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UBA R+D Project FKZ 204 67 456 / 02

OECD Matrix Project

Branch- and product-related emission estimation tool for manufacturers, importers, and downstream users within the REACH-system

Supplement M2
Developing the ESD Matrix

Results of project part B1

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CHEMIE DATEN

This publication is part of the OECD Matrix Project ("Branch- and product-related emission estimation tool for manufacturers, importers, and downstream users within the REACH-system", UBA R+D Project FKZ 204 67 456).

The results of the OECD Matrix Project are documented in a summary report with six supplements.

The **summary report** contains the main results of the OECD Matrix Project

The additional reports (**supplement M1 – M6**) refer in detail to specific parts of the OECD Matrix Project:

Supplement M1: Developing the Target Funnel [Results of Project Part A]
Supplement M2: Developing the ESD Matrix [Results of Project Part B1]
Supplement M3: The ESD Matrix
Supplement M4: Manual for Emission Estimation, Plastic Additives (Project Part B2)
Supplement M5: IT System Manual (Part I); IT Design Document (Part II) (Project Part B2)
Supplement M6: Document Emission Estimation Photochemicals (Project Part B2)

The summary report and the supplements are available as a zip-file. Please contact us.

R+D Project FKZ 204 67 456/02

Branch- and product-related emission estimation tool for manufacturers, importers, and downstream users within the REACH-system

OECD Matrix Project

Results of Project B1:

Developing the ESD Matrix

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Content

1 The OECD Matrix Project: Background

The aim of the OECD matrix project is to support the use of already-existing emission estimation data for the exposure assessment which is required under REACH.

The overall objective of the project is to develop a set of technical guidance documents (manual and software tools) for emission and subsequent exposure estimation as outlined in annex 1 of the draft REACH Regulation. Such guidance shall be robust and easy to use by manufacturers, importers and downstream users of substances. The conceptual approach shall be based on the methodology laid down in EU TGD on Risk Assessment of New and Existing Substances (2003) and the OECD Emission Scenario Documents (ESD).

The project is divided in two subprojects A und B. This report contents the Results of the first part of subproject B ("phase B1").

The following text concentrates on the analysis of central documents (EU TGD, OECD Emission Scenario Documents) regarding emission estimation data. The following 12 OECD ESDs have been analysed[1]:

- Photographic industry (OECD 2004/D3)
- Plastic additives (OECD 2004/D4)
- Rubber additives (OECD 2004/D7)
- Textile finishing industry (OECD 2004/D5)
- Leather processing (PECD 2004/D8)
- Photoresistant use in semiconductor manufacturing (OECD 2004/D9)
- Lubricants and lubricant additives (OECD 2004/D10)
- Coating application via spray-painting in automotive refinishing (OECD 2004/D11)
- Metal finishing (OECD 2004/D12)
- Printing (Draft, UBA 2003)
- Paints, lacquers and varnishes in coatings industry (draft, OECD 2003/D20)

The emission estimation data in these documents have been structurally analysed for the main drivers of emissions.

Emission scenario documents often describe several emission situations ("scenarios"). In order to support the use of these information, for each of the documents such subsets of data referring to a specific emission situation have been identified. These subsets are called "**emission estimation modules**" (EEMs). They have been allocated to a matrix built of the industrial categories and the life cycle stages that are used in the TGD (see annex 1 and chapter 2.2).

[1] In the references, the appendix „D" is a project-specific sorting element and does not refer to the number of the OECD Emission Scenario Document.

2 Results of project phase B1

2.1 Analysis of central documents

Public available data on emission estimation. Within the EU TGD and the OECD emission scenario documents, a large amount of branch-specific emission data has been published. The A-tables of the EU TGD contain release factors for 16 industrial categories regarding the different life cycle stages (mainly production, formulation and industrial use, some information for professional, and private use as well as service life, waste disposal and recovery (see annex 2, annex 3 and chapter 2.2). The B-tables of the EU TGD give default values for the size of a local source (fraction of the main source) and the number of release days per year. In total, the EU TGD contains 31 A-tables and 47 B-tables. The tables in annex 2 and 3 allocate the A- and B-tables to the industrial categories and the life cycle stages.

The OECD Emission Scenario Documents published so far contain a lot of branch-specific data on processes, chemicals used and emission patterns. The OECD emission scenario documents are mainly referring to emissions to the environment. Only in a few[2] cases, emissions and exposures of humans (occupational health) are considered, too.

Structuring the information of a single document. For each of the documents analysed, an Emission Scenario Profile (ES profile) has been prepared (see annex 6). These profiles give a first overview on the structure and the contents of the documents. The total information on emission given in these documents can be subdivided into smaller sets of data referring to specific emission situations. We call such a data set an “Emission Estimation Module” (EEM).

In total, more than 59 emission estimation modules (EEMs) have been identified (see annex 4). For an individual emission scenario document, they are structured using the so-called “mini-matrix” (see fig. 1). It shows directly which life cycle stages and which environmental compartments are addressed by emission estimation data. An example is given in the following figure 1.

