patterns of such substances. For the past few years, Statistics Norway has been working on new statistics on the consumption and emission of hazardous substances in Norway. At present, the statistics cover the emissions of hazardous substances caused by the use of products that are subject to the duty of declaration to the Norwegian Product Register. The statistics include about 450 substances that are categorised as being CMR (may cause cancer, be mutagenic or generate reproductive disorders), chronic toxic, sensitising and/or dangerous for the environment.

The emission of hazardous substances to the surroundings (including air, soil and water) is calculated by multiplying the amount consumed of a substance by an emission factor. The consumption of a substance is expressed as the sum of production and import, minus export, declared to the Product Register. The emission factor represents the fraction of the substance that is not incorporated into a new product, transformed into a new compound, or handled in some other way (e.g. as waste). The fraction of a hazardous substance emitted is assumed to be dependent both on the type of product used and the sector in which it is used.

The model and its emission factors have been gradually improved, incorporating an increasing amount of information. In the present model, the majority of the emission factors are specific for the combination of product type and industrial sector. Some are product-specific factors, while a few emission factors are specified for the combination of product type, industrial sector and substance. The first two groups of emission factors are obtained from two Swedish studies, while the substance-specific factors are based on consultations with relevant industry.

Results show that roughly 0.3 per cent of approximately 6 million tonnes of around 450 selected hazardous substances that are consumed in Norway each year is emitted to the surroundings. In other words, around 19 000 tonnes of a long list of substances classified as CMR, chronic toxic, sensitising and/or dangerous for the environment find their way into the environment every year.

According to present estimates, there has been a substantial reduction in the emissions of CMR-substances since 2002. This decline is mainly due to lower emissions of CMR-substances from the use of energy goods, which is by far the largest source of such substances. Emissions from products containing substances with chronic toxic effects have also fallen since 2002. These emissions are related to both fuel consumption and emissions from the manufacturing industry. Meanwhile, the use and emission of substances with sensitising effects have been quite stable during the past five years. Production and use of paint and varnishes are the main sources of these emissions.

The emissions of substances that are dangerous for the environment increase in the beginning of the period but decline almost correspondingly by 2006. This is mostly due to a decline in the use of these substances in manufacturing industries. However, this reduction is partly counteracted by an increased use of biocides in fish farming.

For all hazard categories other than "Dangerous for the environment", emissions from sectors other than manufacturing industry were predominantly generated by the use of solvents, paint and various construction products in 2006.

Although trends in emissions of a series of hazardous substances may be considered to be a rough indicator of the development of the risk of damage to human health and the environment caused by these substances, such emissions

figures are not a measure of the actual risk they pose. Firstly, not all hazardous substances or emission sources are covered. Secondly, a risk assessment would require the integration of more information, both about the recipient and about various properties of the substances. Thus, one of the first steps towards an approximate quantification of risk, is to give emission figures for different substances weights according to their hazardous properties. Various such hazard weights are available and may be evaluated. Note, however, that hazard weights based on existing R-phrases, could be misleading for substances that are dangerous for the environment. For instance, substances that represent the highest environmental concern, i.e. substances that are persistent (P), bioaccumulative (B) and toxicity (T) (so-called PBT-substances), do not yet have a separate classification category. However, applying appropriate hazard weights to emission figures would probably make the statistics easier to interpret and bring the resulting estimates closer to a measure of risk.

The statistics on hazardous substances is still work in progress. Thus, there will be continued need to improve emission factors, quality and completeness of activity data and as well as the estimation model itself.

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## Sammendrag

Økt oppmerksomhet rundt skadevirkningene av helse- og miljøfarlige stoffer har medført en voksende etterspørsel etter informasjon knyttet til bruk og utslipp av slike stoffer. De siste årene har Statistisk sentralbyrå arbeidet med å lage ny statistikk over forbruk og utslipp av helse- og miljøfarlige stoffer i Norge. Så langt dekker denne statistikken utslipp av et utvalg farlige stoffer grunnet bruk av produkter som er deklarerert til det norske produktregisteret. Statistikken inkluderer rundt 450 stoffer som er kreftfremkallende (C), mutagene (M), reproduksjons-skadelige (R) (såkalte CMR-stoffer), kronisk giftige, allergifremkallende og/eller miljøskadelige.

Utslipp av farlige stoffer til omgivelsene (luft, jord og vann) er beregnet ved å multiplisere mengden av et gitt stoff brukt et gitt år med en utslippsfaktor. Stoffmengden brukt er summen av produksjon og import minus eksport, i henhold til deklarasjoner til Produktregisteret. Utslippsfaktoren er den andelen av stoffmengden brukt som ikke inngår i nye produkter, omdannes til andre stoffer (f.eks. ved forbrenning) eller håndteres på en eller annen måte som forhindrer utslipp (f.eks. avfallshåndtering). Andelen av et farlig stoff som slippes ut antas å avhenge av både typen produkt stoffet inngår i og i hvilken næring (private husholdninger inkludert) produktet brukes.

Modellen med tilhørende utslippsfaktorer har blitt gradvis forbedret siden den først ble laget. Stadig mer informasjon er integrert, for å gi så riktige utslippsestimater som mulig. I den foreliggende modellen er de aller fleste utslippsfaktorene både produkt- og næringsspesifikke. I tillegg finnes produktspesifikke faktorer, og noen få utslippsfaktorer er både produkt-, nærings- og stoffspesifikke. De to førstnevnte gruppene av utslippsfaktorer er hentet fra to ulike svenske studier, mens de stoffspesifikke faktorene er satt i samråd med aktuelle industribedrifter.

Resultatene viser at omtrent 0,3 prosent av rundt 6 millioner tonn av et utvalg på om lag 450 farlige stoffer som brukes hvert år slippes ut. Med andre ord havner årlig rundt 19 000 tonn av en rekke stoffer som er CMR, kronisk giftige, allergifremkallende eller har langtidsvirkende miljøeffekter i omgivelsene.

Ifølge foreliggende estimater, har det vært en betydelig reduksjon i utslippene av CMR-stoffer siden 2002. Hovedårsaken er reduserte utslipp av CMR-stoffer fra bruk av brensel (drivstoff, fyringsolje mm). Bruk av brensel er den klart største kilden til utslipp av CMR-stoffer. Utslipp av kronisk giftige stoffer viser også en nedgang siden 2002, forårsaket av lavere forbruk både av brensel og produkter brukt i industrien. Bruk og utslipp av allergifremkallende stoffer ser derimot ut til å ha vært nokså stabilt de siste fem årene. Produksjon og bruk av maling og lakk er hovedkilden til utslipp av slike stoffer.

Utslipp av miljøskadelige stoffer øker i begynnelsen av perioden, men synker så nærmest tilsvarende innen utgangen av 2006. Nedgangen skyldes først og fremst redusert bruk av slike stoffer i industrien. Dette blir imidlertid delvis motvirket av økt bruk av biocider i oppdrettsnæringen.

For tre av fire fareklasser var løsemidler, maling og diverse produkter brukt i bygg- og anleggsvirksomhet de viktigste utslippskildene av farlige stoffer fra øvrige næringer i 2006, private husholdninger inkludert.

Selv om utviklingen i beregnede utslipp av en rekke helse- og miljøfarlige stoffer gir en grov indikasjon på hvordan risiko for skade på hele og miljø endres, er utslippstallene likevel ikke et mål på den virkelige skaderisikoen stoffene utgjør. For det første er ikke alle farlige stoffer omfattet av statistikken. For det andre vil en vurdering av risiko kreve integrering av mer spesifikk informasjon, både om resipienten og om stoffenes ulike egenskaper. Ett av de første skritt på veien mot et

tilnærmet mål på risiko vil derfor være å vekte de ulike stoffene ut fra deres fysiske og kjemiske egenskaper. Flere forskjellige "farevekter" er tilgjengelig og kan vurderes brukt. Merk imidlertid at farevekter basert på R-setninger kan gi misvisende resultat innen fareklassen miljøfarlig. For eksempel har stoffer med svært alvorlige miljøegenskaper, dvs. de er persistente (P), bioakkumulerende (B) og toksiske (T) (såkalte PBT-stoffer), i dag ingen egen klassifiseringskategori. Bruk av egnede "fareverdier" til å vekte utslippstall vil imidlertid kunne gjøre statistikken lettere å forstå og gi en bedre indikasjon på hvilken risiko helse- og miljøfarlige stoffer representerer.

Statistikken er fortsatt under utvikling, og det vil fremover være behov for stadig forbedring av både utslippsfaktorer, kvalitet og omfang av datagrunnlaget og selve beregningsmodellen.

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# 1. Introduction

## 1.1. Background to the study

Cancer is responsible for one in four deaths in Norway (Statistics Norway 2007a). To what extent this is caused by exposure to toxic substances is uncertain, but it is believed that the rise in incidents of at least some forms of cancer is linked to the increased use of chemicals. For instance, the occurrence of testicular and breast cancer has more than doubled since the 1950s, and the widespread use of endocrine disrupting substances is suspected to be partly to blame (Report No. 14 to the Storting 2006-2007). Endocrine disrupting substances may possibly also be linked to lowered fertility and foetal damage in both humans and animals such as polar bears, gulls and marine snails (Report No. 14 to the Storting 2006-2007).

Increased awareness of the effects of toxic substances on human health and the environment has led to a growing demand for information regarding use and release patterns of these substances (NOU 2005:5). Information on a detailed level exists for many substances, but such detailed information is difficult to use for policy-making purposes.

For the past few years, Statistics Norway has been working on developing new statistics aimed at providing an overview of the consumption and emission of harmful substances in Norway (Finstad and Rypdal 2003, Hansen 2006). The statistics are intended for use by governmental bodies and others as a tool for identifying important emission sources, developing abatement measures and policies for risk reduction, and for monitoring and evaluating the effect of measures taken. These new statistics have been developed in close collaboration with The Norwegian Pollution Control Authority and The Norwegian Product Register<sup>1</sup>.

Although there is a great and growing demand for knowledge on consumption and emissions of hazardous substances, data sources are generally incomplete and difficult to combine without double counting emissions. Thus, producing statistics that can give a representative picture of the level and trend of emissions of hazardous substances in Norway is a considerable challenge.

At present, the statistics cover the emissions of toxic substances caused by the use of products that are subject to the duty of declaration to the Norwegian Product Register. The Product Register was chosen as a starting point for these new statistics on hazardous substances, as it is considered to be the data source that could most easily provide activity data of relatively high quality, with much appurtenant information and fairly good coverage of most product types and sectors. The current statistics include about 450 substances that are categorised as being CMR (may cause cancer, be mutagenic or generate reproductive disorders), chronic toxic, sensitising and/or having long-term detrimental effects on the environment. However, the release of hazardous substances used in the oil industry (the extraction of crude oil and natural gas) is not covered here, as we consider these to be better covered by other data sources than the Product Register.

This report contains the latest results from our work.

## 1.2. Objectives of this work

The objective of this work was to produce statistics that will help governmental bodies and other interested parties in attempting to reduce the risk of damage caused by the use and emission of hazardous substances.

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<sup>1</sup> The Norwegian Register on products containing hazardous substances

The statistics were to consist of consumption and emission figures for the period 2002-2006, based on data from the Norwegian Product Register. Emission factors were to be examined and improved for substances that made large contributions to previous emission estimates.

### **1.3. Structure of this report**

An overview of the abbreviations used throughout this report is given in chapter 2, followed by a chapter describing the substances included in this study (chapter 3). The activity data used for estimating the emissions are presented in chapter 4 and chapter 5 contains information on the calculation model and emission factors. The resulting time series on use and emission patterns are presented in chapter 6. Chapter 7 focuses on areas for methodological improvement.

## 2. Abbreviations and definitions

ATP	Adaption to Technical Progress; Directive 2004/73/EC The 29th Adaption to Technical Progress of the Dangerous Substances Directive 67/548/EEC (European Commission 2004). This directive introduces the latest changes to Annex I, the list of official EU classifications of substances. It includes significant changes to the classification of some substances.
CAS number	An identification number for substances described in the literature, assigned by Chemical Abstract Services, a division of the American Chemical Society. Most CAS numbers refer to individual substances, but some are mixtures, such as petroleum solvents, e.g. naphtha.
CMR	Cancer, Mutation and Reproduction; Group of substances that may cause cancer (be carcinogenic), provoke mutation or cause reproductive damages.
KemI	Kemikalieinspektionen; The Swedish Chemicals Agency
NACE	International nomenclature system for industrial classification (industrial sectors). Codes according to Statistics Norway <i>Standard Industrial Classification</i> (Statistics Norway 2002), based on EU's international industrial standard NACE Rev.1.1., 2002 update.
VOC	Volatile organic compound (VOC) refers to any organic compound having a vapour pressure of 0.01 kPa or more at 293.15 degrees K, or having a corresponding volatility under the particular conditions of use (European Commission 1999).
R-phrases	Risk Phrases, as defined in Annex III of European Union Directive 67/548/EEC: <i>Nature of special risks attributed to dangerous substances and preparations</i> (European Commission 1967).
UCN	Use Code Nordic. The Nordic Product Register's classification system for products.
Source	A combination of industrial sectors and product, specifically defined for this study.

### 3. Substances

#### 3.1. Substance coverage

This study aims to describe use and emissions of substances that are classified as being CMR (may cause cancer, be mutagenic or generate reproductive disorders), chronic toxic, sensitising and/or dangerous for the environment, according to the Norwegian List of Dangerous Substances (“Stofflisten”; FOR 2002-07-16 nr 1139, appendix VI). This list is a result of Norway’s legal implementation of the Annex 1 to Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances. The list is updated through the 29<sup>th</sup> Adaption to Technical Progress (ATP) and currently contains about 3 000 substances with corresponding risk phrases (R-phrases, listed in Appendix A). A total of 2 437 of the substances on this list were identified as having one or more of the properties mentioned above. As a presentation of emission figures for each substance or each R-phrase was considered to be over-complex and impossible to give without violating confidentiality rules, different R-phrases were grouped into four so-called hazard categories. Table 3.1 shows the R-phrases that correspond to each hazard category chosen for this study. The present hazard categories correspond to the categories used in Finstad et al (2003).

**Table 3.1. Hazard categories and corresponding R-phrases**

Hazard category	R-phrases
CMR	R40, R45, R46, R49, R60, R61, R62, R63, R68
Chronic toxic	R48 (all combinations of R48)
Sensitising	R42, R43, R42/43
Dangerous for the environment <sup>1</sup>	R53, R50/53, R51/53, R52/53

<sup>1</sup>Currently includes substances specifically dangerous for animals in the aquatic environment. Other detrimental effects on animals (aquatic or terrestrial), such as reproductive disruption, may be partly covered by the other hazard categories.

In addition, all substances on the government’s Priority List (Reports No. 14 and 26 to the Storting 2006-2007) were included. This list is comprised of around 30 substances and groups of substances of special concern (295 substances in all). The Norwegian government aims to eliminate or substantially reduce emissions of the substances on the list.

Of the 2 732 substances selected, only around 450 were registered in the main data source and thus included in this study. A list of these substances is given in Appendix B. Table 3.2 shows the number of substances covered by this study included each year. The sum over categories is higher than the total, since a substance with more than one hazardous effect will be included in several hazard categories.

**Table 3.2. Number of substances found in the Product Register pertaining to each hazard category, 2002-2006**

	2002	2003	2004	2005	2006
Total <sup>1</sup>	427	420	416	466	454
CMR	153	142	143	159	155
Chronic toxic	52	45	47	52	52
Sensitising	157	165	158	169	165
Dangerous for the environment	264	260	252	297	287

<sup>1</sup> Excluding substances with classification notes, cf section 3.2. below.

It is important to note that for any given substance, the same classification is used for all years. If the classification has changed during the estimation period, the current classification is used. This is done in order to produce consistent time series.

### 3.2. Excluded substances

Some compounds are mixtures rather than pure substances and cannot be given an unequivocal CMR-classification. This applies to many complex petroleum compounds, as well as four other relevant substances<sup>2</sup>. The properties of these compounds depend on the content of one (or more) hazardous substance(s). Such compounds are only considered as carcinogenic (may cause cancer) if the content of carcinogenic substances exceed the limit set in the List of Dangerous Substances (“Stofflisten”). Butane (CAS number 106-97-8) will for instance be classified as a CMR-substance if the content of butadiene is equal to or higher than 0.1 per cent.

Since data from the Product Register do not contain information on the concentration of carcinogenic substances in these compounds, they have been excluded from the emission estimates. The exclusions apply to compounds marked with the letters H, J, K, L and M in the List of Dangerous Substances (“Stofflisten”) (cf. table 3.3). For technical reasons, the exclusions related to carcinogenic properties also exclude one substance (n-hexane) from the other hazard categories. However, only negligible volumes are affected (cf section 6.4).

**Table 3.3. Number of substances with classification notes found in the Product Register and excluded from the emissions estimates, 2002-2006**

	2002	2003	2004	2005	2006
Substances with classification notes	80	92	92	86	87

<sup>2</sup> 1-3 butadiene in butane (CAS 106-97-8) and isobutane (CAS 75-28-5), n-hexane in hexane (CAS 110-54-3), acrylamide in methyl acrylamidoglycolate (CAS 77402-05-2) and methyl acrylamidomethoxyacetate (CAS 77402-03-0).

## 4. Activity data

### 4.1. Product Register 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 declaration<sup>3</sup> 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.

The Product Control Act, the Working Environment Act and the Fire Prevention Act form the basis for the central regulations on classification and labelling of dangerous chemicals. Additional rules for declarations to the Norwegian Product Register are stipulated in the act on Declaration and labelling of microbiological products. Any person placing dangerous chemicals on the Norwegian market for professional or private use has duties pursuant to these regulations. The duty of declaration applies annually to import, export and manufacturing. The only exception is when the amount of a given product placed on the market by a given importer/producer is less than 100 kg per year.

Around 15 000 declarations of hazardous 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 being 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.

In addition, some declarations are submitted to the Product Register even though the products are not under the duty of declaration. In order to avoid random effects known to be related to voluntary declarations, most of these declarations, representing approximately 10 000 products, were excluded from this study. The only exception is a small number of voluntary declarations in 2002-2004 of two biocide products that became subject to the duty of declaration by the end of 2004. Hazardous substances used in the oil industry (the extraction of crude oil and natural gas) were also omitted, as we consider these to be better covered by other data sources than the Product Register.

When a product is declared to the Product Register, a series of information about the registrant and the product must be reported. Most importantly, the chemical composition and the appurtenant volume of individual components are disclosed to the Product Register. Statistics Norway is authorised to use the net quantity of import, export and manufacture of individual components, given by CAS number (classification by Chemical Abstract Services).

The appurtenant information includes:

- Intended use/type of product, given by a code for product type (UCN; Product Register 2007)
- Area of use, given by industrial sector to which the product is sold (following standard industrial classification – NACE; Statistics Norway 2002), including private households (using specific Product Register codes; Product Register 2007)
- Number of declarations

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<sup>3</sup> Cosmetics and health care products are examples of products not subject to the duty of declaration.

The information pertained in the data from the Product Register makes it possible to present results on a substance level, distributed over product types, sectors or a combination of both. As a consequence, the identification of specific substances, products or sectors that have a major influence on the emissions is greatly facilitated.

NACE codes and UCN codes are listed in Appendix C and D respectively.

## 4.2. Modelled distribution 2002-2004

The duty of declaration that forms the basis for data in the Product Register was first passed in 1981 and has since been extended to include more effects and products several times. Since then, the coverage and data quality of the Product Register has changed dramatically. From 2005 and onwards, quantities of a given substance in a given year can be extracted from the register for combinations of products and sectors ( $m_{sp}$ ). However, for the period 2000-2004, quantities can only be given as the sum over all sectors for a given substance in a given product type used in a given year ( $m_p$ ) or as the sum over all products for a given substance used in a given sector in a given year ( $m_s$ ), due to the nature of the registrations. The fraction of a toxic substance emitted is assumed to be dependent both on the type of product used and the industrial sector in which it is used. Thus, in order to assign the most appropriate emission factors, data should be distributed over combinations of products and sectors (table 4.1).

**Table 4.1. Notation for data distributed over product and sector combinations and the marginal sums**

		Product, $p$			
		1	2	3	
		Sum over sectors, $m_p$	$m_1$	$m_2$	$m_3$
		Sum over products, $m_s$			
Industrial sector, $s$	1	$m_{.1}$	$m_{11}$	$m_{21}$	$m_{31}$
	2	$m_{.2}$	$m_{12}$	$m_{22}$	$m_{32}$
	3	$m_{.3}$	$m_{13}$	$m_{23}$	$m_{33}$
	4	$m_{.4}$	$m_{14}$	$m_{24}$	$m_{34}$

Owing to the properties of the Product Register data mentioned above, the distribution of quantities to combinations of product type and industrial sector had to be modelled for the 2002-2004 part of the times series. In order to allocate substance quantities to the different combinations of product and sector, information on the distributions in 2005-2006 were used. The resulting distributions for 2002-2004 were then adjusted to match the marginal sums as closely as possible. For most substances, modelled distributions showed good convergence, i.e. after repeated adjustments, the modelled distribution corresponded well with the true marginal sums. For those substances where the quantity distribution did not converge after 102 adjusting iterations, quantities were re-distributed manually. The reason for lack of convergence seemed to be large discrepancies between the distribution in 2005-2006 and 2002-2004. For substances that did not converge, there were one or more additional combinations of product and industrial sectors in 2002-2004 compared to in 2005-2006. For details on the distribution modelling refer to Appendix E.

## 4.3. Possible sources for error relating to the activity data

The following can potentially be the source of over- or underestimation of use and/or emissions based on Product Register data:

### *Products not being subject to the duty of declaration*

Not all products containing hazardous substances are subject to the duty of declaration, although they may contain substantial amounts of substances classified as being CMR, chronic toxic, sensitising and/or dangerous for the environment, i.e. clothing treated with water repellents or flame retardants. Data sources other than

	the Product Register must be used in order to obtain estimates on emissions caused by the use of such products (cf. section 7.3).
<i>Products subject to the duty of declaration not being declared</i>	Not all products subject to the duty of declaration are declared. Importers/producers may be unaware of the regulation or may deliberately avoid mandatory declaration. This entails underestimation of emissions. Sample surveys carried out by the Norwegian Pollution Control Authority have indicated that as much as 25 per cent of products subject to the duty of declaration are not declared. However, the potential error is considered to be relatively small, as it is likely that this problem mainly concerns products with small consumption volumes (Kraft and Follestad <i>pers. com.</i> ).
<i>Changes in the duty of declaration</i>	Changes in the regulations for classification and labelling will lead to changes in the coverage of the Product Register. For instance, the duty to declare environmentally hazardous products was introduced in 2002, while biocides were included by the end of 2004. If a change in the duty of declaration is suspected to produce a false emission trend, the activity data may be adjusted, in order to reflect the true emission development (cf. section 4.4).
<i>Double counting</i>	Double counting of quantities can occur when declared substances are used to make products that are also declared to the Product Register. This source of error is handled by identifying the combinations of product type and industrial sector that most likely represent use of the substances as raw materials and applying the appurtenant emission factors (cf. section 5.2). However, some of these cases might go undetected, resulting in an overestimation of emissions.
<i>Errors in quantity figures</i>	Several internal checks are performed in order to identify and correct potential errors in the quantity figures extracted from the Product Register (cf. section 4.4).
<i>Incomplete or erroneous sector distribution</i>	According to prevailing rules, only 80 per cent of the quantity declared has to be assigned to an industrial sector. Any remaining quantity is registered without information on sector distribution, leading to an underestimation of emissions from the sector in which this quantity is used. The remaining quantity will be assigned sector "unknown". When a product is registered with several product codes in the same declaration, the quantity is evenly distributed to each of the registered industrial categories to which the product has been sold. This may not reflect the true distribution of the products among sectors. These sources of error in the sector distribution of the data are considered to be negligible, as most products are sold to only one sector (Kraft and Follestad <i>pers. com.</i> ).
<i>Missing product type codes</i>	Some declarations are missing codes for product type. This might lead to an overestimation of consumption of some products and underestimation for others.
<i>Quantities given in intervals (simplified declarations)</i>	For some so-called simplified declarations, substance quantities are given in intervals. The maximum quantity is used for these substances, as it is assumed that there is a higher probability that the true quantity will be close to the maximum value than to the minimum value. Internal checks are performed in order to identify intervals where the quantity figure used is substantially higher than the lower limit of the interval, in order to prevent overestimation (cf. section 4.4).
<i>Negative figures</i>	When declared quantities imported or produced one year are declared as exported the next, net quantities for the latter year are negative. This is currently handled by setting these figures to zero, resulting in an overestimation of intra-country emissions.
<i>Errors in the modelled distributions</i>	Although the modelled quantity distributions seemed to converge well for most substances, the modelled distributions will never be identical to the unknown, true distributions. Furthermore, some adjustments to the distributions had to be made manually for substances that did not converge. In these cases, the correct

distribution could not always be identified when comparing the modelled distribution to the marginal sums.

#### 4.4. Quality Control (QC)

The current QC procedures conducted by Statistics Norway include the following:

##### *Internal checks for data consistency*

- Large between-year discrepancies in the time series of substance quantities are routinely identified and investigated, in order to correct errors in consumption figures.
- Large within-year discrepancies between minimum and maximum quantities in simplified declarations are routinely identified and investigated, in order to prevent overestimation for substances where consumption figures are given in intervals. For 2005 and 2006 potential overestimation of emission figures generated by the use of maximum quantities were estimated. When using the mean of the interval values instead of the maximum, total emissions were reduced by 480 tonnes in 2005 and 330 tonnes in 2006.
- Large within-year discrepancies between totals for industrial sectors (NACE) and totals for products (UCN) are routinely identified and investigated, in order to detect erroneous or incomplete sectoral and product type distribution.

##### *Convergence check of the modelled quantity distribution*

Convergence of the modelled quantity distribution has been checked by comparing marginal sums of the modelled distributions to the true marginal sums, cf. section 4.2 and Appendix E.

##### *Check for possible effects of changes in the duty of declaration*

The trend in declared volume of substances that are assumed to be affected by changes in the duty of declaration to the Product Register is analysed subsequent to substantial changes in the regulations. This is done in order to remove false emission trends. Currently, the data have been analysed with respect to possible effects of the inclusion of environmentally hazardous products and biocides in the duty of declaration. In one substance-, product- and sector-specific case, adjustments were made by including a small number of voluntary declarations of biocides for the first part of the time series (2002-2004). No other adjustments were deemed necessary. Firstly, most of the volume of products that are now declared as biocides was declared under other product type codes prior to the inclusion of biocides in the duty of declaration. Secondly, while the inclusion of environmentally hazardous products increased the number of declarations of such products considerably (sevenfold from 2001 to 2006), the declared volume did not increase substantially (Kraft and Follestad 2007). The reason seems to be that the largest volumes of environmentally hazardous products contain substances with classification (R-phrases) belonging to one or more of the other three hazard categories and were thus already subject to the duty of declaration in 2002.

##### *Comparison with other emission estimates using equivalent activity data*

Time-series for some substances on the Priority List have been compared to data used for other emission calculations performed by the Norwegian Pollution Control Authority. Some discrepancies were found, leading to corrections of both activity data sets.

#### 4.5. Confidentiality

According to § 2-6 of the Statistics Act (Act No. 54 1989), figures shall not be published in such a way that they can be traced to a particular respondent. Under Statistics Norway's rules regarding confidentiality, in order for the statistics to be publishable, aggregated data must consist of at least three observations. In this study one observation corresponds to one declaration. Aggregated data used in result tables have been checked against the true marginal sums of the number of declarations, to make sure that no confidential information is published. For the period with modelled distribution of quantities, all substance, product and sector combinations have been conservatively assumed to correspond to one declaration.

## 5. Emission model

### 5.1. Overview

Our general model is a mass balance *per substance*, where emissions are calculated by multiplying relevant activity data with an emission factor, according to the equation:

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

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

When used in the simplest form, all activities that can lead to or prevent emissions, i.e. waste management, are included in the one emission factor. The general model can be modified so as to integrate various pieces of information on the life cycle of different products. For some products we might have data on the fraction converted into other chemical compounds or the fraction destroyed during waste treatment. This can be expressed through variations of the simple equation, e.g.:

$$\text{emission} = \text{consumption} \times (1 - (\text{factor1} + \text{factor2} + \text{factor3})),$$

where *factor1* is the fraction converted to other chemical compounds, *factor2* is the fraction that becomes part of a new product (without being converted) and *factor3* is the fraction destroyed during waste management.

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. Emissions that in real life are spread out over several years all appear in the emission estimate for the year of registration. 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.

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 hazardous substances caused by products use.

### 5.2. Emission factors

In order to combine emission factors from different data sources, the substances for which the emission factors are applied are currently divided in two: volatile organic compounds (VOC) and other substances not covered by the VOC definition.

There are four groups of emission factors, reflecting decreasing level of knowledge and hence increasing level of uncertainty:

- i) Factors specific for combinations of substance (CAS), product type (UCN) and industrial sector (NACE)
- ii) Factors specific for combinations of product type and industrial sector
- iii) Factors specific for product type
- iv) General emission factor

The first group consists of factors applying to a few substances that are used in high quantities. They have been given emission factors specified for combinations

of product type and industrial sector after consulting the industry. Currently these substances are all non-VOC.

The second group of factors, specified for combinations of product type and industrial sector, apply mainly to VOC. The source of the emission factor values for volatile organic compounds is the Swedish model for estimating VOC emissions from solvent and other product use (Skårman et al 2006). During several studies, Sweden has developed emission factors that take into account different application techniques, abating measures and alternative pathways of release (e.g. waste or water). These country-specific emission factors apply to 12 different industries or activities that correspond to sub-divisions of the four major emission source categories for solvents used in international reporting of air pollution (EEA 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, the most important concerning substances used as raw materials. For each emission source category, two emission factors are applied, one for VOC used as raw materials and one for other uses. Emission factors for raw materials are generally low, since most of the substance will be converted or end up in the product with only small emissions during this process. Products with a high content of the hazardous substance will themselves be declared to the product register, thus being included in the activity data and in most cases being assigned a higher emission factor.

However, there are two problems concerning the identification of raw material:

- i. Some products are declared with a product code for raw material, although they are not used as raw material. This problem 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.
- ii. Some products that are used as raw materials are declared as other product types. This second problem was solved by applying the emission factor for raw materials to other product types assumed to be used as raw materials in the industrial sectors "Manufacture of chemicals and chemical products" (NACE 24) and "Manufacture of rubber and plastic products" (NACE 25).

For several product and sector combinations, emission factors for VOC change over time. However, all emission factors have been constant since 2003.

The third group of emission factors consists of product-specific factors, applied to substances other than VOC. The source of these factors is the Swedish "Exponeringsindex" developed by KemI (Fischer et al 2005) and adapted to the Norwegian estimation model in 2006 (Hansen 2006). Following these studies, products are assigned one of three emission factor values, depending on whether the emissions are expected to be high (1.0), medium (0.5) or low (0.1). Emission factors for raw materials were used only for substances identified as "true" raw materials in combination with a product code for raw materials, following the same line of argument as for the volatile organic compounds. For a list of substances defined as "true" raw material, refer to Appendix F.

Consumption figures that have been assigned sector or product type "unknown" are given a general emission factor of 1.0 (i.e., the maximum value as a worst-case scenario). For the time-series 2002-2004, these figures sum up to less than 30 tonnes of declared substances in total.

For a summary of the emission factors, see Appendix G.

### 5.3. Source allocation

In order to give an as informative presentation of the results as possible, the emission figures have been summed across specific groups of industrial sectors (NACE) and product types (UCN). Energy goods (UCN B55-B60) are treated separately, as they constitute a major part of both consumption and emission figures. Emissions caused by the use of the remaining product types have been divided into manufacturing industries and other industrial sectors. Emissions in the latter source category are then further explored by division into several subgroups. Table 5.1 gives the industrial sectors allocated to the different source categories used to present the results from this study.

Note that drilling chemicals, including crude oil and natural gas (UCN O05), and products consumed in NACE 11 (extraction of crude oil and natural gas) are not included (cf section 4.1.). NACE codes and UCN codes are listed in Appendices C and D.

**Table 5.1. Source categories<sup>1</sup> – industrial sectors**

Source	Industry (NACE)
Manufacturing industries	15-36
Industrial sectors other than manufacturing industries	
- Primary sector (agriculture, forestry and fishing)	01-05
- Construction	45
- Sale, maintenance and repair of motor vehicles and motorcycles, retail sale of automotive fuel	50
- Wholesale trade, except of motor vehicles and motorcycles	51
- Education	80
- Other service industries	93
- Other	14, 37, 40-41, 52-75, 85-92, 99
- Private households	Private households <sup>2</sup>

<sup>1</sup> NACE 11 and UCN O05 are not included in the analysis

<sup>2</sup> Specific codes used by the Product Register

### 5.4. Completeness

The model estimates emissions of selected hazardous substances (cf. appendix B) generated by the use of products that are subject to the duty of declaration in all industrial sectors as well as private households. Manufacture where the selected substances are used as raw materials are included. However, emissions during primary production of the hazardous substances are not included in this model, as these are not covered by the Product Register data.

Some manufacture using hazardous substances as raw materials may produce products that are not subject to the duty of declaration. In such cases emissions from the resulting products can be included by increasing the emission factor used on the manufacturing process.

#### 5.4.1. Technical solution

The process of estimating emissions of hazardous substances employs both Excel and the SAS system software. Data from the Product Register are provided once a year as flat files that are converted directly into a SAS data matrix. The emission factor matrix and the source allocation matrix are revised in Excel and transferred to SAS. Generation of the complete activity dataset, data revision, emission estimation and source allocation and production of result tables are all done using SAS.

### 5.5. Uncertainties

An analysis of uncertainties was not performed in this study, but as described in sections 4.3 and 5.2, both errors in activity data and emission factors contribute to uncertainty in the estimates.

## 6. Results

### 6.1. Overall use and emission trends

Each year, around 6 million tonnes of hazardous substances covered by this study are consumed (c.f. chapter 3 and 4 on coverage). Roughly 0.3 per cent of this is emitted to the surroundings. In other words, around 19 000 tonnes of these substances that are classified as CMR, chronic toxic, sensitising and/or dangerous to the environment find their way in to the environment every year.

Table 6.1 shows amounts consumed and emitted, by hazard category. In this table, a substance is included in several categories if it has more than one hazardous effect. This means that the use and emission figures should not be added across hazard categories.

**Table 6.1. Consumption and emissions of substances by hazard category, 2002-2006. Tonnes**

	2002	2003	2004	2005	2006
<b>Consumption</b>					
CMR	5 883 118	6 548 338	7 474 396	5 439 324	5 244 985
Chronic toxic	264 052	237 701	218 989	187 274	205 715
Sensitising	140 989	143 736	126 152	154 080	147 709
Dangerous for the environment	75 349	82 755	81 781	78 488	62 950
<b>Emissions</b>					
CMR	15 244	13 879	11 680	13 831	12 878
Chronic toxic	1 074	829	848	809	858
Sensitising	2 947	2 950	3 206	2 858	2 906
Dangerous for the environment	4 248	4 449	5 266	5 128	4 497

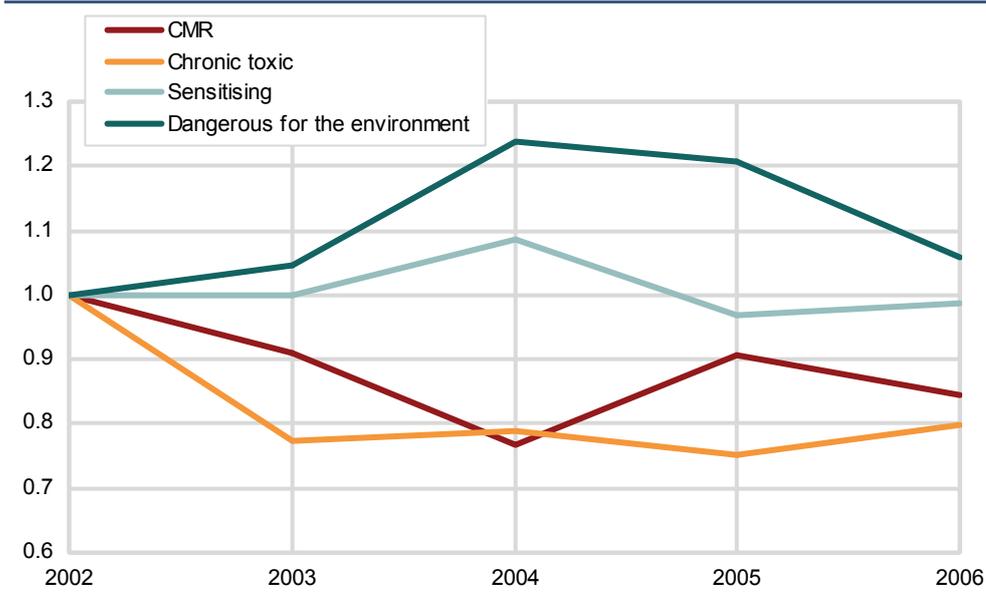
For the CMR-substances, the emission trend is opposite of the development in consumption. While 2003 and 2004 were peak years for consumption, the emissions of CMR-substances in these years were the lowest throughout the time series. The main contributor to the high consumption of CMR substances in 2003-2004 was increased use of products termed "motor fuels" in oil refineries. When used in the oil refinery industry, motor fuels are assumed to be raw material and assigned a very low emission factor (0.00005). When motor fuels are used in other sectors, a higher emission factor is assigned (0.0025), assuming that a small amount of fuel is not combusted. Other emission trends shown in Table 6.1 are described below.

Table 6.2 shows the volume distribution among the number of hazard categories a given substance can pertain to. The greatest amounts by far are included in only one hazard category, while a relatively small volume of a total of six substances occur in the figures for all four hazard categories.

**Table 6.2. Consumption of substances with classifications pertaining to one or more hazard categories, 2002-2006. Tonnes**

Number of hazard categories	2002	2003	2004	2005	2006
1-4	5 969 603	6 643 339	7 565 766	5 527 116	5 318 769
1	5 580 004	6 276 949	7 233 522	5 199 629	4 980 131
2	385 719	363 730	328 981	322 970	334 729
3	3 454	2 520	3 220	4 471	3 871
4	426	141	43	46	40

Figure 6.1 depicts the emission trends of the four hazard categories, relative to the start of the time series.

**Figure 6.1. Emissions of hazardous substances in 2002-2006, relative to the emission level of 2002, by hazard category**

The overall fall in emissions from products containing substances with CMR- and chronic toxic effects is connected to both fuel consumption and reduced emissions from the manufacturing industry (cf. sections 6.2 and 6.3.1). These reductions are partly counteracted by an increasing consumption of solvents in service industries and in connection with sale, maintenance and repair of motor vehicles (cf. section 6.3.2).

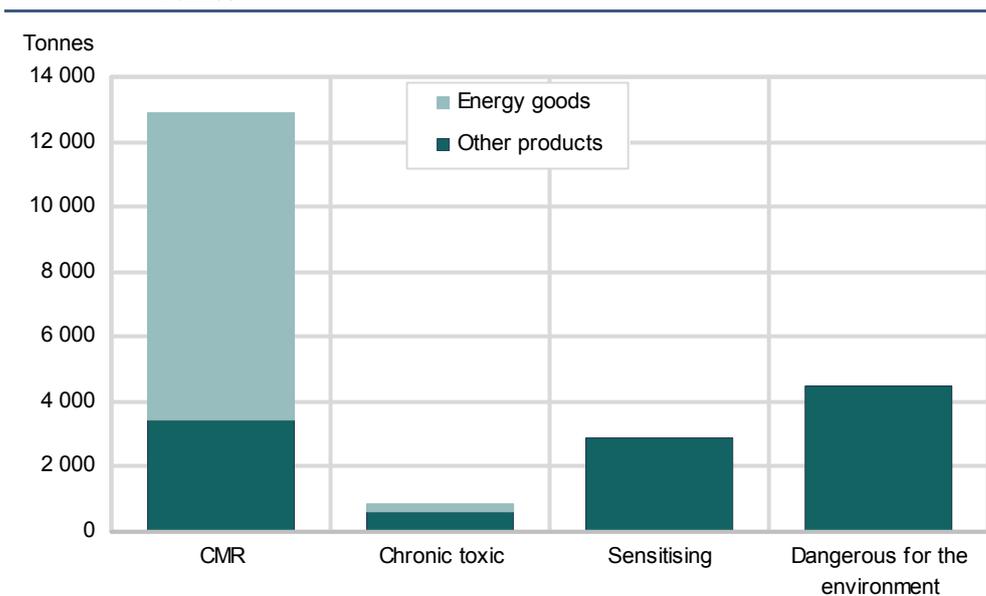
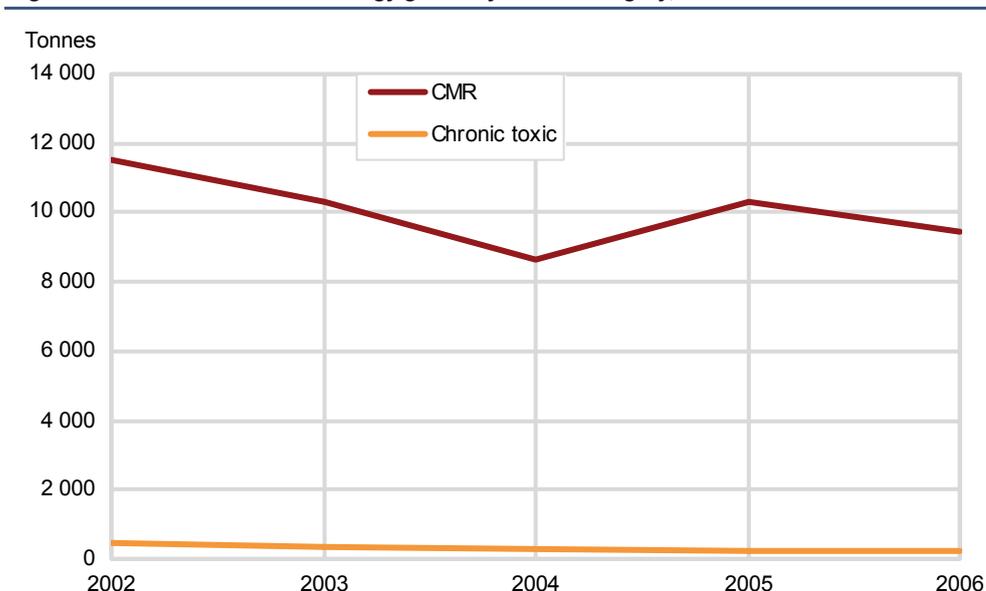
The use and emission of substances with sensitising effects have been relatively stable during the past five years. Production and use of paint and varnishes are the main sources of these emissions, but several product types, displaying partly counteracting trends, contribute considerably to the emission figures (cf. sections 6.3.2).

Emissions of substances classified as dangerous for the environment rise considerably in the beginning of the period and decline almost correspondingly by 2006. The peak in 2004-2005 is a result of a combined effect of increased use of biocides and a high consumption rate in the manufacturing industries (cf. section 6.3.2). It coincides with a change in the duty of declaration, but data analysis suggests that the increase is true and not caused solely by changes in the duty of declaration (cf. section 4.4). The subsequent reduction is mainly due to a decline in the use of these substances in manufacturing industries (cf. section 6.3.1).

For tables on products and substances contributing most to the emissions of each hazard category, see Appendix H-I.

## 6.2. Emissions from energy goods

Motor and heating fuels contain various substances that can have detrimental effects on human health and the environment. In general, fuels have a relatively high content of CMR-substances. Furthermore, emissions of CMR-substances from fuels are widely dispersed, as fuels are used to a large extent by private consumers. Only a very small proportion of the fuels used are emitted, since they are filled in tanks and combusted for heating and transport purposes (cf. Appendix G). However, as millions of tonnes of these products are consumed annually, the emissions of CMR- and chronic toxic substances from fuel are large compared to emissions from other products (figure 6.2). Note that emissions of CMR substances that are formed during combustion (exhaust) are not included in these figures (cf. section 7.3).

**Figure 6.2 Emissions from energy goods and other products by hazard category, 2006. Tonnes****Figure 6.3 Emissions from energy goods by hazard category, 2002-2006. Tonnes**

As illustrated in figure 6.2, the use of fuels, predominantly motor fuels, contributed to more than 70 per cent of emissions of CMR-substances and 30 per cent of emissions of substances with chronic toxic effects in 2006. Meanwhile, as shown in figure 6.3, emissions of CMR-substances from fuel have fallen from 11 500 tonnes in 2002 to about 9 500 tonnes in 2006.

The trend in emissions of CMR-substances from motor fuels seems in large to correspond with sales of petroleum products (Statistics Norway 2007b). From 2002 to 2006 there was a 35 per cent reduction of such emissions attributed to water transport, i.e. ships, ferries and boats (NACE 61). Water transport contribute to around half of the CMR-emissions from motor fuels. During the same period, sales of middle distillates, which include marine diesel used for water transport, decreased by 10.5 per cent. Emissions attributable to retail sale of automotive fuels (NACE 50.5) increased by around 14 per cent, while total sales of car petrol and auto diesel increased by 9.5 per cent between 2002 and 2006. Discrepancies between the trend in emission figures and sales may be caused by hold up of

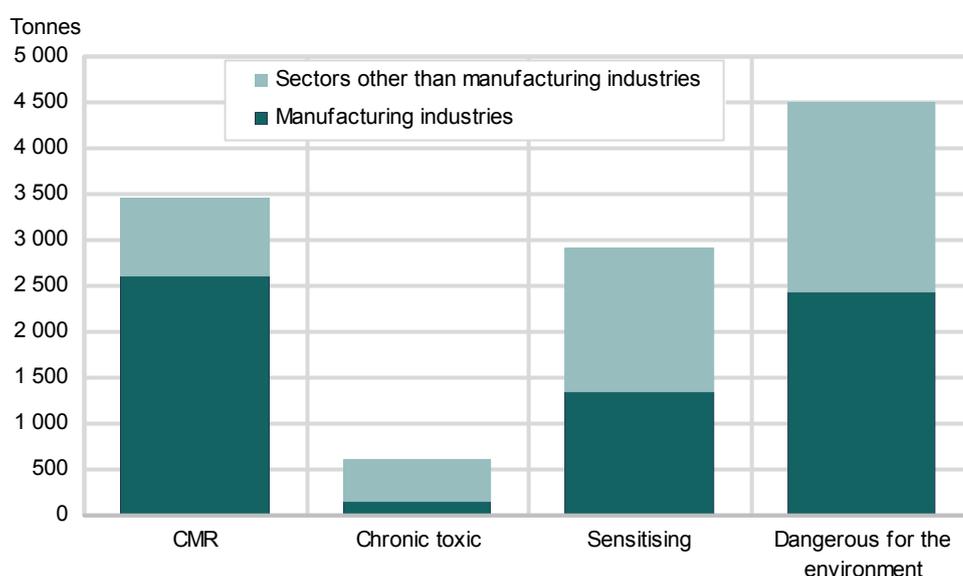
declared products, which the model currently does not take into account (cf. section 5.1).

Note that the emission factors for fuel do not reflect technical differences between combustion engines in ships, motorcars, buses etc or improvements that can reduce fuel emission, such as increased combustion efficiency. Nor are there different emission factors for different types of fuel, such as petrol, and diesel.

### 6.3. Emissions from products other than energy goods

In figure 6.4, emissions from products other than energy goods are divided into two sources: Products used in manufacturing industries and products used in sectors other than the manufacturing industry, such as agriculture and forestry, service sectors and households.

**Figure 6.4. Emissions in 2006 from the two main sources, by hazard category. Tonnes**

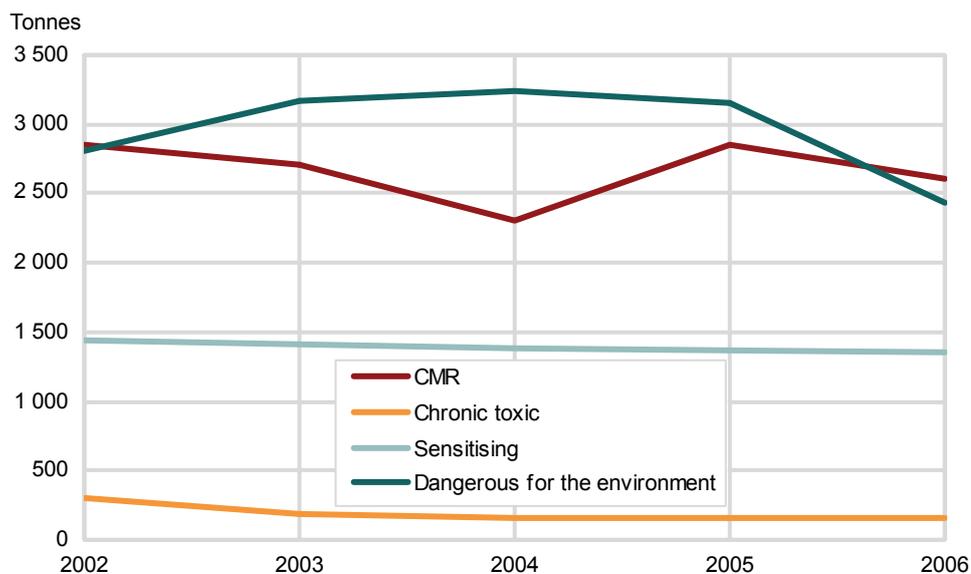


This figure demonstrates that products used in the manufacturing industries are important emission sources across hazard categories, but most predominantly for CMR-substances, when energy goods are excluded. However, emissions of substances with CMR-effects are more than three times higher from the use of energy goods than from manufacturing industries.

#### 6.3.1. Emissions from products used in manufacturing industries

For hazardous substances used in manufacturing industries, emission factors are generally low (see section 5.2). The hazardous substances are often used as intermediates or raw materials in controlled environments where abatement measures are taken. However, manufacturing industries are still a major emission source, as they are the predominant users of substances with CMR-effects and environmentally hazardous substances. Furthermore, emissions from manufacturing industries generally comprise a number of different hazardous substances.

Figure 6.5 shows that emissions from manufacturing industries of substances in all four hazard categories have decreased somewhat since 2002.