Fig. 1 Mini matrix for the OECD Emission Scenario Document on Plastic additives (OECD 2004/D4), IC 11 Polymers Industry.

<table>
<tr><th></th><th>Production</th><th colspan="2">Raw materials handl. formulation</th><th>Industrial use / processing / conversion</th><th>Private use</th><th>Service life</th><th>Waste / recovery</th></tr>
<tr><td>Water</td><td rowspan="3">Not discussed</td><td>EEM 11.1</td><td>EEM 11.3</td><td>EEM 11.5</td><td rowspan="3">Not discussed</td><td>EEM 11.7</td><td>EEM 11.9</td></tr>
<tr><td>Air</td><td>EEM 11.2</td><td>EEM 11.4</td><td>EEM11.6</td><td>EEM11.8</td><td>EEM 11.10</td></tr>
<tr><td>Soil</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Waste</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

[2] E.g. OECD emission scenario document on photoresist use in semiconductor manufacturing (OECD 2004/D9), EEM IC4.EX (the extension „EX“ is given for data sets regarding in addition the resulting exposure situation).

Minimatrices for all ESDs analysed so far are given in annex 5. It is recommended to introduce this element in the ESDs, which are developed in future.

Scale: The emission estimation modules in the matrix cells address local as well as regional emissions. For the life cycle stages production, formulation and industrial use, a local concentration is estimated, based on the production volume of the registrant. Additionally, a regional background concentration can calculate based on 100% of the European production volume. For substances in wide disperse use (private use) or for emissions from service life of articles safety is assessed for the regional scenario.

Interface to appropriate fate models: The OECD ESDs concentrates on emission estimation. Interfaces to environmental fate models are described in some cases for the aquatic environment. Calculations of the PNEC are included in the OECD document on photochemicals. Fate models are described in detail, e.g. in the EU TGD (2003).

2.2 The ESD Matrix

Supporting data access by the ESD matrix. In order to have an overview, which data sets are available for specific industrial categories (ICs) and life cycle stages, all emission scenario modules together are allocated within the ESD matrix. This matrix shows for each industrial category, which A- and B-tables are relevant and whether there are additional information available from OECD emission scenario documents (if this is the case, a short description of the module as well as the reference are provided). The matrix is given in annex 1 of this report.

Covering of life cycle stages: Most of the emission estimation data identified from OECD ESDs refer to the life cycle stages formulation and industrial use. In all cases, for estimations during the production of the chemicals, the appropriate A- and B-tables of the TGD have to be considered. For all other life cycle stages, A- and B-tables as well as emission estimation data from OECD ESDs are available only in some cases (see the ESD matrix, annex 1. For an overview on available A- and B-tables, see annex 2 and annex 3).

The life cycle stage “professional use” is not addressed explicitly in the A- and B-tables of the TGD, neither in the OECD ESDs. For the life cycle stage “Private use”, five A-and six B-tables are available. For the application of decorative paints (IC 14), an additional emission estimation module for general public use is available (EEM 14.12).

For the life cycle stages “service life” and “recovery”, no A- and B-tables are available. The OECD ESDs on plastic additives (OECD 2004/D4), on rubber additives (OECD 2004/D7) and on textile finishing (OECD 2004/D5) describe different types of emissions during service life. Emissions during recovery of chemicals are described for photochemicals (EEM 10.3, OECD 2004/D3).

2.3 Structural analysis of ESDs and generic emission drivers

Differences and similiarities. The analysed OECD ESDs show a broad variety regarding

- Number and complexity of industrial branches covered;
- Number and complexity of processes covered;
- Life cycle stages covered;
- Detailed description of types of chemicals used and their emission behaviour;
- Detailed description of typical point sources, including size and emission pattern;
- Description of branch-specific and process-specific emission drivers.
- Number of emission scenarios;
- Structure of the emission rate formulas.

The OECD ESD (draft) on paints, lacquers and varnishes (OECD 2003/D20) is a good example for a document covering a broad range of industrial applications, from internal lacquering of beverage cans (EEM 14.17 and EEM 14.18) up to the application of coil coatings (EEM 14.20) and the application of marine coatings (EEM 14.21). Just the opposite, the OECD draft on automotive refinishing (OECD 2004/D11) describes exclusively one specific process (spray-painting) (EEM 14a.1-EEM 14A.6). The other emission scenario documents are located in between these two examples. The document on lacquers and varnishes gives highly aggregated emission estimates (OECD 2003/D20). In such cases it is difficult to identify the single emission drivers contributing to the total emission.

Branch-specific data are given in all ESDs analysed so far. In some cases, the emission rate formulas contain branch-specific factors. E.g. are the raw hide-reduction factor for leather industry (“fraction of remaining mass from raw hide”, EEM 7.1, OECD 2004/D8), the fraction of photoresist adhering to the wafer in semiconductor manufacturing (EEM 4.1-4.5, OECD 2004/D9) and the spray gun transfer efficiency (OECD 2004/D11). (More examples are given in the emission scenario profile, see annex 6).