**Figure 6.5. Emissions from manufacturing industries, 2002-2006. Tonnes**

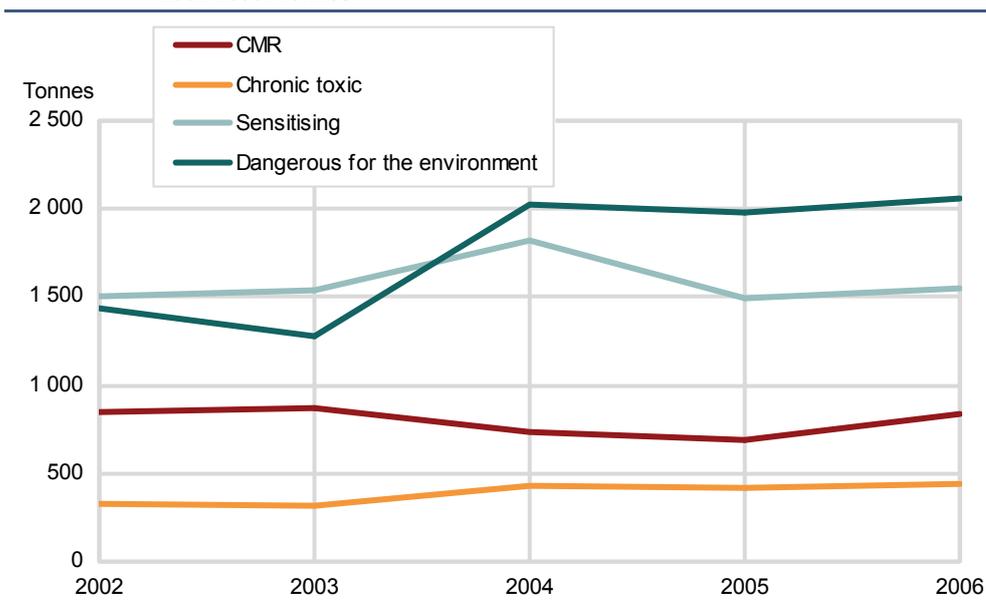
The substantial decline from 2005 to 2006 in emissions of substances that are dangerous for the environment, shown in figure 6.5, is mainly due to reduced consumption of sodium chlorate, sulphamic acid and tris(2-chloroethyl) phosphate. The reduction in emissions of substances with CMR-effects in 2004, is mainly caused by a temporary fall in the use of 1,2-dichloroethane, formaldehyde and tris(2-chloroethyl) phosphate.

Although products used as raw materials are to be given this term when declared to the Product Register, it appears that a number of other high-volume products are also used as raw material. Many of these have been identified and given the emission factor for raw material. However, there may still be some raw materials declared as other product types that have not been identified and thus given a higher emission factor. Hence, emissions from the manufacturing industries may be somewhat overestimated.

### 6.3.2. Emissions from products used in sectors other than manufacturing industries

Emissions of hazardous substances from products being used in sectors other than manufacturing industries, including private households, are of special concern. These products are often used by a large number of people without any control measures, i.e. most of the substances are emitted to the surroundings when a product is used. A high proportion of the CMR-, chronic toxic and sensitising substances is volatile compounds, probably increasing the probability of human exposure.

According to figure 6.6, emissions from these sectors seem to have increased for three out of four hazard categories during the period 2002-2006.

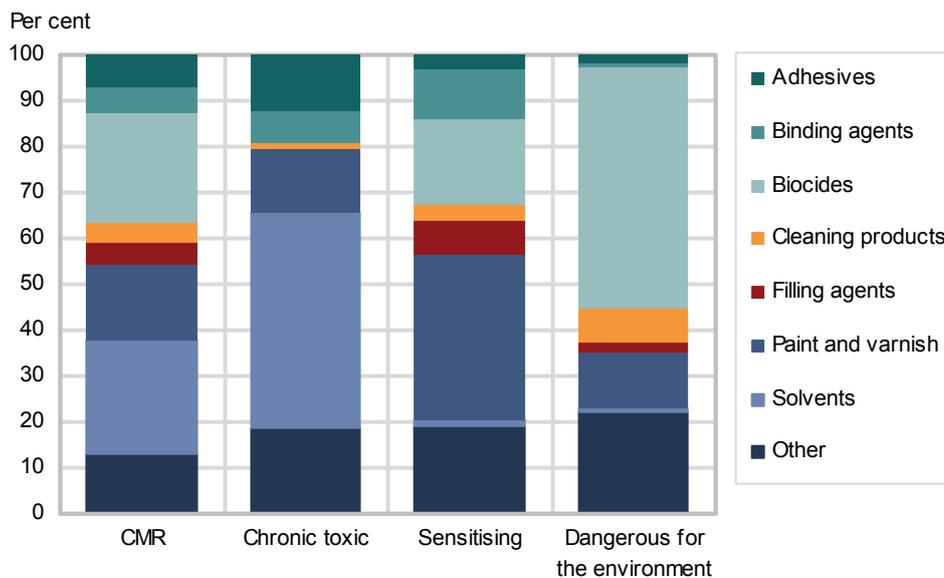
**Figure 6.6. Emissions from products used in sectors other than manufacturing industries, 2002-2006. Tonnes**

Substances that are dangerous for the environment depict the most evident increase. This emission growth is mainly due to an increased use of dicopper oxide in fish farming (included in the primary sector). The declared use of dicopper oxide in biocides has more than tripled since 2002. The growth in dicopper oxide emissions is probably linked to increased activity in the fish farming industry. During 2002 to 2006, production of farmed salmon and trout increased by more than 25 per cent, to nearly 690 000 tonnes, while production of farmed cod increased by 833 per cent, to just over 11 000 tonnes (Statistics Norway 2007c). Note that a small number of voluntary declarations are included in 2002-2004, increasing the emission level by approximately 140-200 tonnes per year (cf. section 4.4).

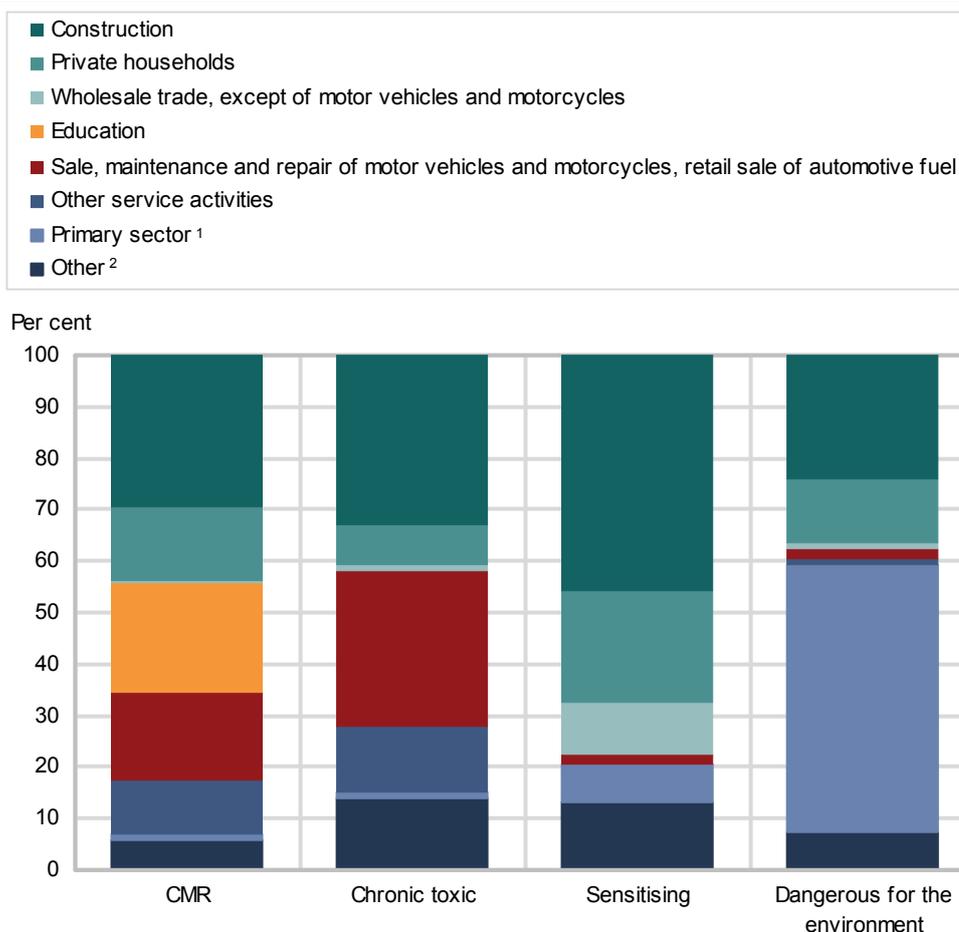
The total increase in emissions of substances that are dangerous for the environment may to some extent be generated by increasing compliance with the new regulations concerning biocides. However, this probably applies to maximum 100 tonnes of the emission increase, as most of these products have been declared under other product type codes prior to the inclusion of biocides in the duty of declaration.

Solvents, paint and various construction products (included in the product category "Other", see below) were the most predominant sources in all hazard categories other than "Dangerous for the environment" in 2006 (figure 6.7). These products dominated emissions from two of the most important non-manufacturing sectors: Construction and private households (figure 6.8). Note that products declared to the Product Register with "wholesale trade" (NACE 51) or "retail trade" (NACE 52) as area of use are in fact used in a number of different sectors, including construction and private households. Thus, information on the distribution of traded products across sectors is needed in order to obtain complete estimates of emissions by sector.

**Figure 6.7. Emissions distributed by main product types used by non-manufacturing industries, by hazard category, 2006. Per cent**



**Figure 6.8. Emissions distributed by main sectors other than manufacturing industries, by hazard category, 2006. Per cent**



<sup>1</sup> Agriculture, forestry and fishing

<sup>2</sup> For confidentiality reasons, "Education" is included in "Other" for "Sensitising effects"

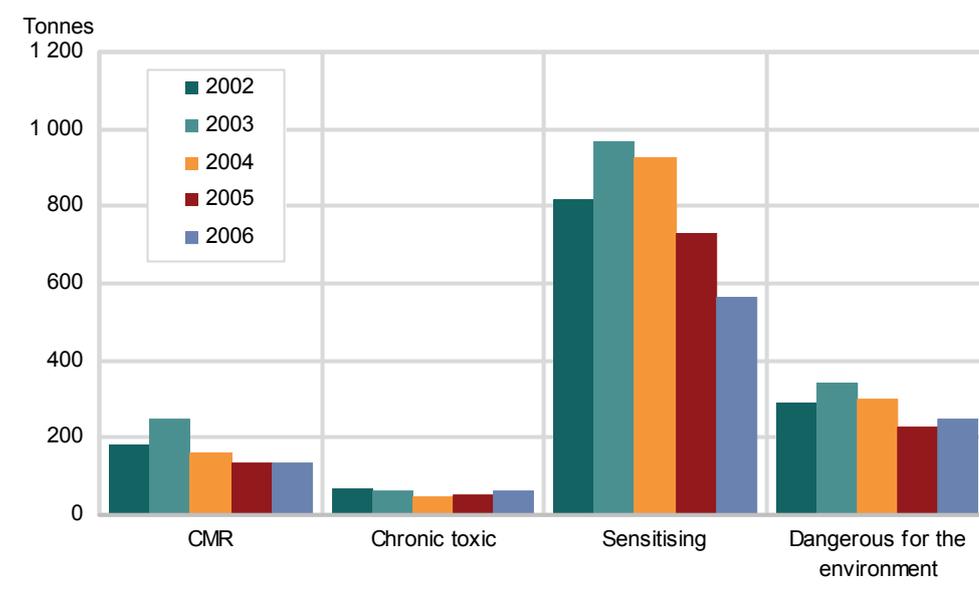
The increase in emissions of substances with chronic toxic effects is mainly caused by growth in the use of solvents related to sale, maintenance and repair of motor vehicles. The development in emissions of sensitising substances is a result of different, partly counteracting trends for several product types, such as paint (decreasing), biocides (increasing) and binding agents (increasing).

For a list of predominant products and substances used in sectors other than manufacturing industries, refer to Appendix J-K.

#### Paint and varnish

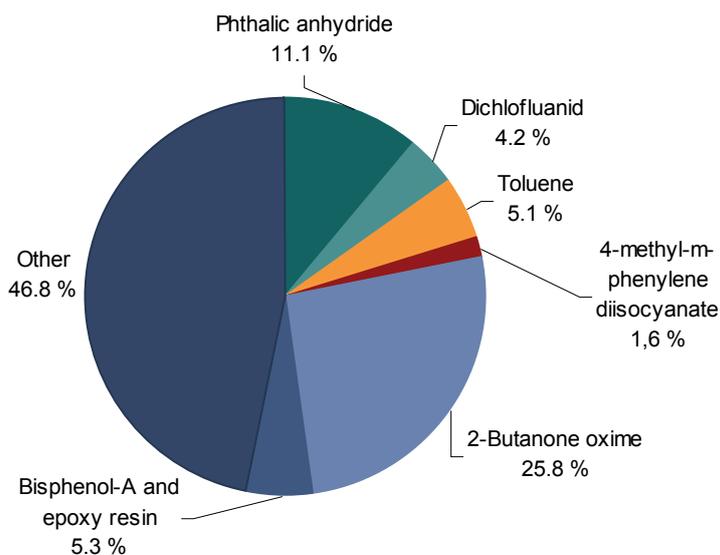
Paint and varnish are mainly the source of emissions of substances belonging to the hazard categories "Sensitising" and "Dangerous for the environment". For sensitising substances and to some extent environmentally hazardous substances in paint and varnish, there is a decreasing emission trend (figure 6.9). This trend corresponds quite well with an apparent ongoing shift in paint consumption, from solvent-based to water-based products: While production and net import of solvent-based paint and varnish decreased by 12 per cent from 2002 to 2006, production and net import of water-based paint and varnish has grown by 25 per cent (Statistics Norway 2007d, 2007e). Most water-based paints are not subject to the duty of declaration, due to low concentrations of hazardous chemicals. The downward trend might also indicate that the content of hazardous substances in labelled paints has been reduced since 2002.

**Figure 6.9** Emissions from the use of paint and varnish in non-manufacturing industries, by hazard category, 2002-2006. Tonnes



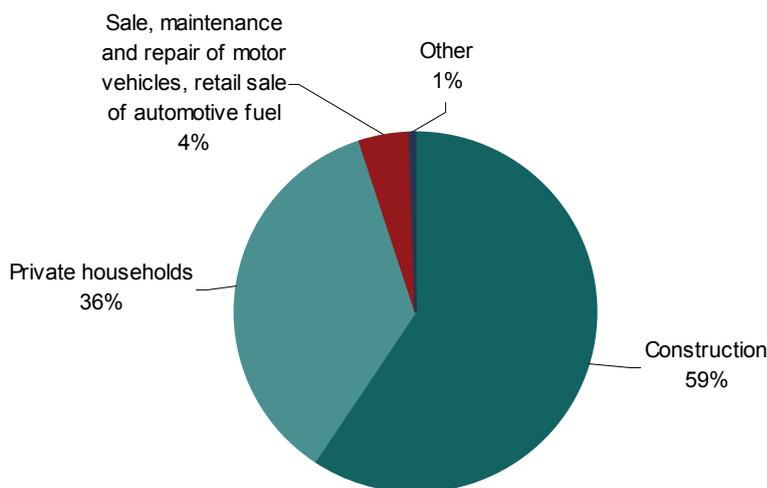
The substance profile of paint and varnish in 2006 is given in figure 6.10.

**Figure 6.10. Substance profile of emissions from paint and varnish used in non-manufacturing industries, 2006**



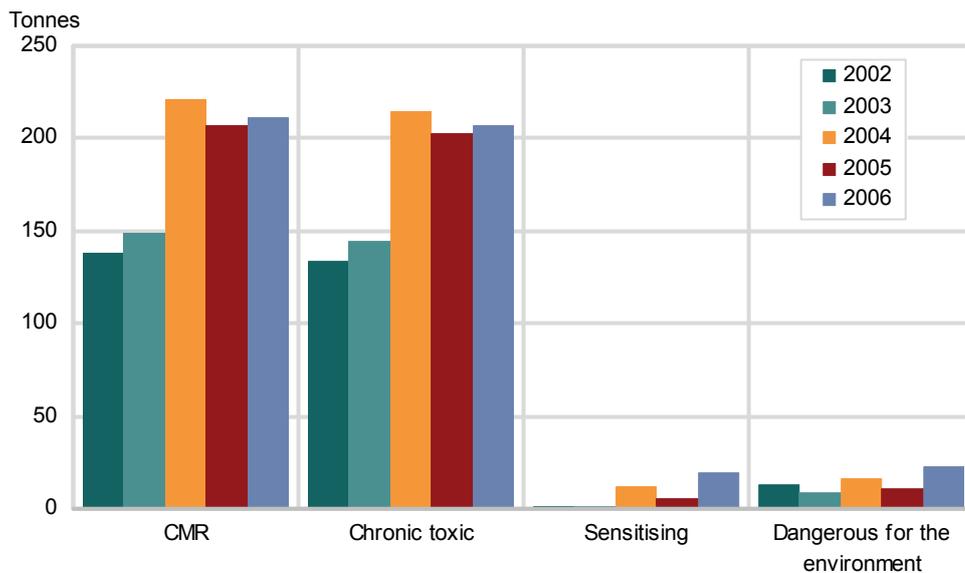
The two main consumers of paint and varnish, the construction sector and private households, generated about 59 and 36 per cent respectively of emissions related to paint and varnish in 2006 (see figure 6.11).

**Figure 6.11. Main emissions sources for paint and varnish among non-manufacturing industries, in 2006**

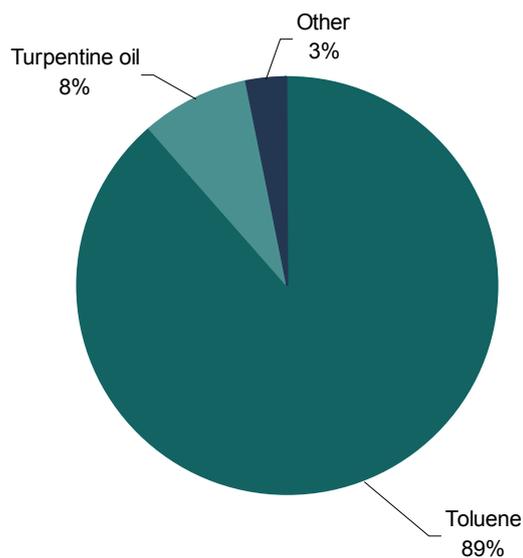


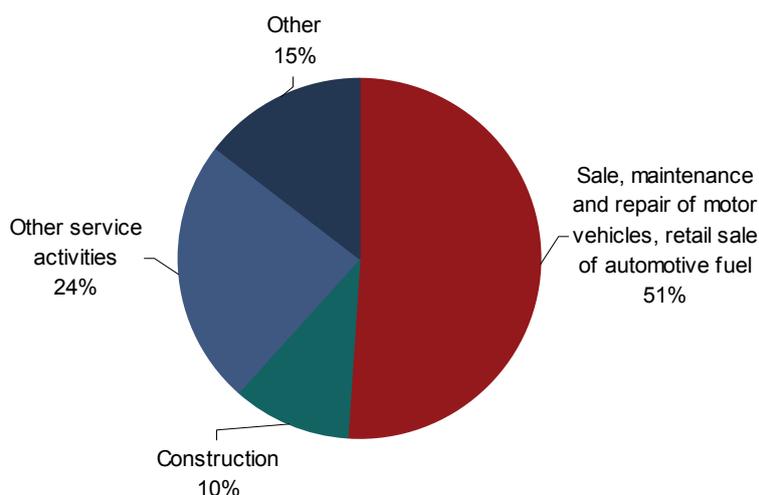
**Solvents** Emissions caused by the use of solvents seem to have risen for all hazard categories since 2002 (figure 6.12). The CMR and chronic toxic categories are closely linked for this product group, since it is dominated by toluene, a substance that might cause both CMR- and chronic toxic effects (figure 6.12). More than half of the solvent consumption in 2006 can be attributed to the sale and repair of motor vehicles (figure 6.13).

**Figure 6.12 Emissions from the use of solvents in non-manufacturing industries, by hazard category, 2002-2006. Tonnes**



**Figure 6.13. Substance profile of emissions from solvents, 2006**



**Figure 6.14** Main emissions sources for solvents, 2006

#### 6.4. Excluded substances

Compounds that cannot be given an unequivocal hazard classification, and thus are excluded from the previous emission estimates, are used in relatively large quantities. However, assuming that the average content of the carcinogenic substances is 0.1 per cent and applying the same emission factors as for the other substances, relatively low emission estimates are produced for these compounds: 18-26 tonnes per year (i.e., around 0.1 per cent of total). Thus, given that the assumption holds, excluding these compounds has little effect on the emission estimates for the CMR-category.

## 6.5. Recalculations

The emission estimates presented in this report are substantially lower than the estimates described in Hansen 2006. There are three reasons for this difference:

- i) Exclusion of complex petroleum compounds with annotation keys (cf. section 3.2)
- ii) Revising of consumption figures (see chapter 4.4)
- iii) Revising of emission factors (see chapter 5.2)

The exclusion of complex petroleum compounds reduced the consumption figures for CMR-substances by about 4 million tonnes (i.e. around 40 per cent) each year. For the other hazard categories, new emission factors were the main reason for lower emission estimates.

## 7. Areas of methodological improvement

Main areas of improvement are given in prioritised order below. The priority-setting is based on the current assessment of the importance of the improvements as well as the expected resource need for each task.

### 7.1. Uncertainty analysis

It is highly recommended that an uncertainty analysis is performed on the emission estimates. This should be done in order to guide further improvement of the estimates, and to better inform users about the uncertainty of the estimates.

### 7.2. Emission factors

Further efforts to identify and adopt emission factors from sources other than the ones currently in use, are recommended. Important sources such as reports from the Norwegian Pollution Control Authority and the Technical Guidance Document on Risk Assessment (2003) can provide valuable information.

### 7.3. Activity data

At present, the statistics on hazardous substances only cover the emission of substances as generated by use of products declared to the Norwegian Product Register in accordance with the duty of declaration. The emission estimates would undoubtedly benefit from increased quality and completeness of the Product Register data. Furthermore, other sources of information on use and emission should be identified and evaluated.

Possible supplementary data include figures on pesticide consumption from Statistics Norway and various data from the Norwegian Pollution Control Authority, such as reported emissions of hazardous substances from primary production of such substances, from deposited products and from other processes that generate the substance in other ways. For instance the use of HFCs in the production of aluminium generates fluorine gas that is released into the surrounding environment and has severe effects on vegetation. This emission of fluorine is not included in the current estimates as they are limited to the emissions of a certain substance caused by the use of this substance.

In addition, the information value of the statistics might be strengthened if more (less hazardous) substances are included (cf section 3.1).

### 7.4. Hold up and accumulated amounts

Some of the products declared to the Product Register a given year are probably stored and used (or exported) in subsequent years. The extent of this should be evaluated and possibly taken into account in the emission model, e.g. by using a moving average.

Furthermore, when a product containing hazardous substances is used over several years, e.g. construction materials, the emissions will probably take place during the whole lifetime of the product. Such product-specific delay in emissions can be included in the current model, but a considerable amount of additional information is required.

### 7.5. Hazard weights

Trends in emissions of hazardous substances may be considered to be a rough indicator of the development of the risk of damage to human health and the environment caused by these substances. However, a quantification of emissions of a series of hazardous substances is not a measure of the actual risk they pose. Firstly, not all hazardous substances or emission sources are covered. Secondly, a

risk assessment would require the integration of more information, both about the recipient and about various properties of the substances. Thus, one of the first steps towards an approximate quantification of risk, is to give emission figures for different substances weights according to their hazardous properties.

Various such hazard weights are available. They may, for instance, be based on R-phrases, as R-phrases to a certain extent are derived from such information. Fischer et al (2005) assigned three different weights (“FaroTal”) to substances pertaining to the hazard category “Dangerous for the environment” (cf table 7.1).

**Table 7.1. Risk-phrases and corresponding hazard weights. Based on Fischer et al (2005)**

Risk-phrases	Hazard weights
R50/53	100
R51/53, R53	32
R52/53	3.2

These hazard weights illustrate how large differences in hazard potency there may be between substances pertaining to the same hazard category and thus underline the potential need to discriminate between such substances.

Note, however, that the classification system (R-phrases) is not exhaustive, e.g. substances that represent the highest environmental concern, i.e. substances that are persistent (P), bioaccumulative (B) and toxic (T) (so-called PBT-substances), do not yet have a separate classification category. Thus, using hazard weights merely based on weighting existing R-phrases in the same hazard category could be very misleading. For instance, perfluorooctanesulfonate (PFOS), a substance of highest concern due to its PBT-properties, is proposed classified with R51/53 (cf. appendix A) under the existing classification system for environmental hazard. However, PFOS is not degraded in the environment by any known mechanism; it accumulates in living organisms and is found in animals and humans in the Arctic. (PFOS is furthermore proposed classified as toxic (R48/25), toxic for reproduction (R61), carcinogenic (R40), and harmful (R20/22)). Following a weighting scheme such as the one proposed by Fischer et al (2005), PFOS would be assigned a lower hazard weight relating to environmental hazard than e.g. dicopper oxide, which is classified with R50/53 (cf. appendix B), although the latter all in all is considered to be of much less concern with regard to long-term effects on the environment.

In the current model, R-phrases are used to group substances according to the type of hazard effect they entail. However, no comparison is made between hazard categories, and no distinction is made between the different hazardous properties pertaining to the same hazard category. Hence, the substitution of one hazardous substance by a less hazardous substance allocated to the same hazard category is not reflected in the aggregated results. For instance, risk-phrases R40 (“Limited evidence of a carcinogenic effect”) and R45 (“May cause cancer”) both place substances in the CMR-group, so the substitution of equal amounts of one with the other will not be displayed in the aggregated emission estimates. Applying appropriate hazard weights to emission figures, e.g. assigning a somewhat lower weight to substances classified as R40 than to substances classified as R45, would both diminish this problem and bring the resulting estimates closer to a measure of risk. Doing so would probably make the statistics easier to interpret and use.

Any hazard weights should be studied and evaluated before use.

## 7.6. Recipient distribution

At present, emission estimates are not split up into figures for the different emission recipients, i.e. air, water and soil. However, the model has been developed so that this division can easily be done, given that the necessary information on emission distribution among recipients is obtained.

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## Appendix A

## List of R-phrases

**R-phrases** (short for **Risk Phrases**) are defined in Annex III of European Union Directive 67/548/EEC: *Nature of special risks attributed to dangerous substances and preparations* (European Commission 1967).

R1:	Explosive when dry
R2:	Risk of explosion by shock, friction, fire or other sources of ignition
R3:	Extreme risk of explosion by shock, friction, fire or other sources of ignition
R4:	Forms very sensitive explosive metallic compounds
R5:	Heating may cause an explosion
R6:	Explosive with or without contact with air
R7:	May cause fire
R8:	Contact with combustible material may cause fire
R9:	Explosive when mixed with combustible material
R10:	Flammable
R11:	Highly flammable
R12:	Extremely flammable
R14:	Reacts violently with water
R15:	Contact with water liberates extremely flammable gases
R16:	Explosive when mixed with oxidising substances
R17:	Spontaneously flammable in air
R18:	In use, may form flammable/explosive vapour-air mixture
R19:	May form explosive peroxides
R20:	Harmful by inhalation
R21:	Harmful in contact with skin
R22:	Harmful if swallowed
R23:	Toxic by inhalation
R24:	Toxic in contact with skin
R25:	Toxic if swallowed
R26:	Very toxic by inhalation
R27:	Very toxic in contact with skin
R28:	Very toxic if swallowed
R29:	Contact with water liberates toxic gas.
R30:	Can become highly flammable in use
R31:	Contact with acids liberates toxic gas
R32:	Contact with acids liberates very toxic gas
R33:	Danger of cumulative effects
R34:	Causes burns
R35:	Causes severe burns
R36:	Irritating to eyes
R37:	Irritating to respiratory system
R38:	Irritating to skin
R39:	Danger of very serious irreversible effects
R40:	Limited evidence of a carcinogenic effect
R41:	Risk of serious damage to eyes
R42:	May cause sensitisation by inhalation
R43:	May cause sensitisation by skin contact
R44:	Risk of explosion if heated under confinement
R45:	May cause cancer
R46:	May cause heritable genetic damage
R48:	Danger of serious damage to health by prolonged exposure
R49:	May cause cancer by inhalation
R50:	Very toxic to aquatic organisms
R51:	Toxic to aquatic organisms
R52:	Harmful to aquatic organisms
R53:	May cause long-term adverse effects in the aquatic environment
R54:	Toxic to flora
R55:	Toxic to fauna
R56:	Toxic to soil organisms
R57:	Toxic to bees

R58:	May cause long-term adverse effects in the environment
R59:	Dangerous for the ozone layer
R60:	May impair fertility
R61:	May cause harm to the unborn child
R62:	Possible risk of impaired fertility
R63:	Possible risk of harm to the unborn child
R64:	May cause harm to breast-fed babies
R65:	Harmful: may cause lung damage if swallowed
R66:	Repeated exposure may cause skin dryness or cracking
R67:	Vapours may cause drowsiness and dizziness
R68:	Possible risk of irreversible effects
R14/15:	Reacts violently with water, liberating extremely flammable gases
R15/29:	Contact with water liberates toxic, extremely flammable gases
R20/21:	Harmful by inhalation and in contact with skin
R20/22:	Harmful by inhalation and if swallowed
R20/21/22:	: Harmful by inhalation, in contact with skin and if swallowed
R21/22:	Harmful in contact with skin and if swallowed
R23/24:	Toxic by inhalation and in contact with skin
R23/25:	Toxic by inhalation and if swallowed
R23/24/25:	Toxic by inhalation, in contact with skin and if swallowed
R24/25:	Toxic in contact with skin and if swallowed
R26/27:	Very toxic by inhalation and in contact with skin
R26/28:	Very toxic by inhalation and if swallowed
R26/27/28:	Very toxic by inhalation, in contact with skin and if swallowed
R27/28:	Very toxic in contact with skin and if swallowed
R36/37:	Irritating to eyes and respiratory system
R36/38:	Irritating to eyes and skin
R36/37/38:	Irritating to eyes, respiratory system and skin
R37/38:	Irritating to respiratory system and skin
R39/23:	Toxic: danger of very serious irreversible effects through inhalation
R39/24:	Toxic: danger of very serious irreversible effects in contact with skin
R39/25:	Toxic: danger of very serious irreversible effects if swallowed
R39/23/24:	Toxic: danger of very serious irreversible effects through inhalation and in contact with skin
R39/23/25:	Toxic: danger of very serious irreversible effects through inhalation and if swallowed
R39/24/25:	Toxic: danger of very serious irreversible effects in contact with skin and if swallowed
R39/23/24/25:	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
R39/26:	Very Toxic: danger of very serious irreversible effects through inhalation
R39/27:	Very Toxic: danger of very serious irreversible effects in contact with skin
R39/28:	Very Toxic: danger of very serious irreversible effects if swallowed
R39/26/27:	Very Toxic: danger of very serious irreversible effects through inhalation and in contact with skin
R39/26/28:	Very Toxic: danger of very serious irreversible effects through inhalation and if swallowed
R39/27/28:	Very Toxic: danger of very serious irreversible effects in contact with skin and if swallowed
R39/26/27/28:	Very Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
R42/43:	May cause sensitisation by inhalation and skin contact
R48/20:	Harmful: danger of serious damage to health by prolonged exposure through inhalation
R48/21:	Harmful: danger of serious damage to health by prolonged exposure in contact with skin
R48/22:	Harmful: danger of serious damage to health by prolonged exposure if swallowed
R48/20/21:	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin
R48/20/22:	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
R48/21/22:	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R48/20/21/22:	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R48/23:	Toxic: danger of serious damage to health by prolonged exposure through inhalation
R48/24:	Toxic: danger of serious damage to health by prolonged exposure in contact with skin
R48/25:	Toxic: danger of serious damage to health by prolonged exposure if swallowed
R48/23/24:	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin
R48/23/25:	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed

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R48/24/25:	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R48/23/24/25:	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R50/53:	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R51/53:	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R52/53:	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R68/20:	Harmful: possible risk of irreversible effects through inhalation
R68/21:	Harmful: possible risk of irreversible effects in contact with skin
R68/22:	Harmful: possible risk of irreversible effects if swallowed
R68/20/21:	Harmful: possible risk of irreversible effects through inhalation and in contact with skin
R68/20/22:	Harmful: possible risk of irreversible effects through inhalation and if swallowed
R68/21/22:	Harmful: possible risk of irreversible effects in contact with skin and if swallowed
R68/20/21/22:	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed

## Appendix B

## List of substances included in this study

Substances included in this study, supplied with CAS-numbers and hazard categories: cmr (CMR-effects), cht (chronic toxic effects), sen (sensitising effects) and env (dangerous for the environment).

CAS	Substance name	Hazard category		
50-00-0	formaldehyde	cmr	sen	
50-32-8	benzo(a)pyrene	cmr	sen	env
52-68-6	trichlorfon		sen	env
53-70-3	dibenz[a,h]anthracene	cmr		env
55-55-0	bis(4-hydroxy-N-methylanilinium) sulphate		cht	sen env
55-63-0	nitroglycerine			env
56-18-8	3,3'-iminodi(propylamine)			sen
56-23-5	carbon tetrachloride	cmr	cht	env
56-35-9	bis(tributyltin) oxide			env
56-55-3	benzo(a)anthracene	cmr		env
58-36-6	diphenoxarsin-10-yl oxide			env
59-50-7	chlorocresol			sen
60-35-5	acetamide	cmr		
62-38-4	phenylmercury acetate		cht	env
62-53-3	aniline	cmr	cht	sen
62-56-6	thiourea	cmr		env
64-67-5	diethyl sulphate	cmr		
66-71-7	1,10-phenanthroline			env
67-66-3	chloroform	cmr	cht	
67-97-0	colecalfiferol		cht	
68-12-2	N,N-Dimethylformamide	cmr		
71-43-2	benzene	cmr	cht	
74-83-9	bromomethane	cmr	cht	
74-87-3	chloromethane	cmr	cht	
75-01-4	vinyl chloride	cmr		
75-07-0	acetaldehyde	cmr		
75-08-1	ethanethiol			env
75-09-2	dichloromethane	cmr		
75-12-7	formamide	cmr		
75-21-8	ethylene oxide	cmr		
75-56-9	methyloxirane	cmr		
77-73-6	4,7-methano-1H-indene, 3a,4,7,7a-tetrahydro-			env
77-78-1	dimethyl sulphate	cmr		sen
78-00-2	tetraethyllead			env
78-30-8	tri-o-tolyl phosphate			env
78-32-0	tri-p-tolyl phosphate			env
78-59-1	2-cyclohexen-1-one, 3,5,5-trimethyl-	cmr		
78-67-1	2,2'-dimethyl-2,2'-azodipropionitrile			env
78-78-4	2-methylbutane			env
79-01-6	trichloroethylene (TRI)	cmr		env
79-06-1	acrylamide	cmr	cht	sen
79-07-2	2-chloroacetamide	cmr		sen
80-05-7	4,4'-Isopropylidenediphen	cmr		sen
80-15-9	alpha,alpha-dimethylbenzyl hydroperoxide		cht	env
80-43-3	bis(alpha,alpha-dimethylbenzyl) peroxide			env
80-62-6	methyl methacrylate			sen
81-14-1	4'-tert-butyl-2',6'-dimethyl-3',5'-dinitroacetophenone (musk ketnoe)			env

81-15-2	5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)	cmr		env
84-74-2	dibutyl phtalate	cmr		
85-42-7	cyclohexane-1,2-dicarboxylic anhydride			sen
85-43-8	1,2,3,6-tetrahydrophthalic anhydride			sen env
85-44-9	phthalic anhydride			sen
85-68-7	benzyl butyl phthalate	cmr		env
86-50-0	azinphos-methyl			sen env
87-66-1	pyrogallol	cmr		env
87-90-1	symclosene			env
88-04-0	4-chloro-3,5-xylenol			sen
88-12-0	1-vinyl-2-pyrrolidone	cmr	cht	
89-83-8	thymol			env
90-43-7	biphenyl-2-ol			env
90-94-8	4,4'-bis(dimethylamino)benzophenone	cmr		
91-08-7	2-methyl-m-phenylene diisocyanate	cmr		sen env
91-20-3	naphthalene	cmr		env
91-66-7	N,N-diethylaniline			env
91-76-9	6-phenyl-1,3,5-triazine-2,4-diyl diamine			env
92-43-3	1-phenyl-3-pyrazolidone			env
92-52-4	biphenyl			env
94-36-0	dibenzoyl peroxide			sen
95-33-0	N-cyclohexylbenzothiazole-2-sulfenamide			sen env
95-50-1	1,2-dichlorobenzene			env
95-53-4	O-toluidine	cmr		
95-63-6	1,2,4-trimethylbenzene			env
95-76-1	3,4-dichloroaniline			sen env
96-23-1	1,3-dichloropropan-2-ol	cmr		
96-29-7	2-butanone oxime	cmr		sen
96-33-3	methyl acrylate			sen
96-45-7	imidazolidine-2-thione	cmr		
97-23-4	dichlorophen			env
97-63-2	ethyl methacrylate			sen
97-74-5	tetramethylthiuram monosulphide			sen env
97-86-9	isobutyl methacrylate			sen
97-88-1	butyl methacrylate			sen
97-90-5	ethylene dimethacrylate			sen
98-01-1	2-furaldehyde	cmr		
98-82-8	cumene			env
98-83-9	2-phenylpropene			env
98-87-3	alpha,alpha-dichlorotoluene	cmr		
99-97-8	N,N-dimethyl-p-toluidine			env
100-44-7	alpha-chlorotoluene	cmr	cht	
100-97-0	methenamine			sen
101-02-0	triphenyl phosphite			env
101-61-1	N,N,N',N'-tetramethyl-4,4'-methylenedianiline	cmr		env
101-68-8	4,4'-methylenediphenyl diisocyanate			sen
101-77-9	4,4'-methylenedianiline	cmr	cht	sen env
101-83-7	dicyclohexylamine			env
102-06-7	1,3-diphenylguanidine	cmr		env
102-77-2	2-(morpholinothio)benzothiazole			sen env
103-11-7	2-ethylhexyl acrylate			sen
103-33-3	azobenzene	cmr	cht	env
103-65-1	propylbenzene			env
103-83-3	benzyl dimethylamine			env
104-40-5	P-nonylphenol			env
104-78-9	3-aminopropyldiethylamine			sen
105-16-8	2-(diethylamino)ethyl methacrylate			sen

106-46-7	1,4-dichlorobenzene	cmr		env
106-47-8	4-chloroaniline	cmr	sen	env
106-89-8	1-chloro-2,3-epoxypropane	cmr	sen	
106-91-2	2,3-epoxypropyl methacrylate		sen	
106-94-5	1-bromopropane	cmr	cht	
106-99-0	buta-1,3-diene	cmr		
107-06-2	1,2-dichloroethane	cmr		
107-13-1	acrylonitrile	cmr	sen	env
107-15-3	1,2-ethanediamine		sen	
107-19-7	prop-2-yn-1-ol			env
107-22-2	glyoxal	cmr	sen	
107-39-1	2,4,4-trimethylpent-1-ene			env
107-64-2	dimethyldioctadecylammonium chloride			env
108-08-7	2,4-dimethylpentane			env
108-31-6	maleic anhydride		sen	
108-67-8	mesitylene			env
108-87-2	methylcyclohexane			env
108-88-3	toluene	cmr	cht	
108-90-7	chlorobenzene			env
108-95-2	phenol	cmr	cht	
109-55-7	3-aminopropyl dimethylamine		sen	
109-66-0	pentane			env
109-86-4	ethanol, 2-methoxy-	cmr		
110-01-0	tetrahydrothiophene			env
110-65-6	but-2-yne-1,4-diol		cht	sen
110-71-4	1,2-dimethoxyethane	cmr		
110-80-5	2-ethoxyethanol	cmr		
110-82-7	cyclohexane			env
110-85-0	piperazine		sen	env
110-88-3	1,3,5-trioxane	cmr		
111-15-9	2-ethoxyethyl acetate	cmr		
111-30-8	glutaral		sen	
111-40-0	2,2'-iminodi(ethylamine)		sen	
111-42-2	ethanol, 2,2'-iminobis-		cht	
111-65-9	octane			env
111-77-3	2-(2-methoxyethoxy)-ethanol	cmr		
111-96-6	bis(2-methoxyethyl) ether	cmr		
112-24-3	trientine		sen	env
112-57-2	3,6,9-triazaundecamethylenediamine		sen	env
115-96-8	tris(2-chloroethyl) phosphate	cmr		env
117-81-7	di(2-ethylhexyl) phthalat (DEHP)	cmr		
118-96-7	2,4,6-trinitrotoluene			env
119-64-2	1,2,3,4-tetrahydronaphthalene			env
120-78-5	di(benzothiazol-2-yl) disulphide		sen	env
120-82-1	1,2,4-trichlorobenzene			env
121-14-2	2,4-dinitrotoluene	cmr	cht	env
121-21-1	2-methyl-4-oxo-3-(penta-2,4-dienyl)cyclopent-2-enyl [1R-[1alpha[S*(Z)],3beta]]-chrysanthemate			env
121-29-9	2-methyl-4-oxo-3-(penta-2,4-dienyl)cyclopent-2-enyl [1R-[1alpha[S*(Z)](3beta)-3-(3-methoxy-2-methyl-3-oxoprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate			env
121-57-3	sulphanilic acid		sen	
121-69-7	N,N-dimethylaniline	cmr		env
121-75-5	malathion			env
122-20-3	1,1',1''-nitriilotripropan-2-ol			env
122-39-4	diphenylamine			env
122-60-1	2,3-epoxypropyl phenyl ether	cmr	sen	env
123-30-8	4-aminophenol	cmr		env
123-31-9	hydroquinone	cmr	sen	

123-77-3	C,C'-azodi(formamide)			sen
123-91-1	1,4-dioxane	cmr		
124-68-5	2-amino-2-methylpropanol			env
126-73-8	tributyl phosphate	cmr		
127-18-4	tetrachloroethene (PER)	cmr		env
127-19-5	N,N-dimethylacetamide	cmr		
127-65-1	tosylchloramide sodium			sen
127-68-4	sodium 3-nitrobenzenesulphonate			sen
131-17-9	diallyl phthalate			env
133-07-3	N-(trichloromethylthio)phthalimide	cmr		sen
134-62-3	N,N-diethyl-m-toluamide			env
135-88-6	N-2-naphthylaniline	cmr		sen env
136-23-2	zinc bis(dibutyldithiocarbamate)			sen env
137-26-8	thiram		cht	sen env
137-30-4	ziram		cht	sen env
138-86-3	dipentene			sen env
140-31-8	2-piperazin-1-ylethylamine			sen env
140-66-9	4-(1,1,3,3-tetramethylbutyl)phenol			env
140-88-5	ethyl acrylate			sen
141-32-2	butyl acrylate			sen
142-59-6	nabam			sen env
142-82-5	heptane			env
142-90-5	dodecyl methacrylate			env
142-96-1	dibutyl ether			env
148-79-8	tiabendazole			env
149-30-4	benzothiazole-2-thiol			sen env
149-57-5	2-ethylhexanoic acid	cmr		
150-68-5	monuron	cmr		env
150-76-5	mequinol			sen
156-43-4	P-phenetidine	cmr		sen
192-97-2	benzo[e]pyrene	cmr		env
193-39-5	indeno[1,2,3-cd]pyrene	cmr		
205-82-3	benzo(j)fluoranthene	cmr		env
205-99-2	benzo(e)acephenanthrylene	cmr		env
207-08-9	benzo(k)fluoranthene	cmr		env
218-01-9	benzo(a)phenanthrene (chrysene)	cmr		env
287-92-3	cyclopentane			env
288-88-0	1,2,4-triazole	cmr		
302-01-2	hydrazine	cmr		sen env
330-54-1	diuron	cmr	cht	env
333-41-5	diazinon			env
383-07-3	2-propenoic acid, 2-[butyl[(heptadecafluorooctyl)sulphonyl]amino]ethyl ester	cmr	cht	env
463-56-9	thiocyanic acid			env
463-82-1	neopentane			env
533-74-4	dazomet			env
540-84-1	2,2,4-trimethylpentane			env
541-02-6	decamethylcyclopentasiloxane			env
542-75-6	1,3-dichloropropene			sen env
548-62-9	[4-[4,4'-bis(dimethylamino)benzhydrylidene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride	cmr		env
552-30-7	1,2,4-tricarboxylic acid 1,2-anhydride benzene			sen
556-52-5	2,3-epoxypropan-1-ol	cmr		
556-67-2	octamethylcyclotetrasiloxane (D4)	cmr		env
557-20-0	diethylzinc			env
569-64-2	[4-[alpha-[4-(dimethylamino)phenyl]benzylidene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride	cmr		env
584-79-2	allethrin			env
584-84-9	4-methyl-m-phenylene diisocyanate	cmr		sen env

606-20-2	2,6-dinitrotoluene	cmr	cht	env
609-72-3	N,N-dimethyl-o-toluidine			env
611-15-4	2-methylstyrene			env
625-45-6	methoxyacetic acid	cmr		
630-08-0	carbon monoxide	cmr	cht	
688-73-3	tri-n-butyltin hydride			env
700-13-0	2,3,5-trimethylhydroquinone			sen env
719-86-8	3-acetyl-1-phenyl-pyrrolidine-2,4-dione		cht	env
731-27-1	dichloro-N-[(dimethylamino)sulphonyl]fluoro-N-(p-tolyl)methanesulphenamide		cht	sen env
732-26-3	2,4,6-tri-tert-butylphenol			env
818-61-1	2-hydroxyethyl acrylate			sen
822-06-0	hexamethylene-1,6-diisocyanate			sen
842-07-9	1-phenylazo-2-naphthol	cmr		sen env
868-77-9	2-hydroxyethyl methacrylate			sen
917-61-3	sodium cyanate			env
923-26-2	2-hydroxypropyl methacrylate			sen
1070-70-8	1,4-butanediyl diacrylate			sen
1072-35-1	lead distearate	cmr		
1085-98-9	dichlofluanid			sen env
1163-19-5	bis(pentabromophenyl) ether (decaDBE)			env
1300-71-6	xyleneol			env
1303-28-2	diarsenic pentaoxide			env
1306-19-0	cadmium oxide	cmr	cht	
1306-23-6	cadmium sulphide	cmr	cht	env
1307-96-6	cobalt oxide			sen env
1308-38-9	chromium (III) oxide			env
1309-64-4	diantimony trioxide	cmr		
1313-27-5	molybdenum trioxide		cht	
1313-99-1	nickel monoxide	cmr		sen env
1314-13-2	zinc oxide			env
1314-41-6	orange lead	cmr		
1314-62-1	divanadium pentaoxide	cmr	cht	env
1317-36-8	lead monoxide	cmr		
1317-38-0	copper oxide			env
1317-39-1	dicopper oxide			env
1317-42-6	cobalt sulphide			sen env
1319-46-6	trilead bis(carbonate) dihydroxide	cmr		
1327-53-3	diarsenic trioxide			env
1333-82-0	chromium trioxide	cmr	cht	sen env
1338-02-9	naphthenic acids, copper salts			env
1344-37-2	lead sulfochromate yellow	cmr		env
1344-48-5	mercury(II) sulfide			env
1589-47-5	2-methoxypropanol	cmr		
1652-63-7	1-propanaminium, 3-[[heptadecafluorooctyl)sulphonyl]amino]-N,N,N-trimethyl-, iodide	cmr	cht	env
1663-39-4	tert-butyl acrylate			sen env
1675-54-3	2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bisoxirane			sen
1680-21-3	1,2-ethanediylbis(oxy-2,1-ethanediyl) diacrylate			sen
1691-99-2	N-ethylheptadecafluoro-N-(2-hydroxyethyl)octanesulphonamide	cmr	cht	env
1717-00-6	1,1-dichloro-1-fluoroethane			env
1897-45-6	chlorothalonil	cmr		sen env
1918-00-9	dicamba			env
1939-36-2	N,N'-propylene-1,3-diylbis[N-(hydroxycarbonylmethyl)glycine]			env
2051-79-8	N5,N5-diethyltoluene-2,5-diamine monohydrochloride			sen env
2155-70-6	tributyl(methacryloyloxy)stannane			env
2210-79-9	2,3-epoxypropyl o-tolyl ether	cmr		sen env
2223-82-7	2,2-dimethyl-1,3-propanediyl diacrylate			sen