A short structural characterisation of the OECD ESDs regarding these aspects is given in the related ES profiles (see annex 6). A deeper structural analysis has been made with some of the OECD ESD, looking especially for the relevant emission and related default values.

Generic emission drivers. In spite of the structural differences mentioned above, it seems that most of the emission situations can be characterized by a specific combination of a restricted number of emission drivers. These "generic" emission drivers are given in table 1.

Table 1 Proposed generic emission drivers.

Driver	
(1) Physical-chemical properties of substances	
(2a) Used amount per time (2b) Frequency and duration of use	Qprod Temis
(3) Partitioning between manufactured good (preparation, (semi)finished article) and losses; driven by • Technology • IPPC[3]	Fx
(4a) On-site emission control measures including partitioning between air/water and external waste treatment	$Fabat_1$
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$
(5) Losses from articles during service life driven by type of use, conditions of use and matrix type • Service life time • Erosion intended/not intended • Surface: volume ratio of matrix • Physical-chemical conditions mitigating losses (temperature weathering, water contact)	
(6a) On-site emission control measures, including partitioning between air/water and external waste treatment in disposal of articles after service life (municipal).	
(6b) External emission control measures at secondary waste disposal site.	

[3] The integrated prevention part belongs to driver 3, the integrated pollution control part belongs to driver 4a.

The branch-specific elements of emissions can probably be understood as modulations of these generic emission drivers. In this case, it should be possible to use the following generic formula as a starting point for emission estimation:

$$E = \frac{Q_{product} * C_{chemical} * F_x * \prod_{j=1}^{n} (1 - F_{abatement\,j})}{T_{emission}}$$

-Formula 1-

With

E emission rate [kg.d^{-1}]

$Q_{product}$ the quantity processes or used per time period [kg.yr^{-1}] (from ESD)

$C_{chemical}$ the concentration of the chemical in the product [kg.kg^{-1}] (from ESD)

F_x relevant emission factor [-] (from matrix emission module)

$F_{abatement}$ efficacy factor for abatement technique (RMM) [-] (from ESD,model or database)

$T_{emission}$ the emission period [d.yr^{-1}] (from ESD or B-table of EU TGD)

A good example for a specific modulation of this formula can be found in the OED ESD on leather processing (OECD 2004/D8). The following formula describes the local emission of a chemical to waste water from leather processing:

$$\mathrm{Elocal}_{\text{x-water}} = Q_{rawhide} \times F_{remaining-mass} \times Q_{chemical-formulation} \times F_{chemical} \times (1 - F_{fixation}) \times F_{daily-production} \times (1 - F_{on-site-treatment})$$

In the project B2, stand-alone emission estimation IT tools will be developed for two branches. The formula –1- given above will be the core of the modules. Within this basic formula for emission estimation, placeholders are inserted for branch-specific emission factors.

Read-across of EE modules: The branch-specific elements of emissions can probably be understood as modulations of the generic emission drivers described above. In this case, it should be possible to have a multiple use of existing emission estimation data sets from OECD ESDs, even if they have been developed in the context of a certain industrial category. It should be possible to convert existing emission scenarios in generic elements characterized by a distinct set of emission drivers. They would become applicable to all emission situations with the same setting of emission drivers. As a consequence, many of the cells of the ESD matrix may become filled which appears to be blank at the moment.

This thesis will be examined by the work with two supply chains in project phase B2.

2.4 Coverage of branch- or company-specific abatement measures

Branch- or company-specific abatement measures. Internal and external risk management measures are one of the key factors determining emissions. The measures can be branch- or process-specific. Under REACH, abatement techniques are part ot the risk

management measures. Abatement measures can include industrial or municipal waste disposal and waste water treatment. It can be distinguished between general applicable abatement measures vs. substance or process specific measures (e.g. removing heavy metals from electroplating solutions). The measures can be integrated, end-of-pipe, on-site or external (see also table 1, chapter 2.3 of this report). In each life cycle stage, abatement techniques can be relevant.

The OECD ESDs do not consider abatement measures in a uniform matter. In some documents, general or branch specific abatement measures are listed (e.g. clean room conditions, use of closed systems (OECD 2004/D9, OECD 2004/D11), good house keeping (OECD 2004/D10, Dust filters, VOC treatment, vacuum cleaners, (OECD 2003/D20). Only in single cases quantitative default values for the efficacy are given – for an example see the following table 2 with data from the OECD ESD on the coating industry (OECD 2003/D20):

Table 2 Assumed values for the efficiency of the different emission treatment techniques during the manufacture of organic solvent borne coatings (batch size of 10.000 litres or greater). OECD 2003/D20, p. 47

Treatment	*Efficiency of the capture device*	*Scrubbing efficiency*
Dust filter	0.97	0.99
VOC treatment	0	0
Vacuum cleaners	0.90	(1)

More often, abatement measures are not described in detail – but during determination of release factors it is assumed that standard abatement techniques are applied. In the emission scenario for HPV intermediates (EU TGD, 2003), in-plant-treatment (e.g. activated carbon treatment and precipitation) is already included in the factors. In these cases it is not possible to identify specific abatement-factors for the modelling of the emission situation. In some cases it is not clear, whether wastewater treatment is included in the emission estimations or not.