2425-79-8	1,4-bis(2,3-epoxypropoxy)butane			sen	
192 337	butyl 2,3-epoxypropyl ether	cmr		sen	env
2451-62-9	1,3,5-tris(oxiranylmethyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione	cmr	cht	sen	env
2634-33-5	1,2-benzisothiazol-3(2H)-one			sen	
2687-94-7	N-(n-octyl)-2-pyrrolidinone				env
2687-96-9	N-(n-dodecyl)pyrrolidinone			sen	env
2699-79-8	sulphuryl difluoride		cht		
2795-39-3	potassium heptadecafluorooctane-1-sulphonate	cmr	cht		env
2855-13-2	3-aminomethyl-3,5,5-trimethylcyclohexylamine			sen	env
2867-47-2	2-dimethylaminoethyl methacrylate			sen	
2893-78-9	troclosene sodium				env
2921-88-2	chlorpyrifos				env
2991-51-7	glycine, N-ethyl-N-[(heptadecafluorooctyl)sulphonyl]-, potassium salt	cmr	cht		env
2997-92-4	2,2'-azobis[2-methylpropionamide] dihydrochloride			sen	
3194-55-6	1,2,5,6,9,10-hexabromocyclododecane				env
3333-67-3	nickel carbonate	cmr		sen	env
3347-22-6	dithianon				env
3380-34-5	triclosan				env
3457-61-2	tert-butyl alpha,alpha-dimethylbenzyl peroxide				env
3508-98-3	2-phenylhexanenitrile				env
3524-68-3	2-(hydroxymethyl)-2-[[[(1-oxoallyl)oxy]methyl]-1,3-propanediyl diacrylate			sen	
698 078	potassium chlorate				env
3825-26-1	ammonium pentadecafluorooctanoate	cmr	cht		
4067-16-7	3,6,9,12-tetraazatetradecamethylenediamine			sen	env
4083-64-1	P-toluenesulphonyl isocyanate			sen	
4098-71-9	3-isocyanatomethyl-3,5,5-trimethylcyclohexyl isocyanate			sen	env
1 029 713	2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol			sen	
4986-89-4	2,2-bis[[[(1-oxoallyl)oxy]methyl]-1,3-propanediyl diacrylate			sen	
5124-30-1	4,4'-methylenedicyclohexyl diisocyanate			sen	
5329-14-6	sulphamidic acid				env
5392-40-5	citral			sen	
1 304 222	hydroxylammonium chloride		cht	sen	
5836-29-3	coumatetralyl		cht		env
5873-54-1	O-(p-isocyanatobenzyl)phenyl isocyanate			sen	
5989-27-5	(R)-p-mentha-1,8-diene			sen	env
5989-54-8	(S)-p-mentha-1,8-diene			sen	env
6317-18-6	methylene dithiocyanate			sen	
6864-37-5	2,2'-dimethyl-4,4'-methylenebis(cyclohexylamine)				env
1 817 789	trans-1-methyl-4-(1-methylvinyl)cyclohexene			sen	env
7085-85-0	ethyl 2-cyanoacrylate			sen	
7439-92-1	lead	cmr			
7439-97-6	mercury				env
7440-02-0	nickel carbonate	cmr		sen	
7440-38-2	arsenic				env
7440-41-7	beryllium	cmr	cht	sen	
7440-43-9	cadmium	cmr			env
7440-48-4	cobalt			sen	env
7440-66-6	zinc				env
7446-14-2	lead sulphate	cmr			
7446-19-7	zinc sulphate (hydrous) (mono-, hexa- and hepta hydrate); zinc sulphate (anhydrous)				env
7447-39-4	copper dichloride				env
7646-79-9	cobalt dichloride	cmr		sen	env
7646-85-7	zinc chloride				env
7705-14-8	(±)-1-methyl-4-(1-methylvinyl)cyclohexene			sen	env
7718-54-9	nickel dichloride	cmr		sen	env
7722-64-7	potassium permanganate				env

7723-14-0	phosphorus (red)				env
7727-21-1	dipotassium peroxodisulphate			sen	
7727-54-0	diammonium peroxodisulphate			sen	
7733-02-0	zinc sulphate				env
7758-89-6	copper chloride				env
7758-95-4	lead dichloride	cmr			
7758-97-6	lead chromate	cmr			env
7758-98-7	copper sulphate				env
7761-88-8	silver nitrate				env
2 146 053	sodium chlorate				env
7778-50-9	potassium dichromate	cmr	cht	sen	env
7779-90-0	trizinc bis(orthophosphate)				env
7782-49-2	selenium				env
7785-87-7	manganese sulphate		cht		env
7786-81-4	nickel sulphate	cmr		sen	env
2 151 068	strontium chromate	cmr			env
7789-12-0	sodium dichromate, dihydrate	cmr	cht	sen	env
7803-49-8	hydroxylamine		cht	sen	
8001-58-9	creosote	cmr			
2 228 840	petroleum	cmr			
8006-64-2	turpentine, oil			sen	env
8007-45-2	tar, coal	cmr			
2 246 493	rosin			sen	
2 247 253	tall-oil rosin			sen	
9000-90-2	amylase, alpha-			sen	
9002-93-1	poly(oxy-1,2-ethandiyl),alfa-(4-(1,1,3,3-tetramethylbutyl)phenyl)-omega-hydroxy-				env
9004-87-9	poly(oxy-1,2-ethandiyl),alfa-(isooctylphenyl)-omega-hydroxy-				env
9012-54-8	cellulase			sen	
2 598 337	subtilisin			sen	
9014-90-8	poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(nonylphenoxy)-,sodium salt				env
9016-45-9	nonylphenol, ethoxylated				env
9036-19-5	octylphenoxy polyethoxyethanol				env
9040-65-7	formaldehyde, polymere with nonylphenol				env
9051-57-4	poly(oxy-1,2-ethanediyl),alfa-sulfo-omega-(nonylphenoxy)-,ammonium salt				env
9063-89-2	poly(oxy-1,2-ethanediyl), alpha-(octylphenyl)-omega-hydroxy-				env
10039-54-0	bis(hydroxylammonium) sulphate		cht	sen	
10046-00-1	hydroxylammonium hydrogensulphate		cht	sen	
10061-01-5	(Z)-1,3-dichloropropene			sen	env
10102-18-8	sodium selenite			sen	env
10124-36-4	cadmium sulphate	cmr	cht		env
10294-40-3	barium chromate				env
10588-01-9	sodium dichromate	cmr	cht	sen	env
10605-21-7	carbendazim	cmr			env
11070-44-3	tetrahydromethylphthalic anhydride			sen	
12035-72-2	trinickel disulphide	cmr		sen	env
12069-69-1	copper(II) carbonate--copper(II) hydroxide (1:1)				env
12122-67-7	zineb			sen	
12141-20-7	trilead dioxide phosphonate	cmr			
12656-85-8	lead chromate molybdate sulfate red	cmr			env
13048-33-4	hexamethylene diacrylate			sen	
13516-27-3	guazatine				env
13530-65-9	zinc chromate	cmr			env
13775-53-6	trisodium hexafluoroaluminate		cht		env
14324-55-1	zinc bis(diethyldithiocarbamate)			sen	env
14650-24-9	2-[[heptadecafluorooctyl]sulphonyl]methylamino]ethyl methacrylate	cmr	cht		env
14816-18-3	phoxim				env

15096-52-3	trisodium hexafluoroaluminate (cryolite)		cht	env
15625-89-5	2-ethyl-2-[[[(1-oxoallyl)oxy]methyl]-1,3-propanediyl diacrylate			sen
16298-38-7	4,4'-methylenebis(2-isopropyl-6-methylaniline)		cht	env
16484-77-8	(R)-2-(4-chloro-2-methylphenoxy)propionic acid			env
17557-23-2	1,3-bis(2,3-epoxypropoxy)-2,2-dimethylpropane			sen
17865-32-6	cyclohexyldimethoxymethylsilane			env
19247-05-3	N-amino-N-carboxymethylglycine		cht	sen
19900-65-3	4,4'-methylenebis(2-ethylaniline)	cmr		env
21087-64-9	metribuzin			env
21564-17-0	(benzothiazol-2-ylthio)methyl thiocyanate			sen
23783-26-8	hydroxyphosphonoacetic acid		cht	sen
25057-89-0	bentazone			sen
25068-38-6	4,4'-Isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane (Bisphenol-A and epoxy resin)			sen
25154-52-3	nonylphenol	cmr		env
25321-14-6	dinitrotoluene	cmr	cht	env
25402-06-6	3-(but-2-enyl)-2-methyl-4-oxocyclopent-2-enyl 2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate			env
25550-51-0	hexahydromethylphthalic anhydride			sen
25584-83-2	acrylic acid, monoester with propane-1,2-diol			sen
25637-99-4	hexabromocyclododecane			env
25646-71-3	N-(2-(4-amino-N-ethyl-m-toluidino)ethyl)methanesulphonamide sesquisulphate			sen
25646-77-9	(4-ammonio-m-tolyl)ethyl(2-hydroxyethyl)ammonium sulphate		cht	sen
26027-38-3	4-nonylphenol, ethoxylated			env
26354-18-7	poly(methylmethacrylate, tributyltin methacrylate)			env
26447-14-3	[(tolyl)oxy]methyl]oxirane	cmr		sen
26447-40-5	methylenediphenyl diisocyanate			sen
26471-62-5	M-tolylidene diisocyanate	cmr		sen
26530-20-1	2-octyl-2H-isothiazol-3-one			sen
26590-20-5	1,2,3,6-tetrahydromethylphthalic anhydride			sen
26635-64-3	isooctane			env
27177-03-3	20-(nonylphenoxy)-3,6,9,12,15,18-hexaoxaicosan-1-ol			env
27177-05-5	23-(nonylphenoxy)-3,6,9,12,15,18,21-heptaaxtricosan-1-ol			env
27177-08-8	29-(nonylphenoxy)-3,6,9,12,15,18,21,24,27-nonaoxanonacosanol			env
27193-86-8	dodecylphenol			env
28434-00-6	3-allyl-2-methyl-4-oxocyclopent-2-en-1-yl [1R-[1alpha(S*),3beta]]-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (S-bioallethrin)			env
28434-01-7	bioresmethrin			env
29081-56-9	ammonium heptadecafluorooctanesulphonate	cmr	cht	env
31394-54-4	isoheptane			env
34123-59-6	3-(4-isopropylphenyl)-1,1-dimethylurea	cmr		env
36669-85-9	calcium P,P'-(1-hydroxyethylene)bis(hydrogen phosphonate)dihydrate			env
37205-87-1	poly(oxy-1,2-ethanediyl), alpha-(isononylphenyl)-omega-hydroxy-			env
37300-23-5	potassium zinc chromate	cmr		env
37441-29-5	5-amino-2,4,6-triiodo-1,3-benzenedicarbonyldichloride			sen
39515-41-8	alpha-cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate			env
42978-66-5	(1-methyl-1,2-ethanediyl)bis[oxy(methyl-2,1-ethanediyl)] diacrylate			sen
51580-86-0	troclosene sodium, dihydrate			env
51811-79-1	polyoxyethylene octadecylphenol (ethoxylated nonylphenol phosphate)			env
52315-07-8	alpha-cyano-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate			env
52623-95-7	poly(oxy-1,2-ethanediyl), alpha-((1.1.3.3.-tetramethyl-butyl)phenyl)-omega-hydroxy-phosphate			env
52645-53-1	M-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate			sen
52918-63-5	alpha-cyano-3-phenoxybenzyl [1R-[1alpha(S*),3alpha]]-3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate			env
53408-94-9	tin (II) methane sulphonate			sen
55512-33-9	O-(6-chloro-3-phenylpyridazin-4-yl) S-octyl thiocarbonate (pyridate)			sen

55965-84-9	Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-2H-isothiazol-3-one [EC no. 220-239-6] (3:1); Mixture of: 5-chloro-2-methyl-4-isothiazolin-3-one [EC no. 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC no. 220-239-6] (3:1)			sen	env
56073-10-0	4-hydroxy-3-(3-(4'-bromo-4-biphenyl)-1,2,3,4-tetrahydro-1-naphthyl)coumarin		cht		env
56773-42-3	tetraethylammonium heptadecafluorooctanesulphonate	cmr	cht		env
56973-87-6	1-(3,3-dimethylcyclohexyl)pent-4-en-1-one				env
57280-22-5	4,4-dimethyl-3,5,8-trioxabicyclo[5.1.0]octane			sen	
58594-72-2	1-[2-(allyloxy)ethyl-2-(2,4-dichlorophenyl)-1H-imidazolium hydrogen sulphate			sen	env
59227-88-2	1-octylazepin-2-one			sen	env
59653-74-6	1,3,5-tris-[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione	cmr	cht	sen	
60207-90-1	1-[[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]methyl]-1H-1,2,4-triazole (propiconazol)			sen	env
60864-33-7	poly(oxy-1,2-ethanediyl), alpha-(phenylmethyl)-omega-((1.1.3.3.-tetramethyl-butyl)-phenoxy)				env
61789-28-4	creosote oil	cmr			
61789-80-8	quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, chlorides (DHTDMAC)				env
61790-14-5	naphthenic acids, lead salts	cmr			
64741-45-3	residues (petroleum), atm. Tower	cmr			
64741-53-3	distillates (petroleum), heavy naphthenic	cmr			
64741-57-7	gas oils (petroleum), heavy vacuum	cmr			
64741-59-9	distillates (petroleum), light catalytic cracked	cmr			
64741-60-2	distillates (petroleum), intermediate catalytic cracked	cmr			
64741-67-9	residues (petroleum), catalytic reformer fractionator	cmr			
64741-80-6	residues (petroleum), thermal cracked	cmr			
64741-82-8	distillates (petroleum), light thermal cracked	cmr			
64742-04-7	extracts (petroleum), heavy paraffinic distillate solvent	cmr			
64742-11-6	extracts (petroleum), heavy naphthenic distillate solvent	cmr			
64742-21-8	distillates (petroleum), acid-treated light paraffinic	cmr			
64742-90-1	residues (petroleum), steam-cracked	cmr			
65996-89-6	tar, coal, high-temp.	cmr			
65996-93-2	pitch, coal tar, high-temp.	cmr			
66197-78-2	26-(nonylphenoxy)-3,6,9,12,15,18,21,24-octaohexacosan-1-yl dihydrogen phosphate				env
67375-30-8	alpha-cypermethrin		cht		env
67485-29-4	5,5-dimethyl-perhydro-pyrimidin-2-one alpha-(4-trifluoromethylstyryl)-alpha-(4-trifluoromethyl)cinnamylidenehydrazone		cht		env
67564-91-4	cis-4-[3-(p-tert-butylphenyl)-2-methylpropyl]-2,6-dimethylmorpholine	cmr			env
68131-73-7	polyethylenepolyamines			sen	env
68334-30-5	fuels, diesel	cmr			
68412-53-3	nonylphenol ethoxylate (EO9) phosphate ester				env
68412-54-4	poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-, branched (Nonylphenol, branched, ethoxylated)				env
68476-30-2	fuel oil, no. -2	cmr			
68476-33-5	fuel oil, residual	cmr			
68476-34-6	fuels, diesel, no. -2	cmr			
68479-98-1	diethylmethylbenzenediamine		cht		env
68515-42-4	1,2-benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	cmr			
68607-30-7	residues (petroleum), topping plant, low-sulfur	cmr			
68609-97-2	oxirane, mono[(C12-14-alkyloxy)methyl] derivs.			sen	
68783-08-4	gas oils (petroleum), heavy atmospheric	cmr			
68783-78-8	quaternary ammonium compounds, dimethylditallow alkyl, chlorides (DTDMAC)				env
68891-21-4	poly(oxy-1,2-ethanediyl), alpha-(dinonylphenyl)-omega-hydroxy-, branched				env
68955-36-2	residues (petroleum), steam-cracked, resinous	cmr			
68987-90-6	poly(oxy-1,2-ethanediyl), alpha-(octylphenyl)-omega-hydroxy-, branched				env
69011-84-3	poly(oxy-1,2-ethanediyl), alpha-sulpho-omega-(octylphenyl)-branched, sodium salt				env
70657-70-4	2-methoxypropyl acetate	cmr			
71868-10-5	2-methyl-1-(4-methylthiophenyl)-2-morpholinopropan-1-one				env
73138-82-6	resin acids and rosin acids			sen	
74223-64-6	metsulfuron-methyl; 2-(4-methoxy-6-methyl-1,3,5-triazin-2-ylcarbamoylsulfamoyl) benzoic acid				env

75490-39-0	2,2,4-trimethyl-4-phenyl-butane-nitrile			env
78587-05-0	hexythiazox; trans-5-(4-chlorophenyl)-N-cyclohexyl-4-methyl-2-oxo-3-thiazolidine-carboxamide			env
80657-64-3	A mixture of: ethyl exo-tricyclo[5.2.1.0.su.2.6.su.]decane-endo-2-carboxylate and ethyl-endo-tricyclo[5.2.1.0.su.2.6.su.]decane-exo-2-carboxylate			env
82633-79-2	2,3,5,6-tetrahydro-2-methyl-2H-cyclopenta[d]-1,2-thiazol-3-one		sen	env
83016-70-0	2-[(2-[2-(dimethylamino)ethoxy]ethyl)methylamino]ethanol			env
84057-97-6	sodium 1-amino-4-[2-methyl-5-(4-methylphenylsulfonfylamino)phenylamino]anthraquinone-2-sulfonate			env
84852-15-3	phenol, 4-nonyl-, branched	cmr		env
85153-92-0	hexasodium 6,13-dichloro-3,10-bis((4-(2,5-disulfonatoanilino)-6-fluoro-1,3,5-triazin-2-ylamino)prop-3-ylamino)-5,12-dioxa-7,14-diazapentacene-4,11-disulfonate		sen	
85535-84-8	alkanes, C10-13, chloro	cmr		env
85535-85-9	alkanes, C14-17, chloro	cmr		env
85954-11-6	2,2'-((3,3',5,5'-tetramethyl-(1,1'-biphenyl)-4,4'-diyl)-bis(oxymethylene))-bis-oxirane	cmr		
89415-87-2	1,3-dichloro-5-ethyl-5-methylimidazolidine-2,4-dione		sen	
90640-84-9	creosote oil, acenaphthene fraction	cmr		
90640-86-1	distillates (coal tar), heavy oils	cmr		
91273-04-0	1-(N,N-bis(2-ethylhexyl)aminomethyl)-1,2,4-triazole		sen	env
91465-08-6	lambda-cyhalotrin (A 1:1 mixture of (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R)-cis-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethylcyclopropanecarboxylate and (R)-alpha-cyano-3-phenoxybenzyl (Z)-(1S)-cis-3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethylcyclopropanecarboxylate)			env
91673-30-2	formaldehyde, reaction products with butylphenol		sen	
92045-29-9	gas oils (petroleum), thermal-cracked, hydrodesulfurized	cmr		
95154-01-1	(benzothiazol-2-ylthio)succinic acid		sen	
103694-68-4	3-(2,2-dimethyl-3-hydroxypropyl)toluene			env
106264-79-3	6-methyl-2,4-bis(methylthio)phenylene-1,3-diamine		sen	env
106990-43-6	N,N',N'',N'''-tetrakis(4,6-bis(butyl-(N-methyl-2,2,6,6-tetramethylpiperidin-4-yl)amino)triazin-2-yl)-4,7-diazadecane-1,10-diamine		sen	env
107534-96-3	1-(4-chlorophenyl)-4,4-dimethyl-3-(1,2,4-triazol-1-ylmethyl)pentan-3-ol	cmr		env
107898-54-4	(+/-) trans-3,3-dimethyl-5-(2,2,3-trimethyl-cyclopent-3-en-1-yl)pent-4-en-2-ol			env
108624-00-6	lithium sodium hydrogen 4-amino-6-(5-(5-chloro-2,6-difluoropyrimidin-4-ylamino)-2-sulfonatophenylazo)-5-hydroxy-3-(4-(2-(sulfonatooxy)ethylsulfonyl)phenylazo)naphthalene-2,7-disulfonate		sen	
109909-39-9	poly(oxy-1,2-ethanediy), alpha-sulfo-omega-(2,4,6-tris(1-methylpropyl)phenoxy)-, sodium salt			env
111337-53-2	lithium 3-oxo-1,2(2H)-benzothiazol-2-ide		sen	env
111687-36-6	ammonium iron(III) trimethylenediaminetetraacetate hemihydrate			env
116889-78-2	tetrasodium 4-amino-5-hydroxy-6-(3-(2-(2-(sulfonatooxy)ethylsulfonyl)ethylcarbonyl)phenylazo)-3-(4-(2-(sulfonatooxy)ethylsulfonyl)phenylazo)naphthalene-2,7-disulfonate		sen	
117527-94-3	A mixture of: tert-alkyl(C12-C14)ammonium bis[1-[(2-hydroxy-5-nitrophenyl)azo]-2-naphthalenolato(2-)]-chromate(1-), tert-alkyl(C12-C14)ammonium bis[1-[(2-hydroxy-4-nitrophenyl)azo]-2-naphthalenolato(2-)]-chromate(1-), tert-alkyl(C12-C14)ammonium bis[1-[[5-(1,1-dimethylpropyl)-2-hydroxy-3-nitrophenyl]azo]-2-naphthalenolato(2-)]-chromate(1-), tert-alkyl(C12-C14)ammonium [[1-[(2-hydroxy-5-nitrophenyl)azo]-2-naphthalenolato(2-)]-[1-[[2-hydroxy-5-nitrophenyl)azo]-2-naphthalenolato(2-)]-chromate(1-), tert-alkyl(C12-C14)ammonium [[1-[[5-(1,1-dimethylpropyl)-2-hydroxy-3-nitrophenyl]azo]-2-naphthalenolato(2-)]-[1-[[2-hydroxy-5-nitrophenyl)azo]-2-naphthalenolato(2-)]-chromate(1-), tert-alkyl(C12-C14)ammonium ((1-(4(or 5)-nitro-2-oxidophenylazo)-2-naphtholato)(1-(3-nitro-2-oxido-5-pentylphenylazo)-2-naphtholato))chromate(1-)			env
119313-12-1	2-benzyl-2-dimethylamino-4'-morpholinobutyrophenone			env
121158-58-5	phenol, dodecyl-, branched			env
121575-60-8	pitch, coal tar, high-temp., heat-treated	cmr		
122070-78-4	phenanthrene, distrn. residues	cmr		
122760-84-3	4-methyl-8-methylenetricyclo[3.3.1.13,7]decan-2-ol		sen	env
124605-82-9	tetra-sodium/lithium 4,4'-bis-(8-amino-3,6-disulfonato-1-naphthol-2-ylazo)-3-methylazobenzene		sen	env
125109-85-5	beta-methyl-3-(1-methylethyl)benzenepropanal			env
125229-74-5	copolymer of vinyl-alcohol and vinyl acetate partially acetylized with 4-(2-(4-formylphenyl)ethenyl)-1-methylpyridinium methylsulfate			env
126833-17-8	N-(2,3-dichloro-4-hydroxyphenyl)-1-methylcyclohexanecarboxamide			env
127087-87-0	4-nonylphenol, branched, ethoxylated			env

127519-17-9	A mixture of branched and linear C7-C9 alkyl 3-[3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxyphenyl]propionates			env
129050-62-0	trisodium N,N-bis(carboxymethyl)-beta-alanine			env
136213-71-3	trisodium 5-amino-3-[5-(2-bromoacryloylamino)-2-sulfonatophenylazo]-4-hydroxy-6-(4-vinylsulfonylphenylazo)naphthalene-2,7-disulfonate			env
139504-68-0	1-[(2-tert-butylcyclohexyl)oxy]butan-2-ol			env
140921-24-0	1,6-hexanediyl-bis(2-(2-(1-ethylpentyl)-3-oxazolidinyl)ethyl)carbamate			sen
141517-21-7	trifloxystrobin (ISO); (E,E)-alpha-methoxyimino-{2-[[[1-[3-(trifluoromethyl)phenyl]ethylidene]amino]oxy]methyl]benzeneacetic acid methyl ester			sen env
141773-73-1	2-(1-(3',3'-dimethyl-1'-cyclohexyl)ethoxy)-2-methyl propyl propanoate			env
143683-23-2	tetrasodium-1,2-bis(4-fluoro-6-[5-(1-amino-2-sulfonatoanthrachinon-4-ylamino)-2,4,6-trimethyl-3-sulfonatophenylamino]-1,3,5-triazin-2-ylamino)ethane			sen env
143860-04-2	3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	cmr		env
145052-34-2	bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphin oxide			sen env
146177-84-6	sodium 2-(4-(4-fluoro-6-(2-sulfoethylamino)-[1,3,5]triazin-2-ylamino)-2-ureidophenylazo)-5-(4-sulfophenylazo)benzene-1-sulfonate			sen
149626-00-6	lithium sodium (2-(((5-((2,5-dichlorophenyl)azo)-2-hydroxyphenyl)methylene)amino)benzoato(2-))(2-((4,5-dihydro-3-methyl-5-oxo-1-phenyl-1H-pyrazol-4-yl)azo)-5-sulfobenzoato(3-)) chromate(2-)			env
149850-31-7	sodium 1,2-bis[4-[4-(4-(4-sulfophenylazo)-2-sulfophenylazo)-2-ureido-phenylamino]-6-fluoro-1,3,5-triazin-2-ylamino]propane, sodium salt			sen
151006-59-6	A mixture of: branched triacontane, branched dotriacontane, branched tetratriacontane and branched hexatriacontane			env
156738-27-1	sodium 4-[4-(4-hydroxyphenylazo)phenylamino]-3-nitrobenzenesulfonate			sen env
161935-19-9	4-[4-amino-5-hydroxy-3-(4-(2-sulfoxyethylsulfonyl)phenylazo)-2,7-disulfonapht-6-ylazo]-6-[3-(4-amino-5-hydroxy-3-(4-(2-sulfoxyethylsulfonyl)phenylazo)-2,7-disulfonapht-6-ylazo)]phenylcarbonylamino]benzenesulfonic acid, x sodium salt			sen
162881-26-7	phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide			sen env
171090-93-0	A mixture of: esters of C14-C15 branched alcohols with 3,5-di-t-butyl-4-hydroxyphenyl propionic acid, C15 branched and linear alkyl 3,5-bis(1,1-dimethylethyl)-4-hydroxybenzenepropanoate and C13 branched and linear alkyl 3,5-bis(1,1-dimethylethyl)-4-hydroxybenzenepropanoat			env
171599-85-2	N,N'-bis(6-chloro-4-[6-(4-vinylsulfonylphenylazo)-2,7-disulfonic acid 5-hydroxy-napht-4-ylamino]-1,3,5-triazin-2-yl)-N-(2-hydroxyethyl)-ethane-1,2-diamine, sodium salt			sen

## Appendix C

## Standard Industrial Classification (SIC2002/NACE) (Statistics Norway 2002)

NACE	Title
1	Agriculture, hunting and related service activities
2	Forestry, logging and related service activities
5	Fishing, fish farming and related service activities
10	Mining of coal and lignite, extraction of peat
11	Extraction of crude petroleum and natural gas, service activities incidental to oil and gas extraction excluding surveying
12	Mining of uranium and thorium ores
13	Mining of metal ores
14	Other mining and quarrying
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel, dressing and dyeing of fur
19	Tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture, manufacturing n.e.c.
37	Recycling
40	Electricity, gas, steam and hot water supply
41	Collection, purification and distribution of water
45	Construction
50	Sale, maintenance and repair of motor vehicles and motorcycles, retail sale of automotive fuel
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52	Retail trade, except of motor vehicles and motorcycles. Repair of personal and household goods
55	Hotels and restaurants
60	Land transport. transport via pipelines
61	Water transport
62	Air transport
63	Supporting and auxiliary transport activities, activities of travel agencies
64	Post and telecommunications
65	Financial intermediation, except insurance and pension funding
66	Insurance and pension funding, except compulsory social security
67	Activities auxiliary to financial intermediation
70	Real estate activities
71	Renting of machinery and equipment without operator and of personal and household goods
72	Computers and related activities
73	Research and development
74	Other business activities
75	Public administration and defence, compulsory social security
80	Education
85	Health and social work
90	Sewage and refuse disposal, sanitation and similar activities
91	Activities of membership organizations n.e.c.
92	Recreational, cultural and sporting activities
93	Other service activities
95	Activities of households with employed persons
99	Extra-territorial organizations and bodies

## Use Code Nordic (UCN)

UCN are product types developed by the Nordic Product Register Group – a subgroup under the Nordic Chemical Group – Nordic Council of Ministers (Product Register 2007)

Product code (UCN)	Product type
A05100	Filtration materials
A05200	Filtration media
A05250	Ion exchanger
A05300	Air cleaners and anti-odour agents (not filters)
A05400	Other absorbents and adsorbents
A20100	Anti-scaling agents
A25100	Anti-set-off agents
A40100	De-icing agents
A40200	Cooling agents
A40300	Other anti-freezing agents
A45100	Anti-clotting agents
A50100	Anti-tack agents
A55100	Anti-static agents
A60100	Dressing agents (glazing agents, polishing agents)
B15110	Human hygiene biocidal products (PT1)
B15120	Private area and public health area disinfectants and other biocidal products (PT2)
B15130	Veterinary hygiene biocidal products (PT3)
B15140	Food and feed area disinfectants (PT4)
B15142	Sanitation agents for toilets
B15150	Drinking water disinfectants (PT5)
B15310	In-can preservatives (PT6)
B15315	Wood preservatives (PT8)
B15320	Film preservatives (PT7)
B15330	Fibre, leather, rubber and polymerised materials preservatives (PT9)
B15340	Masonry preservatives (PT10)
B15350	Preservatives for liquid-cooling and processing systems (PT11)
B15360	Slimecides (PT12)
B15370	Metalworking-fluid preservatives (PT13)
B15510	Rodenticides (PT14)
B15520	Avicides (PT15)
B15530	Molluscicides (PT16)
B15540	Piscicides (PT17)
B15550	Insecticides, acaricides and products to control other arthropods (PT18)
B15560	Repellents and attractants (PT19)
B15710	Preservatives for food or feedstock (PT20)
B15720	Antifouling (PT21)
B15730	Embalming and taxidermist fluids (PT22)
B15740	Control of other vertebrates (PT23)
B16110	Insecticides
B16120	Fungicides
B16130	Herbicides (weed killers)
B16140	Growth inhibitors
B16150	Soil disinfection agents
B16190	Other plant protection products
B18100	Car care products
B20100	Binding agents for paints, adhesives etc
B20200	Binding agents for moulding sand
B20300	Other binding agents
B25200	Bleaching agents for textiles
B25300	Other bleaching agents
B30100	Blasting agents (sandblasting agents)
B35100	Softeners for plastic, rubber, paint and adhesive
B35200	Softeners - Softeners not included in B35100
B45100	Flame retardants
B50100	Fire extinguishing agents
B55100	Motor fuels
B55150	Ignition gas
B55200	Heating fuels
B55300	Other fuels

B60100	Anti-knocking agents
B60200	Other fuel additives
B65100	Deposit inhibitors
D05100	Denaturing agents
D15100	Propellants
D20100	Industry perfumes - (odorants)
D20200	Deodorants - Chemicals and products that not are cosmetic products
D20300	Other odour agents
D25100	Dental products
E03100	Expanding products
E05100	Extraction agents
E07100	Semiconductors
E07200	Commutators and materials for commutators
E07300	Conductive materials
E07400	Dielectrics
E07500	Transformers and materials for transformers
E07900	Other electric and electromechanical components
E10100	Electrolytes
E15100	Emulsion-inhibiting agents
E20100	EP-additives
F05100	Pigments to glazing materials, enamels and glass
F05110	Pigments to paint and printing inks
F05250	Pigment pastes
F05400	Regenerator to colours
F05990	Other colouring agents
F10100	Fixatives
F10300	Fixing agents for photocopies
F10400	Fixing agents for offset plates
F10700	Other fixing agents
F12100	Coating agents
F15100	Flotation agents
F20100	Flux agents (casting)
F32100	Bleachers for photographic film
F32150	Toners to photographic paper
F32200	Fixatives for photographic film
F32300	Developers for photographic film
F32400	Film hardeners
F32600	Photographic emulsions
F32800	Stopping bath
F32900	Retouch chemicals
F32990	Other photographic chemicals
F35200	Developers for photocopies
F35300	Offset developers
F35400	Other developers
F40100	Friction agents
F45100	Reinforcing fillers
F45200	Extenders
F45300	Other fillers
F50100	Flocculating chemicals
F50150	Slag initiators
F50200	Poly-electrolytes
F50300	Other flocculating agents
G05100	Salts for galvanic baths
G05200	Glazing additives
G05300	Flux agents for hot electroplating
G05400	Other galvano-technical agents
G10100	Hair remover
G10200	Tannin
G10300	Pyring remedies
G10400	Thouging products
G10990	Other tanning agents
G12300	Calendring agents
G12900	Other glossing agents
G15100	Enamels
G15200	Glazing materials
G15300	Other related coatings
G30100	Joint-less floors
G30200	Other flooring materials
G35100	Rubberising materials
G40100	Fertilizers
H10100	Hydraulic oils

H10200	Brake Fluids
H10990	Hydraulic fluids, by general
H15100	Concrete hardeners
H15400	Plastic hardeners
H15500	Other hardeners
I05100	Leather impregnation agents
I05200	Paper impregnation agents
I05300	Textile impregnation agents
I05400	Wood impregnation agents , wood preserving agents
I05450	Closing net proofing
I05500	Other impregnation agents
I15100	Fire prevention materials
I15200	Other thermic insulating materials
I15300	Electric current insulation materials
I15400	Sound insulating materials
I15500	Light insulating materials
I15600	Other insulation materials
K15100	Coagulating agents
K20100	Sequestering agents
K25100	Anti-mist agents
K25200	Condensation removers
K25300	Other anti-condensation agents
K35100	Cement/concrete/mortar
K35120	Fireproof cement
K35200	Plastic construction materials
K35300	Steel construction materials
K35500	Road construction materials
K35900	Other construction materials
K40100	Contactors (electrical)
K45100	Correction lacquers (offices)
K45200	Correction lacquers (printing plates)
K45400	Erasing fluid
K45500	Eraser (rubber)
K45600	Other correction materials
K52110	Shaving foams
K52120	Shaving creams and lotions
K52190	Other shaving products
K52210	Body lotions
K52220	Face creams
K52230	Eye creams
K52240	Hands creams
K52250	Leg creams
K52260	Foot creams
K52270	Exfoliating creme
K52280	Depilatories
K52290	Sunbathing creams
K52300	After sun preparations
K52310	(toilet soaps, deodorant soaps, bath foams, shower gels)
K52320	Eye make-up removers
K52330	Make-up removers
K52350	Skin tonic
K52360	Bath salts and oils
K52370	Skin protection preparations
K52380	Face masks
K52390	Face steam bath
K52400	Anti-wrinkle products
K52410	Massage oils
K52420	Body powders
K52430	Products for external intimate hygiene
K52440	Skin-whitening products
K52450	Corn remedies
K52460	Deodorants
K52470	Antiperspirants
K52480	Skin care preparations for babies
K52490	Other skin care preparations
K52510	Hair bleaches
K52520	Hair dye permanent
K52530	Hair dye, semi-permanent
K52540	Hair dye, temporary
K52550	Hair cosmetics
K52560	Hair cleansing products (shampoos, powders etc)

K52570	Lotions for straighten out hair	
K52580	Water undulation lotions	
K52590	Permanent remedies	
K52600	Hair balsam	
K52610	Hair lotion	
K52620	Hair mousse	
K52630	Hair wax	
K52640	Hair spray (hair lacquer)	
K52650	Other hair setting products	
K52660	Hair treatment	
K52690	Other hair dressing products	
K52710	Eye shadow	
K52720	Mascara	
K52730	Liner (kajal)	
K52740	Other Eye make-up	
K52750	Rouge	
K52760	Powder (face)	
K52770	Lipstick and Lip salve	
K52780	Lip liner	
K52790	Other face make-up	
K52800	Nail varnish	
K52810	Nail varnish remover	
K52820	Nail hardner	
K52830	Cuticle remover	
K52840	Other products for nail care and make-up	
K52850	Face paints	
K52860	Artist make-up and effects	
K52870	Body paints	
K52880	Products for tanning without sun	
K52890	Perfumes, toilet waters and eau de Cologne	
K52900	Other cosmetic products	
K52910	Toothpaste for children	
K52920	Toothpaste and other tooth-cleaning products	
K52930	Tooth bleaching	
K52940	Dental plate remedy	
K52950	Tooth rinsing remedies	
K52960	Chewing gum	
K52980	Other tooth and mouth care products	
K55100	Cooling agents	
K60100	Drilling oils	
K60140	Threading oils	
K60150	Honing oils	
K60160	Lubricants for broaching	
K60200	Cooling agents for grinding	
K60250	Other fluids for removing metal	
K60300	Milling oils	
K60350	Other fluids for modelling metal	
K60400	Punching oils	
K60450	Other fluids for cutting metal	
K60500	Other cutting fluids	
L05100	Reagents	
L05200	Indicators (pH-Indicators)	
L05250	Nutritive medium - Chemicals and products that for growing of micro-organisms	
L05300	Other laboratory chemicals	
L10...	Adhesives	
...	10 water based	1 Industrial use
...	20 based on organic thinners	2 Consumer use
...	30 No thinner	
...	40 Powder	
...	50 Cyanoacrylate	
...	60 Hardner for adhesive	
L15100	Flux agents for soldering	
L15200	Soldering metals	
L15990	Other soldering agents	
L20050	Veterinary pharmaceuticals	
L20080	Anaesthesia	
L20100	Pharmaceuticals for organs of digestion and metabolism	
L20200	Pharmaceuticals for blood and blood-generating organs	
L20250	Pharmaceuticals for heart- and circulation	
L20300	Pharmaceuticals for skin treatment (dermatological agents)	
L20400	Pharmaceuticals for the urinary system (not sexual hormones)	

L20430	Sexual hormones (incl contraceptive (P-) pills)		
L20450	Hormones for systemic use		
L20500	Pharmaceuticals for infectious diseases, systemic preparations		
L20600	Pharmaceuticals for muscles, joints and bones		
L20700	Pharmaceuticals for the central nervous system		
L20800	Pharmaceuticals for respiration organs		
L20850	Pharmaceuticals for sense organs		
L20910	AI preparations		
L20920	Cytostatica and immune-suppressive preparations		
L20930	Other therapeutic preparations		
L20940	Diagnostic preparations		
L20960	Diet preparations		
L20990	Other pharmaceuticals		
M05...	Paint and varnish		
...	1 Water based	1 Active biological/biocide function (not antifouling)	1 Interior
...	2 Volatile organic thinner	2 Fire prevention	2 Exterior
...	3 Non volatile organic thinner eg Linseed oil	3 Active corrosion inhibitor	3 Industrial use
...	4 No thinner	4 Decorative/protection	4 Base colour for boats and ships
...	5 Powder based	9 Other (including road-, art-, furniture-, autpaint)	5 Powder based
...	6 Hardeners to paint and varnish		
M08100	Additives for paint and varnishes not mentioned elsewhere in the table Pigments is not to be classified in this code		
M10100	Remover for printing ink		
M10200	Graffiti removers		
M10300	Paint and varnish removers		
M15100	Metal staining agents		
M15200	Non-galvanic metal surface coatings (chromatisising agents)		
M15300	Hardening agents (metal, tarnishing agents)		
M15400	Rust removers		
M15500	Other surface treatment of metal		
O15100	Solvents		
O25100	Moisturizers		
O25200	Dispersion agents (carriers)		
O25300	Emulsifiers		
O25400	Anti foaming agents, foamreducing agents		
O25500	Other surface active agents		
O27100	Surface treatment for paper and cardboard		
O27200	Corroding agent for electronics		
O27300	Corroding agent for glass		
O27900	Other surface treatment for other non-metals		
O30100	Stove black polish		
O40100	Burnishing (bronzing) agents		
O40200	Other oxidation agents		
P01200	Bearing linings		
P01300	Gaskets, unspecified		
P01400	Gaskets for fuel engines		
P01600	Gaskets for pumps,machines, boilers etc		
P01900	Other gaskets		
P05100	PH-regulating agents		
P10050	Polishing agents for rubber materials		
P10100	Polishing agents for lacquers (car wax)		
P10150	Polishing agents for leather (incl shoe polish)		
P10200	Polishing agents for metal		
P10400	Polishing agents for furniture		
P10450	Polishing agents for plastic materials		
P10500	Wax and other polishing preparations for floors		
P10990	Other polishing agents		
P15100	Accelerators		
P15200	Activators		
P15300	Retarders		
P15400	Other inhibitors		
P15500	Catalysts		
P15900	Process regulators		
R03100	Radioactive materials		
R05100	Reduction agents		
R10100	Degreasers (cold degreasing, de-waxing, de-polishing)		
R10130	Drain Cleaners		

R10150	General cleaning/washing agents (floor wash, basic cleaning)
R10160	Auto shampoo
R10250	Glass- and window cleaner (window polish)
R10330	High pressure cleaning/washing agents
R10340	Anti-incrustators
R10350	Lime deposit (calcium) remover
R10370	Cleaning/washing agents for washing machines
R10400	Cleaning/washing agents for dish washing (machines)
R10450	Stove- and grill cleaning agents
R10500	Spot (stain) removers
R10600	Foam cleaning/washing agents
R10700	Windscreen washing agents
R10800	Carpet detergents
R10970	Washing agents for textile (detergents)
R10980	Optical whiteners
R10990	Other cleaning/washing agents
R15100	Cracking indicators
R20100	Underseal materials, incl cavity seals
R20200	Corrosion inhibitors
R20900	Other anti-corrosion materials
R30100	Raw materials for synthesis and intermediate products
R30200	Raw materials for production of glass and ceramics
R30300	Raw materials for production of rubber products
R30400	Raw materials for production of semi-conductors
R30500	Raw materials for production of cosmetics etc
R30600	Raw materials for production of medicament/medicine
R30700	Raw materials for production of metals
R30800	Raw materials for production of plastics
R30900	Raw materials for production of paper
R30990	Other raw materials
S05150	Oil sanitation agents
S05200	Other sanitation agents
S07100	Sensitisers for photocopies
S07200	Sensitisers for serigraphy
S07900	Other sensitisers
S10100	Writing ink
S10200	Ribbons
S10300	Carbon paper
S10400	Self-copying paper
S10500	Spirit markers
S10600	Other writing materials
S15100	Foaming agents for solid materials, plastic, rubber etc
S15200	Foaming agents for liquids
S25100	Rinsing agents (for dish washing machines)
S25500	Rinsing agents (textiles)
S25990	Other rinsing agents
S30100	Sludge treatment preparations
S35100	Abrasives
S40100	Oils and waxes for laths and shutters
S40200	Casting slips for plastic etc
S40300	Slip agents for modelling metal
S40400	Slip agents for sand moulding
S40500	Other anti-setoff agents
S42100	Aroma boosters
S42200	Ensilage means
S42300	Nutrient - (included vitamins)
S42500	Sweetening agents
S42600	Food colours
S42900	Other food and fodder additives
S45110	Base Oils
S45120	Brake grease
S45150	Gear oils
S45170	Stiff (cup) grease
S45180	Motor oils
S45200	Friction-reducing additives
S45250	Additive to lubricating agents
S45300	Other lubricants
S50100	Gunpowder
S50200	Pyrotechnical products
S50900	Other explosives
S60100	Antioxidants (anti-ozonants)

S60150	Anti-siccatives		
S60200	Other stabilizers		
S65100	Moulding compounds		
S70100	Dust laying agents		
S75100	Flux agents for welding		
S75200	Electrodes (welding)		
S75400	Other welding auxiliaries		
S80100	Stimulating agents		
T10200	Toners for photocopies and laserprinters		
T10900	Other toners		
T15...	Printing ink		
...	1 Water base	1 Letterpress printing	2 Metal
...	2 Based on organic thinner	2 Rotogravure	3 Plastic
...	3 No thinner	3 Flexocolour (aniline dye)	4 Fabric
...	4 Powder	4 Offset printing	5 Other
...	5 Hardener to printing inks	5 Serigraphic printing	2 Metal
...	6 Additive to printing inks	6 Fabric printing	
		7 Other	
T20100	Drying agents		
U05100	Padding (filling) materials		
U05200	Stopping material		
U05300	Tightening materials (putty)		
U05340	Sealing agents for rock		
U05350	Curing agents for padding		
U05400	Other filling materials		
V05100	Water softeners		
V10100	Heat transmission agents		
V15100	Thickening agents		
V15200	Gelatinising agents		
V15400	Thixotropic additives		
V15500	Other viscosity-changing agents		
V20100	Vulcanizers		
X05984- X99999	Dummy codes		

## Modelling substance distribution

### Data

Data are given as quantities of substances for the years 2002-2006. For the years 2005 and 2006, substance quantities are distributed over combinations of substance, product and industrial sector (including the private sector). For previous years, only marginal sums for the combinations substance\*product and substance\*sector are given.

Assuming that the distribution of substance quantities over combinations of substance, product and industrial sector (substance\*product\*sector) in 2005-2006 is representative for the distribution pattern in 2000-2004, the latter can be modelled for the period 2000-2004, termed the estimation period, using data for the years 2005 and 2006, termed the modelling period. In order to evaluate the distribution model, a corresponding model is calculated using data for 2006 and subsequently applied to data for 2005. The resulting distribution is then compared to the true distribution in 2005.

### Notation

In the following, capital letters refer to the modelling period and lowercase letters refer to the estimation period. Furthermore, let  $p$  denote product,  $s$  denote industrial sector and  $F$  denote a coefficient called the structure factor. The level of detail of both product and industrial sector codes are as given by the data. The calculations below refer to a given substance. Thus, there is no denotation for substance.

$M_{ps}$  denotes the quantity (in tonnes) of the substance in the modelling period in product  $p$  and industrial sector  $s$ . The quantity  $M_{ps}$  is calculated as the sum of quantities in all declarations with a positive figure and referring to the modelling period and product  $p$  and industrial sector  $s$ .

$M_p$  denotes the total quantity of the substance in the modelling period in product

$$p \quad (M_p = \sum_s M_{ps}.)$$

$M_{.s}$  denotes the total quantity of the substance in the modelling period in industry

$$s. \quad (M_{.s} = \sum_p M_{ps}.)$$

$M$  denotes the total quantity of the substance in the modelling period.

$$(M = \sum_p \sum_s M_{ps}.)$$

$m_p$  denotes the total quantity of the substance in the estimation period in product

$m_s$  denotes the total quantity of the substance in the estimation period in industry

$m$  denotes the overall quantity of the substance in the estimation period.

In principle,  $m = \sum_p m_p$  and  $m = \sum_s m_s$ , but the two sums do not always

correspond in the data. This is due to incomplete declarations. Some products are declared without an industrial sector code and some substances are declared with a sector code but no product type code. However, before any other calculations are carried out, product sums and industry sums must be consistent. Hence, the quotient between the two sums is calculated as  $s_0 = \sum_p m_p / \sum_s m_s$  and a

proportional adjustment of the smallest marginal sum is performed. In the calculations to follow, let  $m = \max(\sum_p m_{p.}, \sum_s m_{.s})$ .

**Method**

For all substances with a positive overall sum in the modelling period, a structure factor is calculated for every product\*sector combination, using the expression:

$$F_{ps} = \frac{M_{ps} \cdot M}{M_{p.} \cdot M_{.s}}, \text{ if } M_{p.} > 0 \text{ and } M_{.s} > 0. \text{ (If } M_{ps} > 0, \text{ then both } M_{p.} > 0 \text{ and } M_{.s} > 0.)$$

Otherwise,  $F_{ps} = 0$ , i.e. both when the product\*sector combination was not observed for the given substance in 2005 or 2006 ( $M > 0$  and  $M_{ps} = 0$ ) and for substances not observed in 2005 or 2006 ( $M = 0$  and  $m > 0$ .)

The quantity sums in the year of estimation are harmonised by adjusting the product or sector quantity proportionally to the largest total sum of the two:

If  $s_0 \leq 1$ , let  $\tilde{m}_{p.} = \frac{m_{p.}}{s_0}$  for all  $p$  and  $\tilde{m}_{.s} = m_{.s}$  for all  $s$ .

If  $s_0 > 1$ , let  $\tilde{m}_{p.} = m_{p.}$  for all  $p$  and  $\tilde{m}_{.s} = s_0 \cdot m_{.s}$  for all  $s$ .

Subsequently, initial quantities for the year of estimation are calculated in one of two ways:

$$\tilde{m}_{ps} = F_{ps} \cdot \frac{\tilde{m}_{p.} \cdot \tilde{m}_{.s}}{m}, \text{ if } m > 0, \text{ and } \tilde{m}_{ps} = 0 \text{ if } m = 0.$$

Then a so-called raking procedure is performed in order to match the estimated quantity distribution with the original distribution between products and industrial sectors in the year of estimation: First, estimates are adjusted so product sums correspond to the original product marginal. This is done using the following calculations:

$$m_{p.}^{(1)} = \sum_s \tilde{m}_{ps}, \text{ which calculates product quantity sums from initial values,}$$

followed by

$$\hat{m}_{ps}^{(1)} = \frac{m_{p.}}{m_{p.}^{(1)}} \cdot \tilde{m}_{ps}, \text{ which yields the first estimate of the product*sector distributed}$$

quantities, when  $m_{p.}^{(1)} > 0$ .

In case  $m_{p.}^{(1)} = 0$ , the distribution over industrial sectors for product  $p$  is calculated from the given general sector marginal by the formula

$$\hat{m}_{ps}^{(1)} = \frac{m_{.s}}{\sum_{s'} m_{.s'}} \cdot m_{p.}$$

Second, the sector sums are calculated using the estimates, by

$$m_{.s}^{(2)} = \sum_p \hat{m}_{ps}^{(1)},$$

followed by an adjustment of the estimates so that they correspond to the given sector marginal, by

$$\hat{m}_{ps}^{(2)} = \frac{m_{.s}}{m_{.s}^{(2)}} \cdot \hat{m}_{ps}^{(1)}.$$

By repeating this procedure many times, the resulting quantity distribution generally concurs well with both the given marginal sums and under the given constraints also concurs as well as possible with the structure factors calculated for the modelling period, i.e. the typical distribution of substance quantities between product\*sector combinations. In each iteration, the following calculations are done

$$m_{p.}^{(n+1)} = \sum_s \hat{m}_{ps}^{(n)}, \hat{m}_{ps}^{(n+1)} = \frac{m_{p.}}{m_{p.}^{(n+1)}} \cdot \hat{m}_{ps}^{(n)}, m_{.s}^{(n+2)} = \sum_p \hat{m}_{ps}^{(n)}, \hat{m}_{ps}^{(n+2)} = \frac{m_{.s}}{m_{.s}^{(n+2)}} \cdot \hat{m}_{ps}^{(n+1)}.$$

The calculations are ended after an adjustment to the given marginal for the product quantities, as this marginal is considered the more reliable of the two and because the emission factors generally vary more between products than between industrial sectors.

Convergence is evaluated by looking at the discrepancy between the sector marginal of the estimated quantity distribution and the true sector marginal over all years. After one initial adjustment to the product marginal followed by 101 iterations, the quantity distributions showed good convergence for most substances.

Thus,  $\hat{m}_{ps} = \hat{m}_{ps}^{(203)}$  was used as the final estimates for the simultaneous distribution. However, for some substances, the convergence of the procedure was very slow, i.e. some discrepancy from the given marginal for industry remains in the final estimates. Among those substances that did not converge well, those with discrepancies of more than 1,000 tonnes and net overall quantity ( $m$ ) exceeding 10,000 tonnes quantities were redistributed manually, in accordance with the true sector marginals. Estimated distributions were manually compared to the sector marginal for more than 20 substances. Adjustments to the quantity distribution were made for 7 substances.