This difficulty regards to end-of-pipe-measures and - to an even larger extend - to process-internal and integrated measures. Integrated pollution prevention measurers are more difficult to quantify compared to onsite-pollution control. Integrated pollution and prevention control (IPPC) standards aim at minimising the primary losses from processes (prevention) and optimising the overall efficiency of secondary abatement techniques. This usually includes choices to which extent abatement takes place at production site, at public wastewater treatment or at special waste treatment facilities (including recycling). Where and at which rate the emission takes place at the end, is a question of environmental legislation and costs. This kind of “industrial waste processing” is not yet well reflected in the TGD supply chain model and the subsequent methodology neither in the OECD ESDs.

Abatement factors: For the emission and the exposure assessment under REACH, risk management measures are an important interface for responsibility. Within an exposure scenario, the manufacturer describes how he controls exposure and which measures he recommends downstream users to take. As a consequence, consideration of abatement

measures becomes an essential element of emission estimation. Regarding the present situation of abatement factors within ESDs, the following recommendations are made[4]:

- It should be clearly indicated whether published ESDs contain quantified abatement-factors.
- For standard techniques of risk management, standard values for efficacy should be determined which can be used as default values within emission estimates[5]. It is recommended to use standard measures as reference points, not maximum measures. If possible, values for best available techniques can be given additionally (for refinement options).
- Packages of abatement measures (and corresponding factors for packages) are more appropriate than a huge number of specific, stand alone measures. Packages/ cluster modules (combinations of individual measures) give more degrees of freedom to select individual measures without the need to communicate them. Abatement techniques are part of the risk management measures.
- It would be a great advantage to get the knowledge from down-stream companies on their standard measures currently applied into the system (inventory of possible techniques/techniques-in-use). The emission estimation tools should support the use of this knowledge for the emission estimation work.
- It would be helpful to have stand alone ESDs for external abatement techniques rather than addressing external abatement in UC-ESDs or IC-ESDs.

Possibilities to include the effect of risk management measures into the emission estimations will be checked and elaborated exemplary in the two supply chains chosen for IT tool development in project phase B2.

2.5 Structural agreement of the ESD and the IC/UC-approach to the supply chain structure of REACH

Emission estimation data and the existing IC/UC system. For exposure assessment of existing and new substances, a system of 16 industrial categories and 55 use categories (some of them are divided into subcategories) has been described in the TGDs[6]. Different categorization systems have been discussed which could support the identification of appropriate emission estimation data by producers, importers or downstream users of substances, which have been studied in detail in subproject A. Conclusions from this discussion are:

- As main identifiers the industrial category and the use category are still useful.

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4 This point has been intensively discussed together with the colleagues of RIVM and UBA and with the members of the steering group (meeting on 29.th January 2005).

5 A project on abatement techniques and emission estimates is planned in the Netherlands by the RIVM.

6 As an additional element, “main categories” are used in the TGD: Main category I (use in closed system, further distinction made between Ia, Ib, Ib formulation, Ic, Ic formulation), MC II (inclusion into or onto a matrix, further distinction made between II formulation, II processing), MC III (further distinction made between III, III FO, III Processing), MC IV (dispersive use). For emission estimation, these classifications are not specific enough.

- Additional specifications are included in some of the OECD emission scenario documents itself – e.g. 15 subtypes of plastic additives in the document on plastic additives (OECD 2004/D4). These identifiers should consider the branch-specific terminology (regarding product groups, product subgroups, technical functions of a substance, technical functions of preparations, product types, compound types, process types, abatement techniques).
- As part of subproject A, a refinement of the IC/UC-approach will become available. Some ICs may be extended, some UCs may be clarified. This could be an important input in the on going discussion on use- and exposure categories in REACH.
- For sufficient information on emissions and exposures through the supply chain the life cycle stage of formulation is a key step. Within the given TGD supply chain model, for the life cycle stage "formulation" the focus is set on emissions due to mixing or blending. This IC structure does not reflect the fact, that formulators themselves often use preparations as input for their formulations. In these cases, "formulation" takes place in a two step process:
  - Step 1: Production of a preparation (mixture of substances), done by the step-1-formulator. E.g.: production of a pH-stabilizing agent, which can be used in varnishes, optical brighteners or other formulations. Sometimes step-1-formulators are called "performance package manufacturers". They are close to the manufacturer of the chemicals. Often they produce their performance packages for a broad range of uses, which they do not necessarily know in detail.
  - Step 2: Use of this preparation as a raw material for the production of a specific formulation (mixture of substances, often containing preparations), done by the step-2-formulator. In most cases, step-2-formulators know their clients and the conditions of use of their formulations very well. But often they do not know the composition of the preparation, which they buy from the "performance package producers", the step-1-formulators.

  Step-1-formulators have knowledge on the composition of performance packages; step-2-formulators have knowledge on the products and processes in which the substances are used further down the chain. Both types of formulators together have the knowledge necessary to do the exposure estimation duties under REACH. Knowledge of the preparation type could become important information in order to find the appropriate emission scenario data set. As a supplement to the existing IC/UC-structure of the EU TGD, we recommend to split the life cycle stage "formulation" in two sub-stages. (For further information, see annex 7).

A generic supply chain model for REACH has been further elaborated within the two supply chains selected for IT tool-development in this project. It is documented in chapter 3 of the Matrix Summary Report.

3 Further Results

Public awareness of already existing emission estimation data. The EU TGD and the OECD ESDs are rarely known or used in the existing supply chains – in spite of the fact, that the OECD ESDs have been developed in cooperation with companies and industry associations. Therefore the use of this information by the actors of REACH requires intensive communication work.

Further documents containing emission estimation data.

- In addition to the EU TGD and the OECD ESDs analysed in project phase B1, further data sources with relevance for emission estimation exist for several branches (see annex 8)..

Identified emission estimation data from these sources can be documented as emission estimation modules. They can be allocated to specific cells of the ESD Matrix in the same way as described above for data sets from OECD ESDs.

4 Recommendations for the future work from project Part B1

The following recommendations have been developed during the first phase of project Part B of the OECD Matrix Project. The conclusions and recommendations from all parts of the OECD Matrix Project are given in chapter 7 of the Matrix Summary Report.

1. In each ESD a table should be included to show which ICs, UCs, MCs (see food note 5), RMMs and process types have been taken into consideration.
2. The distinct emission scenarios of an ESD could be marked as emission estimation modules. A mini-matrix (see fig. 1) can show at a glance which life cycle stages and which environmental compartments are addressed and can be included in an ESD, too.
3. New identified emission estimation module can be allocated to the ESD matrix. This matrix can serve as a reference point for the selection of appropriate data sets for emission estimation.
4. Risk management measures should be addressed clearly in emission estimates. A list of standard techniques including default values for efficacy would be a very useful instrument (see chapter 2.4).
5. Data on the emission pattern in space and time (duration, frequency, special distribution, emissions during service life) should be part of ESDs in future.
6. The generic formula for emission estimation (formula 1, see chapt. 2.3) should be tested as core element of a module. This core element can be adapted to branch-specific emission situations.
7. As a supplement to the existing IC/UC-structure of the EU TGD, the life cycle stage “formulation” should be splitted in two sub-stages (production of a preparation and production of a specific formulation for DUs). This will be further elaborated within the two supply chains selected for IT tool-development in this project.

8. The industrial category “Others” (IC 0/15) should be diversified (approximately 40% of the industrial applications belong to this category).
9. The existing data on emissions of chemicals (ESDs resp. emission estimation modules) should be transformed into an electronic library system. From this system, the substance manufacturer can learn about the conditions of use and the factors driving the emission in his markets. Measures suitable to ensure safe use can be selected from this system.
10. The library systems need a navigation system, to identify the most appropriate module for a certain combination of preparation type, industry sector, life cycle stage, substance function and substance properties and process type.
11. Stand-alone IT tools should be developed which support the calculation of the emissions depending on the process type, the conditions of use and the measures applied. This follows as part B2 of the project for two supply chains. The Results from this work might be useful as a blueprint for similar tool developments in other supply chains.

5 References

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OECD 2004/D8: OECD Series on Emission Scenario Documents, No. 8, Emission scenario document on leather processing. OECD, Environment Directorate, June 2004.

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OECD 2004/D12: OECD Series on Emission Scenario Documents, No. 12, Emission scenario document on metal finishing. OECD, Environment Directorate, November 2004.

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Annex 1: The ESD Matrix

➔ see additional file **Supplement M3**

Annex 2: Allocation of A-tables[1] of EU TGD on Risk Assessment (2003)

IC	**Allocation of A-tables**	**Life cycle stages**								**Environmental compartment**			
		production	***formulation***	***industrial use***	***prof. use***	***private use***	***service life***	***recovery***	***waste disposal***	***waste-water***	***air***	***soil***	
1	**Agricultural industry**	***A1.1***	***A2.1***	A3.1									
2	**Chem. industry: Basic chemicals**	***A1.1***	***A2.1***	A3.2									
3	**Chem. industry: Chemicals used in synthesis**	**A1.1** or A1.2	***A2.1***	A3.3									
4	**Electrical/electronic engineering industry**	***A1.1***	***A2.1***	A3.4									
5	**Personal/domestic**	**A1.1** or A1#	***A2.1 or*** A2#			A4.1							
6	**Public domain**	**A1.1** or A1#	***A2.1 or*** A2#	A3.5									
7	**Leather processing industry**	**A1.1** or A1.3	***A2.1***	A3.6									
8	**Metal extraction industry, refining, and processing industry**	***A1.1***	**A2.1** A2.2	A3.7									
9	**Mineral oil and fuel industry**	***A1.1***	***A2.1***	A3.8		A4.2							
10	**Photographic industry**	***A1.1***	**A2.1** A2.3	A3.9		A4.3			A5.1				
IC	**Allocation of A -tables**	**Life cycle stages**								**Environmental compartment**			
		production	***formulation***	***industrial use***	***prof. use***	***private use***	***service life***	***recovery***	***waste disposal***	***waste-water***	***air***	***soil***	