It has been shown that the raking procedure always converges to a result that is closest to the starting values, in the sense of Minimum Discrimination Information Distance (Ruscendorf 1995). Furthermore, other studies have described the iterative proportional fitting procedure (raking) we have used to construct the simultaneous distribution by product and industrial sector, including the proof of convergence when all initial cell values are positive (Ireland and Kullback 1968a, Ireland and Kullback 1968b). The fact that this result extends to the case of non-negative initial values is shown in Sinkhorn (1967).

### Evaluation

The model is evaluated by calculating a similar model with structure factors based on data only from the year 2006 and applying it to the year 2005, but stopping after the second adjustment to the product marginal, i.e. using  $\hat{m}_{ps} = m_{ps}^{(3)}$ . In this

calculation only the first alternative,  $\hat{m}_{ps}^{(1)} = \frac{m_p}{m_p^{(1)}} \cdot \tilde{m}_{ps}$ , came to use in the

calculation of  $\hat{m}_{ps}^{(1)}$ , so that the distribution of a substance\*product combination on industrial sectors in all cases is based on the observed distribution for this substance\*product combination in the modelling year 2006.

For each substance, the necessary percentage of the quantity that must be moved from one product\*industry combination to another (with the same product) to obtain the given simultaneous distribution over product\*industry from the estimated distribution for the year 2005, is calculated using the formula

$$A = \frac{1}{2 \cdot m} \cdot \sum_p \sum_s |m_{ps} - \hat{m}_{ps}^{(3)}| \cdot 100\% .$$

Among 783 substances observed in the data for one of the years 2005 and 2006, there are 695 substances that obtain the correct distribution with this procedure. (Substances with 0 quantity in 2005 are included.) A total of 74 substances have between 0 and 1 per cent of the quantity distributed to the wrong industrial sector, 4 substances have between 1 and 2 per cent wrongly distributed, 2 substances have between 3 and 4 per cent wrongly distributed and the last eight substances have 6, 8, 9, 25, 30, 54, 65 and 97 per cent wrongly distributed. This seems acceptable for a model that uses no other information from the year of estimation than the marginal distributions. A simple model that did not use the industry marginal  $m_s$  was also considered, with a fairly good result. However, the chosen procedure was a clear improvement over this simple model.

**Expected quality of the estimated distribution**

While the evaluation above is based on a model estimated from a one-year modelling period, the applied model is based on a two-year modelling period with correspondingly more data. Distributing substance quantities in an incorrect industrial sector does not necessarily imply that the wrong emission factor is assigned or that the assigned emission factor differs greatly from the correct one. Furthermore, the errors can go in both directions and partly cancel each other out. Still, no mathematical guarantee can be given that the error in the emission estimate is less significant than indicated by the percentage of the substance quantities that have been distributed to the wrong industrial sectors. In theory, a quantity of 990 may be placed in product\*sector combinations with the emission factor 0.001 and a quantity of 10 in a product\*sector combination with the emission factor 0.5, and a quantity of 10 should be moved from the first mentioned to the last mentioned. In this case, only 1 per cent is wrongly distributed, but the emissions are underestimated by 45 per cent. However, in absolute figures, the estimation error will not exceed the amount wrongly distributed between industrial sectors.

In the evaluation, the time between the modelling period and the estimation period is one year, while in the application of the chosen model it is up to 5.5 years. There is reason to believe that the errors in the application will exceed the errors calculated in the evaluation by a factor that is less than the number of years between the modelling period and the estimation period.

In conclusion, the method is considered as suitable for estimating a simultaneous distribution for the purpose of estimating substance emissions. Other sources of error, e.g. the emission factors, are likely to contribute considerably more to the uncertainty in the emission estimates than the errors in the modelled quantity distribution.

## Appendix F

**Raw materials (Intermediates)**

List of substances assumed to be raw material (intermediates) when associated with a product type code for raw material (R30). The selection is based on Fischer et al. (2005). The following substances were added to the list by Fischer et al. 2005: 1,2-dichloroethane (CAS 107-06-2), nickel (CAS 7440-02-0) and zinc (powder) (CAS 7440-66-6).

CAS	Substance name
50-00-0	formaldehyde
50-32-8	benzo(a)pyrene
75-01-4	vinyl chloride
75-07-0	acetaldehyde
75-21-8	ethylene oxide
77-73-6	4,7-methano-1H-indene, 3a,4,7,7a-tetrahydro-
80-05-7	4,4'-Isopropylidenediphen
85-44-9	phthalic anhydride
106-99-0	buta-1,3-diene
107-06-2	1,2-dichloroethane
107-13-1	acrylonitrile
108-95-2	phenol
110-01-0	tetrahydrothiophene
123-77-3	C,C'-azodi(formamide)
127-18-4	tetrachloroethene (PER)
584-84-9	4-methyl-m-phenylene diisocyanate
2425-79-8	1,4-bis(2,3-epoxypropoxy)butane
6864-37-5	2,2'-dimethyl-4,4'-methylenebis(cyclohexylamine)
7440-02-0	nickel carbonate
7440-66-6	zinc
2 228 840	petroleum
64741-53-3	distillates (petroleum), heavy naphthenic
65996-93-2	pitch, coal tar, high-temp.

## Appendix G

## Emission factors

List of emission factors, given for combinations of specific substances (CAS), groups of substances, product types, industrial sectors and whether the substances are considered to be used as raw materials or not.

CAS	Group	Raw material	Product code	NACE	Emission factor
Specified	Non-VOC	No	A01000 - Z99998	27 - 27	0.0001
Specified	Non-VOC	No	A01000 - Z99998	26 - 27	0.001
Specified	Non-VOC	No	B15720 - B15720	Private, 01 - 35	0.9
Specified	Non-VOC	No	B15720 - B15720	35.12 - 99	0.9
Specified	Non-VOC	No	B15720 - B15720	35.11 - 35.11	0
Specified	Non-VOC	No	B25300 - B25300	24 - 24	0.0001
Specified	Non-VOC	No	B25300 - B25300	21 - 23	0.06
Specified	Non-VOC	No	B60100 - B60299	Private, 01 - 22	1
Specified	Non-VOC	No	B60100 - B60299	24 - 99	1
Specified	Non-VOC	No	M05000 - M05999	35.11 - 35.11	0
Specified	Non-VOC	No	R30100 - R30100	21 - 21	0.06
Specified	Non-VOC	No	R30700 - R30700	27 - 27	0.00005
Specified	Non-VOC	No	R30700 - R30700	15 - 37	0.0001
Not specified	Non-VOC	No	A00000 - Z99999	Private, 01 - 99	1
Not specified	Non-VOC	No	A05100 - A05400	Private, 01 - 99	0.1
Not specified	Non-VOC	No	A20100 - A20100	Private, 01 - 99	1
Not specified	Non-VOC	No	A40100 - A40300	Private, 01 - 99	1
Not specified	Non-VOC	No	A45100 - A55100	Private, 01 - 99	0.5
Not specified	Non-VOC	No	A60100 - A60100	Private, 01 - 99	1
Not specified	Non-VOC	No	B15110 - B15120	Private, 01 - 99	1
Not specified	Non-VOC	No	B15130 - B15130	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B15140 - B15150	Private, 01 - 99	1
Not specified	Non-VOC	No	B15310 - B15310	Private, 01 - 23	1
Not specified	Non-VOC	No	B15310 - B15310	25 - 99	1
Not specified	Non-VOC	No	B15310 - B15310	24 - 24	0.0001
Not specified	Non-VOC	No	B15315 - B15360	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B15370 - B15370	Private, 01 - 99	1
Not specified	Non-VOC	No	B15399 - B15399	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B15510 - B15510	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B15550 - B15550	Private, 01 - 99	1
Not specified	Non-VOC	No	B15560 - B15560	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B15710 - B15720	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B15730 - B15730	Private, 01 - 99	0.1
Not specified	Non-VOC	No	B16110 - B16190	Private, 01 - 99	1
Not specified	Non-VOC	No	B16120 - B16120	Private, 01 - 23	1
Not specified	Non-VOC	No	B16120 - B16120	25 - 99	1
Not specified	Non-VOC	No	B16120 - B16120	24 - 24	0.0001
Not specified	Non-VOC	No	B18100 - B18100	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B20100 - B20100	Private, 01 - 23	0.5
Not specified	Non-VOC	No	B20100 - B20100	26 - 99	0.5
Not specified	Non-VOC	No	B20100 - B20100	24 - 25	0.0001
Not specified	Non-VOC	No	B20200 - B20200	Private, 01 - 99	0.1
Not specified	Non-VOC	No	B20300 - B20300	Private, 01 - 23	0.5
Not specified	Non-VOC	No	B20300 - B20300	26 - 99	0.5
Not specified	Non-VOC	No	B20300 - B20300	24 - 25	0.0001
Not specified	Non-VOC	No	B25200 - B25300	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B30100 - B30100	Private, 01 - 99	0.5
Not specified	Non-VOC	No	B35100 - B35200	Private, 01 - 23	0.5
Not specified	Non-VOC	No	B35100 - B35200	26 - 99	0.5
Not specified	Non-VOC	No	B35100 - B35200	24 - 25	0.0001
Not specified	Non-VOC	No	B45100 - B45100	Private, 01 - 99	0.1
Not specified	Non-VOC	No	B50100 - B50100	Private, 01 - 99	1
Not specified	Non-VOC	No	B55100 - B55100	Private, 01 - 22	0.0025
Not specified	Non-VOC	No	B55100 - B55100	24 - 99	0.0025
Not specified	Non-VOC	No	B55100 - B60299	23 - 23	0.00005
Not specified	Non-VOC	No	B55150 - B55150	Private, 01 - 99	0.1
Not specified	Non-VOC	No	B55200 - B55200	Private, 01 - 99	0.000005
Not specified	Non-VOC	No	B55300 - B55300	Private, 01 - 99	0.00125
Not specified	Non-VOC	No	B60100 - B60299	Private, 01 - 22	0.0025
Not specified	Non-VOC	No	B60100 - B60299	24 - 99	0.0025
Not specified	Non-VOC	No	B65100 - B65100	Private, 01 - 99	0.5

Not specified	Non-VOC	No	D15100	-	D15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	D20100	-	D20300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	D25100	-	D25100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	E03100	-	E05100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	E07100	-	E07900	Private, 01	-	99	0.1
Not specified	Non-VOC	No	E10100	-	E10100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	E15100	-	E15100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	E20100	-	E20100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	F05100	-	F05990	Private, 01	-	23	0.5
Not specified	Non-VOC	No	F05100	-	F05990	26	-	99	0.5
Not specified	Non-VOC	No	F05100	-	F05990	24	-	25	0.0001
Not specified	Non-VOC	No	F10100	-	F10100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F10700	-	F10700	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F12100	-	F12100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F15100	-	F15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F20100	-	F20100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	F32100	-	F35400	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F40100	-	F40100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	F45100	-	F45300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F50100	-	F50150	Private, 01	-	99	0.5
Not specified	Non-VOC	No	F50200	-	F50200	Private, 01	-	99	0.1
Not specified	Non-VOC	No	F50300	-	F50300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	G05100	-	G05400	Private, 01	-	99	0.1
Not specified	Non-VOC	No	G10100	-	G10990	Private, 01	-	99	0.5
Not specified	Non-VOC	No	G12300	-	G12900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	G15100	-	G15300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	G30100	-	G30100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	G30200	-	G30200	Private, 01	-	99	0.5
Not specified	Non-VOC	No	G35100	-	G35100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	G40100	-	G40100	Private, 01	-	23	1
Not specified	Non-VOC	No	G40100	-	G40100	25	-	99	1
Not specified	Non-VOC	No	G40100	-	G40100	24	-	24	0.0001
Not specified	Non-VOC	No	H10100	-	H10100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	H10200	-	H10200	Private, 01	-	99	1
Not specified	Non-VOC	No	H15100	-	H15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	H15400	-	H15500	Private, 01	-	99	0.1
Not specified	Non-VOC	No	I05100	-	I05400	Private, 01	-	99	0.5
Not specified	Non-VOC	No	I05450	-	I05500	Private, 01	-	99	1
Not specified	Non-VOC	No	I15100	-	I15600	Private, 01	-	99	0.1
Not specified	Non-VOC	No	K15100	-	K15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K20100	-	K20100	Private, 01	-	23	1
Not specified	Non-VOC	No	K20100	-	K20100	25	-	99	1
Not specified	Non-VOC	No	K20100	-	K20100	24	-	24	0.0001
Not specified	Non-VOC	No	K25100	-	K25300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K35100	-	K35120	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K35200	-	K35200	Private, 01	-	99	1
Not specified	Non-VOC	No	K35300	-	K35300	Private, 01	-	99	0.1
Not specified	Non-VOC	No	K35500	-	K35900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K40100	-	K40100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K45100	-	K45600	Private, 01	-	99	0.1
Not specified	Non-VOC	No	K52120	-	K52300	Private, 01	-	99	0.1
Not specified	Non-VOC	No	K52310	-	K52350	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K52370	-	K52370	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K52490	-	K52490	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K52560	-	K52560	Private, 01	-	99	1
Not specified	Non-VOC	No	K52620	-	K52620	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K52640	-	K52640	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K52890	-	K52900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	K52910	-	K52980	Private, 01	-	99	1
Not specified	Non-VOC	No	K55100	-	K55100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	K60100	-	K60500	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L05100	-	L05300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L10101	-	L10102	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L10201	-	L10301	Private, 01	-	99	0.1
Not specified	Non-VOC	No	L10302	-	L10402	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L10501	-	L10602	Private, 01	-	99	0.1
Not specified	Non-VOC	No	L15100	-	L15990	Private, 01	-	99	0.1
Not specified	Non-VOC	No	L20050	-	L20050	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L20250	-	L20250	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L20600	-	L20600	Private, 01	-	99	0.5
Not specified	Non-VOC	No	L20990	-	L20990	Private, 01	-	99	0.5

Not specified	Non-VOC	No	M05111	-	M05112	Private, 01	-	99	1
Not specified	Non-VOC	No	M05113	-	M05114	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05121	-	M05121	Private, 01	-	99	1
Not specified	Non-VOC	No	M05123	-	M05124	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05131	-	M05131	Private, 01	-	99	1
Not specified	Non-VOC	No	M05133	-	M05134	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05139	-	M05139	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05141	-	M05141	Private, 01	-	99	1
Not specified	Non-VOC	No	M05142	-	M05144	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05149	-	M05149	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05211	-	M05214	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05219	-	M05219	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05223	-	M05224	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05231	-	M05232	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05233	-	M05234	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05239	-	M05239	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05241	-	M05242	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05243	-	M05244	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05249	-	M05249	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05314	-	M05314	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05323	-	M05323	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05333	-	M05334	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05341	-	M05344	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05349	-	M05349	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05413	-	M05413	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05422	-	M05422	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05423	-	M05423	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05432	-	M05432	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05433	-	M05434	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05439	-	M05442	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05443	-	M05444	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05449	-	M05449	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05531	-	M05531	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05533	-	M05533	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05541	-	M05544	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05549	-	M05549	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05613	-	M05614	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05632	-	M05632	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05633	-	M05634	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05639	-	M05639	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05641	-	M05642	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M05643	-	M05644	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M05649	-	M05649	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M08100	-	M08100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M10100	-	M10300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M10990	-	M10990	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M15100	-	M15200	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M15300	-	M15300	Private, 01	-	99	0.1
Not specified	Non-VOC	No	M15400	-	M15400	Private, 01	-	99	0.5
Not specified	Non-VOC	No	M15500	-	M15500	Private, 01	-	99	0.1
Not specified	Non-VOC	No	O05010	-	O05990	Private, 01	-	99	0
Not specified	Non-VOC	No	O15100	-	O15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	O25100	-	O25400	Private, 01	-	23	0.5
Not specified	Non-VOC	No	O25100	-	O25400	26	-	99	0.5
Not specified	Non-VOC	No	O25100	-	O25400	24	-	25	0.0001
Not specified	Non-VOC	No	O25500	-	O25500	Private, 01	-	99	1
Not specified	Non-VOC	No	O27100	-	O27100	Private, 01	-	23	0.5
Not specified	Non-VOC	No	O27100	-	O27100	25	-	99	0.5
Not specified	Non-VOC	No	O27100	-	O27100	24	-	24	0.0001
Not specified	Non-VOC	No	O27200	-	O27200	Private, 01	-	99	0.1
Not specified	Non-VOC	No	O27300	-	O27300	Private, 01	-	99	0.1
Not specified	Non-VOC	No	O27900	-	O27900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	O30100	-	O30100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	O40100	-	O40200	Private, 01	-	99	0.1
Not specified	Non-VOC	No	P01400	-	P01400	Private, 01	-	99	0.5
Not specified	Non-VOC	No	P01900	-	P01900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	P05100	-	P05100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	P10050	-	P10050	Private, 01	-	99	0.1
Not specified	Non-VOC	No	P10100	-	P10100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	P10150	-	P10990	Private, 01	-	99	0.1
Not specified	Non-VOC	No	P15100	-	P15200	Private, 01	-	23	0.1

Not specified	Non-VOC	No	P15100 - P15200	26	-	99	0.1
Not specified	Non-VOC	No	P15100 - P15900	24	-	25	0.0001
Not specified	Non-VOC	No	P15300 - P15300	Private, 01	-	23	0.5
Not specified	Non-VOC	No	P15300 - P15300	26	-	99	0.5
Not specified	Non-VOC	No	P15400 - P15900	Private, 01	-	23	0.1
Not specified	Non-VOC	No	P15400 - P15900	26	-	99	0.1
Not specified	Non-VOC	No	R05100 - R05100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	R10100 - R10160	Private, 01	-	99	1
Not specified	Non-VOC	No	R10250 - R10250	Private, 01	-	99	0.1
Not specified	Non-VOC	No	R10330 - R10330	Private, 01	-	99	0.5
Not specified	Non-VOC	No	R10340 - R10340	Private, 01	-	99	0.1
Not specified	Non-VOC	No	R10350 - R10600	Private, 01	-	99	1
Not specified	Non-VOC	No	R10700 - R10800	Private, 01	-	99	0.5
Not specified	Non-VOC	No	R10970 - R10990	Private, 01	-	23	1
Not specified	Non-VOC	No	R10970 - R10990	25	-	99	1
Not specified	Non-VOC	No	R10970 - R10990	24	-	24	0.0001
Not specified	Non-VOC	No	R15100 - R15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	R20100 - R20900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	R30100 - R30100	Private, 01	-	23	0.1
Not specified	Non-VOC	No	R30100 - R30100	26	-	99	0.1
Not specified	Non-VOC	Yes	R30100 - R30999	Private, 01	-	99	0.0001
Not specified	Non-VOC	No	R30100 - R30999	24	-	25	0.0001
Not specified	Non-VOC	No	R30200 - R30200	Private, 01	-	99	0.00001
Not specified	Non-VOC	No	R30300 - R30300	Private, 01	-	99	0.00005
Not specified	Non-VOC	No	R30500 - R30600	Private, 01	-	99	0.00005
Not specified	Non-VOC	No	R30700 - R30800	Private, 01	-	99	0.0001
Not specified	Non-VOC	No	R30900 - R30900	Private, 01	-	99	0.00005
Not specified	Non-VOC	No	R30990 - R30990	Private, 01	-	99	0.00001
Not specified	Non-VOC	No	S05150 - S05150	Private, 01	-	99	1
Not specified	Non-VOC	No	S05200 - S05200	Private, 01	-	99	0.5
Not specified	Non-VOC	No	S10100 - S10600	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S15100 - S15200	Private, 01	-	99	1
Not specified	Non-VOC	No	S25100 - S25990	Private, 01	-	99	1
Not specified	Non-VOC	No	S30100 - S30100	Private, 01	-	99	1
Not specified	Non-VOC	No	S35100 - S35100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S40100 - S40500	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S42200 - S42200	Private, 01	-	99	0.5
Not specified	Non-VOC	No	S42900 - S42900	Private, 01	-	99	0.5
Not specified	Non-VOC	No	S45110 - S45300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	S50200 - S50200	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S50900 - S50900	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S60100 - S60100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	S60200 - S60200	Private, 01	-	23	0.5
Not specified	Non-VOC	No	S60200 - S60200	26	-	99	0.5
Not specified	Non-VOC	No	S60200 - S60200	24	-	25	0.0001
Not specified	Non-VOC	No	S65100 - S65100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S70100 - S70100	Private, 01	-	99	1
Not specified	Non-VOC	No	S75400 - S75400	Private, 01	-	99	0.1
Not specified	Non-VOC	No	S90100 - S90100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15121 - T15121	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15131 - T15131	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15153 - T15153	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15221 - T15221	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15225 - T15225	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15231 - T15231	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15233 - T15233	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15235 - T15235	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15241 - T15241	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15251 - T15253	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15255 - T15255	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15271 - T15271	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15275 - T15275	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15311 - T15311	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15313 - T15313	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15323 - T15323	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15331 - T15331	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15333 - T15333	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15341 - T15341	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15343 - T15343	Private, 01	-	99	0.1
Not specified	Non-VOC	No	T15351 - T15351	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15353 - T15353	Private, 01	-	99	0.5

Not specified	Non-VOC	No	T15355	-	T15355	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15551	-	T15551	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15553	-	T15553	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15555	-	T15555	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15575	-	T15575	Private, 01	-	99	0.5
Not specified	Non-VOC	No	T15641	-	T15641	Private, 01	-	99	1
Not specified	Non-VOC	No	T15675	-	T15675	Private, 01	-	23	0.5
Not specified	Non-VOC	No	T15675	-	T15675	25	-	99	0.5
Not specified	Non-VOC	No	T15675	-	T15675	24	-	24	0.0001
Not specified	Non-VOC	No	T20100	-	T20100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	U05100	-	U05300	Private, 01	-	99	0.5
Not specified	Non-VOC	No	U05340	-	U05340	Private, 01	-	99	1
Not specified	Non-VOC	No	U05350	-	U05350	Private, 01	-	99	0.1
Not specified	Non-VOC	No	U05400	-	U05400	Private, 01	-	99	1
Not specified	Non-VOC	No	V10100	-	V10100	Private, 01	-	99	0.1
Not specified	Non-VOC	No	V15100	-	V15100	Private, 01	-	99	0.5
Not specified	Non-VOC	No	V15400	-	V15400	Private, 01	-	99	0.1
Not specified	Non-VOC	No	V15500	-	V15500	Private, 01	-	99	0.5
Not specified	Non-VOC	No	V20100	-	V20100	Private, 01	-	99	0.1
Not specified	VOC	No	A00000	-	Z99999	Private, 01	-	99	1
Not specified	VOC	No	A05000	-	A40199	24	-	24	0.0025
Not specified	VOC	No	A05000	-	B14999	20	-	20	0.25
Not specified	VOC	No	A05000	-	B15700	15	-	16	0.25
Not specified	VOC	No	A05000	-	B15700	11	-	11	0.0025
Not specified	VOC	No	A05000	-	B15710	35	-	36	0.25
Not specified	VOC	No	A05000	-	B15710	34	-	34	0.2
Not specified	VOC	No	A05000	-	B15710	26	-	33	0.25
Not specified	VOC	No	A05000	-	B15710	25	-	25	0.25
Not specified	VOC	No	A05000	-	B15710	23	-	23	0.0025
Not specified	VOC	No	A05000	-	B15710	22	-	22	0.55*
Not specified	VOC	No	A05000	-	B15710	21	-	21	0.25*
Not specified	VOC	No	A05000	-	B15710	18	-	19	0.1
Not specified	VOC	No	A05000	-	B15710	17	-	17	0.1
Not specified	VOC	No	A40000	-	A40999	60	-	62	0.1
Not specified	VOC	No	A40200	-	A40300	24	-	24	0.001
Not specified	VOC	No	A40400	-	B15710	24	-	24	0.0025*
Not specified	VOC	No	A55100	-	A60100	93	-	93	0.57
Not specified	VOC	No	B15000	-	B15999	20	-	20	0.15
Not specified	VOC	No	B15120	-	B15120	93	-	93	0.57
Not specified	VOC	No	B15140	-	B15140	93	-	93	0.57
Not specified	VOC	No	B15330	-	B15330	93	-	93	0.57
Not specified	VOC	No	B15710	-	B15710	Private, 01	-	16	0.1
Not specified	VOC	No	B15720	-	B15720	21	-	37	0.3*
Not specified	VOC	No	B15720	-	B15720	15	-	19	0.3*
Not specified	VOC	No	B15720	-	B15720	11	-	11	0.3*
Not specified	VOC	No	B15730	-	B20299	25	-	25	0.25*
Not specified	VOC	No	B15730	-	B20299	24	-	24	0.0025*
Not specified	VOC	No	B15730	-	B54999	35	-	36	0.25*
Not specified	VOC	No	B15730	-	B54999	34	-	34	0.2
Not specified	VOC	No	B15730	-	B54999	26	-	33	0.25*
Not specified	VOC	No	B15730	-	B54999	23	-	23	0.0025*
Not specified	VOC	No	B15730	-	B54999	22	-	22	0.55*
*Not specified	VOC	No	B15730	-	B54999	21	-	21	0.25*
Not specified	VOC	No	B15730	-	B54999	18	-	19	0.1
Not specified	VOC	No	B15730	-	B54999	17	-	17	0.1
Not specified	VOC	No	B15730	-	B54999	15	-	16	0.25*
Not specified	VOC	No	B15730	-	B54999	11	-	11	0.0025
Not specified	VOC	No	B16000	-	B16999	20	-	20	0.15
Not specified	VOC	No	B17000	-	B54999	20	-	20	0.25*
Not specified	VOC	No	B20300	-	B20300	24	-	25	0.001
Not specified	VOC	No	B20400	-	B25299	25	-	25	0.25*
Not specified	VOC	No	B20400	-	B25299	24	-	24	0.0025*
Not specified	VOC	No	B25200	-	B25200	93	-	93	0.57
Not specified	VOC	No	B25300	-	B25300	24	-	25	0.001
Not specified	VOC	No	B25400	-	B54999	25	-	25	0.25*
Not specified	VOC	No	B25400	-	B54999	24	-	24	0.0025*
Not specified	VOC	No	B35200	-	B35200	93	-	93	0.57
Not specified	VOC	No	B55100	-	B55100	Private, 01	-	99	0.0025
Not specified	VOC	No	B55200	-	B55200	Private, 01	-	99	0.000005
Not specified	VOC	No	B55300	-	B55300	Private, 01	-	99	0.00125
Not specified	VOC	No	B60100	-	B60299	Private, 01	-	22	0.0025