11	**Polymers industry**	***A1.1***		***A2.1***		A3.10 or	A3.11							
12	**Pulp, paper, and board industry**	***A1.1*** *or*	*A1.3*	***A2.1***		A3.12 or	A3.13				A5.2			
13	**Textile processing industry**	***A1.1*** *or*	*A1.3*	***A2.1***		A3.14			A4.4					
14	**Paints, lacquers, and varnishes industry**	***A1.1***		***A2.1***		A3.15			A4.5					
16	**Engineering industry: Civil and mechanical**	***A1.1***		***A2.1***		A3.16			A3.16					
0 / 15	**Others**	***A1.1***		***A2.1***		A3.16								
	Number of tables	**4 (= 1**	+ 3)	**4 (= 1**	+ 3)	**16**		0	**5** (+1)	0	0	**2**	**In total:**	***31 A-tables***

[1] If several A-tables are listed the selection of the respective table depends on the use category and/or the tonnage level.

Annex 3: Allocation of B-tables[1] of EU TGD on Risk Assessment (2003)

IC	Allocation of B-tables	Life cycle stages														Environmental compartment			
		production				*formulation*			*industrial use*		*prof. use*	*private use*		*service life*	*recovery*	*waste disposal*	*waste-water*	*air*	*soil*	
1	Agricultural industry	*B1.1*	*B1.2*	*B1.3*	*B1.4*	*B2.1*	*B2.2*	*B2.3*	*B3.1*											
2	Chem. industry: Basic chemicals	*B1.1*		*B1.5*		*B2.4*		*B2.5*	*B3.2*											
3	Chem. industry: Chemicals used in synthesis	B1.2		B1.6		*B2.3*		*B2.4*	B3.2											
4	Electrical/electronic engineering industry	*B1.6*		*B1.7*		*B2.3*		*B2.4*	*B3.2*											
5	Personal/domestic	*B1.6*		*B1.7*		B2.1		B2.3				B4.1	B4#							
6	Public domain	*B1.6*		*B1.7*		B2.1		*B2.3*	*B3.3*											
7	Leather processing industry	B1.4		B1.8	B1.9	B2.3	*B2.4*	*B2.6*	B3.4											
8	Metal extraction industry, refining, and processing industry	*B1.2*	*B1.4*	*B1.6*	*B1.10*	*B2.3*		*B2.4*	B3.5	B3.6										
IC	Allocation of B-tables	Life cycle stages														Environmental compartment			

		production				*formulation*			*industrial use*		*prof. use*	*private use*		*service life*	*recovery*	*waste disposal*	*waste-water*	*air*	*soil*	
9	**Mineral oil and fuel industry**	*B1.1*	*B1.2*	*B1.4*	*B1.11*	*B2.6*	*B2.7*	*B2.8*	*B3.7*			B4.1								
10	**Photographic industry**	*B1.4*		*B1.12*		B2.3		B2.8	B3.8			B4.2				B5.1				
11	**Polymers industry**	*B1.4*	*B1.9*	*B1.13*	*B1.14*	*B2.3*	*B2.8*	*B2.9*	B3.9											
12	**Pulp, paper, and board industry**	*B1.4*	*B1.8*	*B1.9*		*B2.1*	*B2.3*	*B2.8*	B3.10							B5.2				
13	**Textile processing industry**	*B1.2*		*B1.6*		*B2.3*		*B2.10*	*B3.11*	*B3.12*		B4.3								
14	**Paints, lacquers, and varnishes industry**	*B1.2*		*B1.6*		*B2.3*		*B2.10*	*B3.13*			B4.4	B4.5							
16	**Engineering industry: Civil and mechanical**	*B1.2*		*B1.6*		*B2.3*		*B2.8*	*B3.14*			B4.5								
0 / 15	**Others**	*B1.2*		*B1.6*		*B2.3*		*B2.8*	*B3.14*			B4.5				B5.3				
	Number of tables	***14 B-tables***				***10 B-tables***			**14 B-tables**		0	**6 B-tabl.**		0	0	**3 B-tabl.**	**In total:**	***47 B-tables***		

[1] If several B-tables are listed the selection of the respective table depends on the use category and/or the tonnage level.

Annex 4: List of emission estimation modules (EEMs)[1]

EEM IC 4.1: Emission scenario for release of photoresist from transport container residues. Emission collected as waste (OECD ESD No. 9, 2004/D9, p. 13).

EEM IC 4.2: Emission scenario for release of photoresist from equipment cleaning. Emission collected as waste (OECD ESD No. 9, 2004/D9, p. 13).

EEM IC 4.3: Emission scenario for release of photoresist from dispensed photoresist. Emission to waste (OECD ESD No. 9, 2004/D9, p. 14).

EEM IC 4.4: Emission scenario for release of photoresist from developing the wafer. Emission collected as waste water (OECD ESD No. 9, 2004/D9, p. 15).

EEM IC 4.5: Emission scenario for release of photoresist from etching and stripping of wafer. Emission collected as waste (OECD ESD No. 9, 2004/D9, p. 15).

EEM IC 7.1: Emission scenario for release of chemicals used in leather processing. Emission to waste water (OECD ESD No. 8, 2004/D8, p. 27).

EEM IC 8.1: Release of a water-miscible cooling lubricant emulsion in the watery phase during waste / recovery treatment (Baumann, 1999/D18, p. 15 – 17).

EEM IC 8.2: Release of an aquaeous cooling lubricant solution in the watery phase during waste / recovery treatment (Baumann, 1999/D18, p. 19).

EEM IC 10.1: Release of photochemicals by the use of processing solutions (OECD ESD No. 5, 2004/D3, p. 11 – 21).

EEM IC 10.2: Release of ingredients of the emulsion layer of the photographic material during processing (OECD ESD No. 5, 2004/D3, p. 25 – 26).

EEM IC 10.3: Release of photochemicals during waste disposal of used processing baths by specialised disposal companies (OECD ESD No. 5, 2004/D3, p. 22 – 25).

EEM IC 11.1: Release of additives from materials handling to water (OECD ESD No. 3, 2004/D4, p. 32).

EEM IC 11.2: Release of additives from materials handling to air (OECD ESD No. 3, 2004/D4, p. 32).

EEM IC 11.3: Release of additives from compounding to water (OECD ESD No. 3, 2004/D4, p. 32).

EEM IC 11.4: Release of additives from compounding to air (OECD ESD No. 3, 2004/D4, p. 32).

EEM IC 11.5: Release of additives from conversion to water (OECD ESD No. 3, 2004/D4, p. 32).

EEM IC 11.6: Release of additives from conversion to air (OECD ESD No. 3, 2004/D4, p. 32).

EEM IC 11.7: Release of additives during the service life of polymers to water (OECD ESD No. 3, 2004/D4, p. 35).

EEM IC 11.8: Release of additives during the service life of polymers to air (OECD ESD No. 3, 2004/D4, p. 35).

EEM IC 11.9: Release of additives from disposal of a polymer product, to water (OECD ESD No. 3, 2004/D4, p. 36).

[1] The Emission Estimation Modules of the Emission Profiles D10 and D12 will be included after the meeting of the OECD Task Force on Environmental Exposure Assessment held in Paris on 13th and 14th October 2005.

EEM IC 11.10: Release of additives from disposal of a polymer product, to air (OECD ESD No. 3, 2004/D4, p. 36).

EEM IC 11R.1: Emission scenario for release of additives during formulation / processing of rubber. Emission to waste water (OECD ESD No. 6, 2004/D7, p. 25).

EEM IC 11R.2: Emission scenario for release of additives during formulation / processing of rubber. Emission to air and soil (OECD ESD No. 6, 2004/D7, p. 30 et sqq.).

EEM IC 11R.3: Emission scenario for release of rubber additive breakdown production by abrasion of tyres. Emission to soil (OECD ESD No. 6, 2004/D7, p. 31 et sqq.).

EEM IC 13.1: Local emission of substances emitted in pre-treatment processes (preparation agents, sizing agents, biozides; from imported fabrics/fibres). Emissions to water. Daily emission rates (OECD ESD No. 7, 2004/D5, chap. 10.1.1, p. 49).

EEM IC 13.2: Local emission of substances emitted in exhaust processes (basic chemicals, dyestuffs, auxiliaries). Emissions to water. Daily emission rates (OECD ESD No. 7, 2004/D5, chap. 10.1.2, p. 50).

EEM IC 13.3: Local emission of substances emitted in padding processes, printing and coating (basic chemicals, dyestuffs, auxiliaries). Emissions to water. Daily emission rates (OECD ESD No. 7, 2004/D5, chap. 10.1.3, p. 51).

EEM IC 13.4: Local emission of substances emitted in the off-gas of finishing recipes (from a stenter) and emissions of preparation agents. Emissions to air. Daily emission rates (OECD ESD No. 7, 2004/D5, chap. 10.2, p. 52).

EEM IC 13.5: Continental/regional emission of substances from articles during their service life. Emissions to water. Yearly emission rates (OECD ESD No. 7, 2004/D5, chap. 10.3, OECD 2004/D5, p. 55).

EEM IC 14.1: Emission calculation (release factors) for formulation of organic solvent-borne coatings, standard batch. Emission to air, water and waste (RPA, 2003/D6, p. 35 et sqq., table 4.3, p. 42).

EEM IC 14.2: Emission calculation (release factors) for formulation of organic solvent-borne coatings, large batch (10.000 l). Emission to air, water and waste (RPA, 2003/D6, p. 44 et sqq., table 4.6, p. 46).

EEM IC 14.3: Emission calculation (release factors) for formulation of water-borne, aqueous dispersion coatings, standard batch. Air, water and waste (RPA, 2003/D6, p. 51 et sqq., table 5.6, p. 54).