Not specified	VOC	No	B60100 - B60299	24	-	99	0.0025
Not specified	VOC	No	B60100 - B60299	23	-	23	0.00005
Not specified	VOC	No	B61000 - E03099	25	-	25	0.25*
Not specified	VOC	No	B61000 - E03099	24	-	24	0.0025*
Not specified	VOC	No	B61000 - H19999	20	-	20	0.25*
Not specified	VOC	No	B61000 - L20999	35	-	36	0.25*
Not specified	VOC	No	B61000 - L20999	34	-	34	0.2
Not specified	VOC	No	B61000 - L20999	26	-	33	0.25*
Not specified	VOC	No	B61000 - L20999	23	-	23	0.0025*
Not specified	VOC	No	B61000 - L20999	22	-	22	0.55*
Not specified	VOC	No	B61000 - L20999	21	-	21	0.25*
Not specified	VOC	No	B61000 - L20999	18	-	19	0.1
Not specified	VOC	No	B61000 - L20999	17	-	17	0.1
Not specified	VOC	No	B61000 - L20999	15	-	16	0.25*
Not specified	VOC	No	B61000 - L20999	11	-	11	0.0025
Not specified	VOC	No	D20300 - D20300	93	-	93	0.57
Not specified	VOC	No	E03100 - E03100	24	-	25	0.001
Not specified	VOC	No	E03200 - H15399	25	-	25	0.25*
Not specified	VOC	No	E03200 - H15399	24	-	24	0.0025*
Not specified	VOC	No	E20000 - E20999	Private, 01	-	99	0
Not specified	VOC	No	F05990 - F05990	93	-	93	0.57
Not specified	VOC	No	G10400 - G10400	93	-	93	0.57
Not specified	VOC	No	H15400 - H15400	24	-	25	0.001
Not specified	VOC	No	H15500 - K35199	25	-	25	0.25*
Not specified	VOC	No	H15500 - K35199	24	-	24	0.0025*
Not specified	VOC	No	I05000 - I05999	20	-	20	0.15
Not specified	VOC	No	I05100 - I05100	93	-	93	0.57
Not specified	VOC	No	I05300 - I05300	93	-	93	0.57
Not specified	VOC	No	I05500 - I05500	93	-	93	0.57
Not specified	VOC	No	I06000 - L20999	20	-	20	0.25*
Not specified	VOC	No	K20100 - K20100	93	-	93	0.57
Not specified	VOC	No	K35200 - K35200	24	-	25	0.001
Not specified	VOC	No	K35300 - L20999	25	-	25	0.25*
Not specified	VOC	No	K35300 - L20999	24	-	24	0.0025*
Not specified	VOC	No	L15000 - L15999	Private, 01	-	99	0
Not specified	VOC	No	M05000 - M05999	25	-	37	0.3*
Not specified	VOC	No	M05000 - M05999	24.4	-	24.7	0.3*
Not specified	VOC	No	M05000 - M05999	24.3	-	24.3	0.001
Not specified	VOC	No	M05000 - M05999	24	-	24.2	0.3*
Not specified	VOC	No	M05000 - M05999	15	-	23	0.3*
Not specified	VOC	No	M05000 - M05999	11	-	11	0.3*
Not specified	VOC	No	M08000 - O04999	35	-	36	0.25*
Not specified	VOC	No	M08000 - O04999	34	-	34	0.2
Not specified	VOC	No	M08000 - O04999	26	-	33	0.25*
Not specified	VOC	No	M08000 - O04999	25	-	25	0.25*
Not specified	VOC	No	M08000 - O04999	24	-	24	0.0025*
Not specified	VOC	No	M08000 - O04999	23	-	23	0.0025*
Not specified	VOC	No	M08000 - O04999	22	-	22	0.55*
Not specified	VOC	No	M08000 - O04999	21	-	21	0.25*
Not specified	VOC	No	M08000 - O04999	20	-	20	0.25*
Not specified	VOC	No	M08000 - O04999	18	-	19	0.1
Not specified	VOC	No	M08000 - O04999	17	-	17	0.1
Not specified	VOC	No	M08000 - O04999	15	-	16	0.25*
Not specified	VOC	No	M08000 - O04999	11	-	11	0.0025
Not specified	VOC	No	M10300 - M10300	93	-	93	0.57
Not specified	VOC	No	O05010 - O05010	Private, 01	-	10	1
Not specified	VOC	No	O05010 - O05010	24	-	99	1
Not specified	VOC	No	O05010 - O05010	23	-	23	0.001
Not specified	VOC	No	O05010 - O05010	12	-	22	1
Not specified	VOC	No	O05010 - O05010	11	-	11	0.001
Not specified	VOC	No	O05020 - O15099	25	-	25	0.25*
Not specified	VOC	No	O05020 - O15099	24	-	24	0.0025*
Not specified	VOC	No	O05020 - R29999	20	-	20	0.25*
Not specified	VOC	No	O05020 - S42100	15	-	16	0.25*
Not specified	VOC	No	O05020 - S42100	11	-	11	0.0025
Not specified	VOC	No	O05020 - Y99999	35	-	36	0.25*
Not specified	VOC	No	O05020 - Y99999	34	-	34	0.2
Not specified	VOC	No	O05020 - Y99999	26	-	33	0.25*
Not specified	VOC	No	O05020 - Y99999	23	-	23	0.0025*
Not specified	VOC	No	O05020 - Y99999	22	-	22	0.55*
Not specified	VOC	No	O05020 - Y99999	21	-	21	0.25*

Not specified	VOC	No	O05020 - Y99999	18	-	19	0.1
Not specified	VOC	No	O05020 - Y99999	17	-	17	0.1
Not specified	VOC	No	O15100 - O15100	93	-	93	0.57
Not specified	VOC	No	O15100 - O15100	24	-	25	0.001
Not specified	VOC	No	O15200 - P15899	25	-	25	0.25*
Not specified	VOC	No	O15200 - P15899	24	-	24	0.0025*
Not specified	VOC	No	O25100 - O25500	93	-	93	0.57
Not specified	VOC	No	P05100 - P05100	93	-	93	0.57
Not specified	VOC	No	P15900 - P15900	24	-	25	0.001
Not specified	VOC	No	P16000 - R29999	25	-	25	0.25*
Not specified	VOC	No	P16000 - R29999	24	-	24	0.0025*
Not specified	VOC	No	R10100 - R10100	93	-	93	0.57
Not specified	VOC	No	R10150 - R10150	93	-	93	0.57
Not specified	VOC	No	R10350 - R10350	93	-	93	0.57
Not specified	VOC	No	R10400 - R10400	93	-	93	0.57
Not specified	VOC	No	R10500 - R10600	93	-	93	0.57
Not specified	VOC	No	R10800 - R10990	93	-	93	0.57
Not specified	VOC	No	R20200 - R20200	93	-	93	0.57
Not specified	VOC	No	R30000 - R30999	93	-	93	0.57
Not specified	VOC	Yes	R30000 - R30999	26	-	28	0.001
Not specified	VOC	No	R30000 - R30999	24	-	25	0.001
Not specified	VOC	Yes	R30000 - R30999	21	-	23	0.001
Not specified	VOC	No	R30000 - R30999	20	-	20	0.15
Not specified	VOC	Yes	R30000 - R30999	15	-	19	0.1
Not specified	VOC	Yes	R30000 - R30999	11	-	11	0.001
Not specified	VOC	No	R31000 - S42199	25	-	25	0.25*
Not specified	VOC	No	R31000 - S42199	24	-	24	0.0025*
Not specified	VOC	No	R31000 - V14999	20	-	20	0.25*
Not specified	VOC	No	S25100 - S25500	93	-	93	0.57
Not specified	VOC	No	S42200 - S42200	Private, 01	-	16	0.1
Not specified	VOC	No	S42200 - S42200	24	-	25	0.001
Not specified	VOC	No	S42300 - X99997	25	-	25	0.25*
Not specified	VOC	No	S42300 - X99997	24	-	24	0.0025*
Not specified	VOC	No	S42300 - Y99999	15	-	16	0.25*
Not specified	VOC	No	S42300 - Y99999	11	-	11	0.0025
Not specified	VOC	No	S50000 - S50999	Private, 01	-	99	0
Not specified	VOC	No	S75000 - S75999	Private, 01	-	99	0
Not specified	VOC	No	V15400 - V15400	20	-	20	0.15
Not specified	VOC	No	V16000 - Y99999	20	-	20	0.25*
Not specified	VOC	No	X99998 - X99998	24	-	25	0.001
Not specified	VOC	No	Y00000 - Y99999	25	-	25	0.25*
Not specified	VOC	No	Y00000 - Y99999	24	-	24	0.0025*

\*Emission factor for 2002 somewhat higher

## Appendix H

## Products contributing most to emissions, by hazard category, 2002-2006. Tonnes emitted

For confidentiality reasons, some high-volume product type had to be included in "Other" for the hazard category "CMR".

Product type	2002	2003	2004	2005	2006
<b>CMR</b>					
Energy goods (motor and heating fuels) (B55)	11 533	10 299	8 639	10 288	9 429
Biocides (B15)	134	105	575	922	952
Raw materials (R30)	743	776	593	788	762
Solvents (O15)	171	185	257	232	241
Binding agents (B20)	604	831	432	471	214
Paint and varnish (M05)	255	321	214	186	188
Insulation materials (I15)	76	81	90	72	91
Adhesives (L10)	88	65	83	78	83
Curing agents (H15)	71	71	86	81	78
Foaming agents (S15)	136	126	134	112	75
Moulding compounds (S65)	81	78	69	42	42
Impregnation (I05)	738	451	49	43	27
Construction materials (K35)	167	81	36	34	14
Other	446	411	422	481	681
<b>Chronic toxic</b>					
Energy goods (motor and heating fuels) (B55)	443	330	271	226	254
Solvents (O15)	157	164	239	223	232
Paint and varnish (M05)	123	102	83	89	94
Adhesives (L10)	68	45	61	58	68
Binding agents (B20)	55	45	41	46	45
Raw materials (R30)	50	37	33	40	34
Process regulators (P15)	12	2	3	16	18
Paint and varnish removers (M10)	9	12	10	9	11
Cleaning products (R10)	28	9	6	7	6
Impregnation (I05)	34	11	11	5	4
Galvano-technical agents (G05)	24	5	4	13	4
Other	71	66	86	78	87
<b>Sensitising</b>					
Paint and varnish (M05)	934	1 097	1 021	825	683
Biocides (B15)	163	128	230	334	477
Binding agents (B20)	201	203	329	153	277
Construction materials (K35)	236	228	214	269	246
Insulation materials (I15)	184	176	184	150	191
Curing agents (H15)	151	135	200	181	174
Flooring materials (G30)	130	107	105	118	152
Filling agents (U05)	95	102	107	122	126
Raw materials (R30)	184	208	179	176	117
Foaming agents (S15)	144	153	141	123	84
Cleaning products (R10)	59	44	62	55	73
Adhesives (L10)	82	72	71	74	68
Moulding compounds (S65)	83	80	71	44	44
Glazing materials, enamels etc. (G15)	68	64	36	34	42
Impregnation (I05)	68	34	143	62	41
Other	165	120	115	139	114
<b>Dangerous for the environment</b>					
Biocides (B15)	488	454	871	1 178	1 394
Insulation materials (I15)	388	623	482	622	736
Bleaching agents (B25)	542	612	860	583	585
Paint and varnish (M05)	468	532	428	363	401
Cleaning products (R10)	360	266	670	611	258
Construction materials (K35)	192	129	131	142	120
Binding agents (B20)	439	472	485	324	96
Foaming agents (S15)	137	127	145	122	85
Flooring materials (G30)	59	63	62	75	80
Colouring agents (F05)	75	90	54	56	78
Adhesives (L10)	55	40	56	69	56
Raw materials (R30)	282	142	114	452	55
Impregnation (I05)	188	285	359	81	47
Enamels, glazing materials and other coatings (G15)	90	65	37	36	43
Moulding compounds (S65)	82	79	70	43	43
Curing agents (H15)	39	55	57	35	42
Rust inhibitors (R20)	26	83	63	8	33
Other	338	332	323	328	345

## Appendix I

## Substances contributing most to emissions, by hazard category, 2002-2006. Tonnes emitted

For confidentiality reasons, some high-volume substances had to be included in "Other" for the hazard categories "CMR" and "Chronic toxic".

CAS	Substance name	2002	2003	2004	2005	2006
<b>CMR</b>						
68334-30-5	fuels, diesel	5 538	4 370	3 336	5 883	6 355
68476-30-2	fuel oil, no. -2	3 434	3 458	2 698	3 657	2 574
50-00-0	formaldehyde	267	246	238	239	425
108-88-3	toluene	465	327	399	379	399
630-08-0	carbon monoxide	211	272	282	249	279
68476-33-5	fuel oil, residual	612	657	307	517	247
65996-93-2	pitch, coal tar, high-temp.	165	137	162	160	171
584-84-9	4-methyl-m-phenylene diisocyanate	246	264	228	207	138
26471-62-5	M-tolylidene diisocyanate	79	103	121	99	101
107-22-2	glyoxal	64	65	79	78	74
108-95-2	phenol	67	41	44	48	59
115-96-8	tris(2-chloroethyl) phosphate	336	364	234	251	56
75-09-2	dichloromethane	58	58	61	52	49
1309-64-4	diantimony trioxide	155	372	109	111	48
96-29-7	2-butanone oxime	66	75	77	55	48
Other		3 481	3 072	3 306	1 847	1 857
<b>Chronic toxic</b>						
108-88-3	toluene	465	327	399	379	399
630-08-0	carbon monoxide	211	272	282	249	279
108-95-2	phenol	67	41	44	48	59
731-27-1	dichloro-N-[(dimethylamino)sulphonyl]fluoro-N-(p-tolyl)methanesulphenamide	18	10	8	13	13
71-43-2	benzene	158	95	22	13	11
111-42-2	ethanol, 2,2'-iminobis-	13	12	7	8	10
1333-82-0	chromium trioxide	41	16	14	9	9
68479-98-1	diethylmethylbenzenediamine	1	1	1	3	7
Other		101	55	73	86	73
<b>Sensitising</b>						
85-44-9	phthalic anhydride	636	723	731	597	448
50-00-0	formaldehyde	267	246	238	239	425
101-68-8	4,4'-methylenediphenyl diisocyanate	223	181	215	252	371
25068-38-6	4,4'-Isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane (Bisphenol-A and epoxy resin)	271	197	206	231	234
108-31-6	maleic anhydride	122	170	161	161	154
584-84-9	4-methyl-m-phenylene diisocyanate	246	264	228	207	138
2855-13-2	3-aminomethyl-3,5,5-trimethylcyclohexylamine	87	137	100	135	106
80-62-6	methyl methacrylate	114	95	80	112	104
1085-98-9	dichlofluanid	120	135	127	91	102
26471-62-5	M-tolylidene diisocyanate	79	103	121	99	101
8006-64-2	turpentine, oil	15	15	72	55	87
8050-09-7	rosin	86	81	182	99	82
107-22-2	glyoxal	64	65	79	78	74
96-29-7	2-butanone oxime	66	75	77	55	48
91-08-7	2-methyl-m-phenylene diisocyanate	80	69	66	57	41
26447-40-5	methylenediphenyl diisocyanate	43	26	24	17	35
Other		429	369	499	373	359
<b>Dangerous for the environment</b>						
1317-39-1	dicopper oxide	506	427	926	876	1 018
7775-09-9	sodium chlorate	750	616	867	910	592
109-66-0	pentane	272	467	296	474	498
25068-38-6	4,4'-Isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane (Bisphenol-A and epoxy resin)	271	197	206	231	234
5329-14-6	sulphamic acid	197	153	589	525	195

12069-69-1	copper(II) carbonate--copper(II) hydroxide (1:1)	109	283	121	119	179
78-78-4	2-methylbutane	59	110	116	108	162
1308-38-9	chromium (III) oxide	174	155	151	150	161
584-84-9	4-methyl-m-phenylene diisocyanate	246	264	228	207	138
2855-13-2	3-aminomethyl-3,5,5-trimethylcyclohexylamine	87	137	100	135	106
1085-98-9	dichlofluanid	120	135	127	91	102
26471-62-5	M-tolyldene diisocyanate	79	103	121	99	101
8006-64-2	turpentine, oil	15	15	72	55	87
142-82-5	heptane	92	78	72	82	75
1314-13-2	zinc oxide	54	39	86	75	68
115-96-8	tris(2-chloroethyl) phosphate	336	364	234	251	56
7440-66-6	zinc	39	58	65	40	52
7779-90-0	trizinc bis(orthophosphate)	40	98	81	25	49
Other		804	751	810	675	623

## Products contributing most to emissions from other sectors than manufacturing industries, by hazard category, 2002-2006. Tonnes emitted

For confidentiality reasons, some high-volume product types had to be included in "Other" for all hazard categories.

Product type	2002	2003	2004	2005	2006
<b>CMR</b>					
Solvents (O15)	138	149	221	207	211
Biocides (B15)	52	39	51	53	203
Paint and varnish (M05)	181	247	158	137	137
Adhesives (L10)	45	44	58	53	57
Binding agents (B20)	44	45	43	52	47
Filling agents (U05)	12	25	21	30	39
Cleaning products (R10)	47	38	39	35	38
Paint and varnish removers (M10)	46	45	41	38	38
Anti-freezing agents (A40)	48	66	4	8	16
Laboratory chemicals (L05)	7	11	10	11	13
Hydraulic fluids (H10)	12	11	12	13	11
Rust inhibitors (R20)	2	3	6	5	10
Polishing agents (P10)	10	3	7	2	5
Construction materials (K35)	115	38	10	12	2
Impregnation (I05)	58	69	20	18	1
Other	33	27	24	18	16
<b>Chronic toxic</b>					
Solvents (O15)	134	145	214	203	207
Paint and varnish (M05)	66	60	48	54	63
Adhesives (L10)	44	42	55	51	54
Cleaning products (R10)	27	9	6	7	6
Other	61	63	102	107	115
<b>Sensitising</b>					
Paint and varnish (M05)	818	969	928	732	563
Biocides (B15)	53	49	136	167	294
Binding agents (B20)	84	83	217	69	168
Flooring materials (G30)	112	92	87	100	131
Filling agents (U05)	82	92	94	110	112
Cleaning products (R10)	42	33	52	47	53
Adhesives (L10)	46	49	40	41	47
Curing agents (H15)	45	46	50	41	41
Insulation materials (I15)	27	26	29	31	37
Impregnation (I05)	24	10	93	47	27
Construction materials (K35)	64	17	18	23	22
Solvents (O15)	1	2	12	6	20
Process regulators (P15)	17	26	23	35	1
Raw materials (R30)	23	18	19	-	-
Other	63	24	26	46	41
<b>Dangerous for the environment</b>					
Biocides (B15)	477	319	647	987	1 086
Paint and varnish (M05)	290	342	300	227	251
Cleaning products (R10)	187	156	158	143	152
Construction materials (K35)	97	67	89	96	88
Flooring materials (G30)	58	61	59	72	77
Colouring agents (F05)	66	82	49	52	57
Filling agents (U05)	11	24	20	28	40
Adhesives (L10)	34	31	34	42	40
Biocides (B16)	3	1	1	36	36

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Impregnation (I05)	30	15	284	60	35
Curing agents (H15)	30	36	35	27	33
Solvents (O15)	13	8	16	11	23
Binding agents (B20)	40	33	192	29	13
Polishing agents (P10)	9	4	8	9	10
Laboratory chemicals (L05)	9	18	8	9	9
Lubricants (S45)	18	8	9	9	7
Rust inhibitors (R20)	8	5	7	5	5
Process regulators (P15)	17	26	24	35	1
Galvano-technical agents (G05)	8	11	2	0	0
Other	31	31	84	100	97

## Substances contributing most to emissions from other sectors than manufacturing industries, by hazard category, 2002-2006. Tonnes emitted

For confidentiality reasons, some high-volume substances had to be included in "Other" for all hazard categories except "CMR".

CAS	Substance name	2002	2003	2004	2005	2006
<b>CMR</b>						
108-88-3	toluene	276	261	332	317	338
50-00-0	formaldehyde	60	64	74	54	208
75-09-2	dichloromethane	55	55	59	50	47
96-29-7	2-butanone oxime	61	71	71	53	45
149-57-5	2-ethylhexanoic acid	67	74	20	25	36
584-84-9	4-methyl-m-phenylene diisocyanate	53	47	43	35	33
85535-85-9	alkanes, C14-17, chloro	11	20	13	22	31
108-95-2	phenol	25	26	27	32	30
127-18-4	tetrachloroethene (PER)	9	15	10	19	22
8007-45-2	tar, coal	30	124	14	19	3
Other		204	114	75	66	47
<b>Chronic toxic</b>						
108-88-3	toluene	276	261	332	317	338
108-95-2	phenol	25	26	27	32	30
731-27-1	dichloro-N-[(dimethylamino)sulphonyl]fluoro-N-(p-tolyl)methanesulphenamide	10	9	7	12	12
Other		21	22	59	61	65
<b>Sensitising</b>						
85-44-9	phthalic anhydride	524	571	594	448	302
101-68-8	4,4'-methylenediphenyl diisocyanate	109	103	108	147	257
50-00-0	formaldehyde	60	64	74	54	208
1085-98-9	dichlofluanid	118	135	126	91	102
2855-13-2	3-aminomethyl-3,5,5-trimethylcyclohexylamine	76	102	82	126	99
25068-38-6	4,4'-Isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane (Bisphenol-A and epoxy resin)	127	81	83	100	87
8006-64-2	turpentine, oil	10	13	71	55	86
80-62-6	methyl methacrylate	61	60	45	79	64
8050-09-7	rosin	71	66	143	75	63
96-29-7	2-butanone oxime	61	71	71	53	45
26447-40-5	methylenediphenyl diisocyanate	38	23	24	17	34
584-84-9	4-methyl-m-phenylene diisocyanate	53	47	43	35	33
5989-27-5	(R)-p-mentha-1,8-diene	22	12	15	17	25
9014-01-1	subtilisin	11	11	14	16	15
731-27-1	dichloro-N-[(dimethylamino)sulphonyl]fluoro-N-(p-tolyl)methanesulphenamide	10	9	7	12	12
108-31-6	maleic anhydride	16	15	18	18	10
112-24-3	trientine	21	42	200	37	5
Other		112	110	105	105	98
<b>Dangerous for the environment</b>						
1317-39-1	dicopper oxide	471	300	791	849	994
1308-38-9	chromium (III) oxide	88	80	105	105	115
1085-98-9	dichlofluanid	118	135	126	91	102
2855-13-2	3-aminomethyl-3,5,5-trimethylcyclohexylamine	76	102	82	126	99
5329-14-6	sulphamidic acid	122	100	130	119	90
25068-38-6	4,4'-Isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane (Bisphenol-A and epoxy resin)	127	81	83	100	87
8006-64-2	turpentine, oil	10	13	71	55	86
142-82-5	heptane	75	66	57	66	61
584-84-9	4-methyl-m-phenylene diisocyanate	53	47	43	35	33
85535-85-9	alkanes, C14-17, chloro	11	20	13	22	31
1314-13-2	zinc oxide	12	14	33	32	29
5989-27-5	(R)-p-mentha-1,8-diene	22	12	15	17	25
2893-78-9	troclosene sodium	9	15	10	19	22

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95-63-6	1,2,4-trimethylbenzene	25	22	20	19	19
731-27-1	dichloro-N-[(dimethylamino)sulphonyl]fluoro-N-(p-tolyl)methanesulphenamide	21	17	17	14	13
7779-90-0	trizinc bis(orthophosphate)	10	9	7	12	12
51580-86-0	troclosene sodium, dihydrate	13	11	16	9	11
112-24-3	trientine	4	8	14	19	11
Other		21	42	200	37	5
		146	183	191	231	212

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