EEM IC 14.4: Emission calculation (release factors) for formulation of water-borne, aqueous dispersion coatings, large batch. Air, water and waste (RPA, 2003/D6, p. 56 et sqq., table 5.9, p. 57).

EEM IC 14.5: Emission calculation (release factors) for formulation of water-borne, water-reducible coatings and colloidal dispersions, standard batch. Air, water and waste (RPA, 2003/D6, p. 58 et sqq., table 5.12, p. 61).

EEM IC 14.6: Emission calculation (release factors) for formulation of water-borne, water-reducible coatings and colloidal dispersions, large batch. Air, water and waste (RPA, 2003/D6, p. 62 et sqq., table 5.15, p. 63).

EEM IC 14.7: Emission calculation (release factors) for formulation of melt-blend powder coatings, standard batch. Air, water and waste (RPA, 2003/D6, p. 67 et sqq., table 6.1, p. 71).

EEM IC 14.8: Emission calculation (release factors) for formulation of melt-blend powder coatings, large batch. Air, water and waste (RPA, 2003/D6, p. 75 et sqq., table 6.5, p. 76).

EEM IC 14.9: Emission calculation (release factors) for formulation of dry-blend powder coatings, standard batch. Air, water and waste (RPA, 2003/D6, p. 79 et sqq., table 6.7, p. 82).

EEM IC 14.10: Emission estimate for application of wooden furniture coatings, spray application (RPA, 2003/D6, p. 94 et sqq., fig. 3.1, p. 97).

EEM IC 14.11: Emission estimate for application of wooden furniture coatings, flat line application (RPA, 2003/D6, fig. 3.2, p. 99).

EEM IC 14.12: Emission estimate for application of decorative paints, general public use (RPA, 2003/D6, fig. 4.1, p. 104).

EEM IC 14.13: Emission estimate for application of decorative paints, professional use (RPA, 2003/D6, fig. 4.1, p. 104).

EEM IC 14.14: Emission estimate for application in automotive coating, original automotive equipment manufacture (OEM) (RPA, 2003/D6, fig. 5.2, p. 114).

EEM IC 14.15: Emission estimate for application in automotive coating, refinishing, dry back booth (RPA, 2003/D6, fig. 5.3, p. 115).

EEM IC 14.16: Emission estimate for application in automotive coating, refinishing, wet back booth (RPA, 2003/D6, fig. 5.4, p. 116).

EEM IC 14.17: Emission estimate for application of metal packaging coatings, 2-piece-beer/beverage can, external coating (RPA, 2003/D6, fig. 6.3, p. 123).

EEM IC 14.18: Emission estimate for application of metal packaging coatings, 2-piece-beer/beverage can, internal lacquering (RPA, 2003/D6, fig. 6.4, p. 123).

EEM IC 14.19: Emission estimate for application of metal packaging coatings, 3-piece-food/ general line can (RPA, 2003/D6, fig. 6.5, p. 124).

EEM IC 14.20: Emission estimate for application of coil coatings (RPA, 2003/D6, fig. 7.2, p. 130).

EEM IC 14.21: Emission estimate for application of marine coatings (non-antifoulant) (RPA, 2003/D6, fig. 8.1, p. 135).

EEM IC 14.22: Emission estimate for application of coatings for aircrafts painting (RPA, 2003/D6, fig. 9.1, p. 140).

EEM IC 14.23: Emission estimate for application of coatings for rail vehicle painting (RPA, 2003/D6, fig. 10.2, p. 146).

EEM IC 14.24: Emission estimate for the treatment of coatings wastes (RPA, 2003/D6, fig. 11.2, p. 150).

EEM IC 14A.1: Emission scenario for release of coatings by spray-application from captured over-spray. Emission collected as waste (OECD ESD No. 11, 2004/D11, p. 19).

EEM IC 14A.2: Emission scenario for release of coatings by spray-application from gun cleaning. Emission collected as waste (OECD ESD No. 11, 2004/D11, p. 19).

EEM IC 14A.3: Emission scenario for release of coatings by spray-application from container residue. Emission collected as waste (OECD ESD No. 11, 2004/D11, p. 20).

EEM IC 14A.4: Emission scenario for release of coatings by spray-application from overspray. Emission to air (OECD ESD No. 11, 2004/D11, p. 21).

EEM IC 14A.5: Emission scenario for release of coatings by spray-application from clean-up of mixing apparatus and guns. Emission to water (OECD ESD No. 11, 2004/D11, p. 21).

EEM IC 14A.6: Emission scenario for release of coatings by spray-application from clean-up of mixing apparatus and guns using water back booths. Emission to water (OECD ESD No. 11, 2004/D11, p. 21).

Additional related data sets:

EE data set IC 2/3.1: Release factors for the emission of HPV intermediates during production. Emission to water (EU TGD/D14, 2003, chapter 7).

EE data set IC 2/3.2: Release factors for the emission of HPV intermediates during processing. Emission to water (EU TGD/D14, 2003, chapter 7).

EE data set IC 2/EXP1: Effluent discharge rate for STP in France and Germany. Determination of default value (EU TGD/D14, 2003, chapter 7, p. 12 et sqq.).

EE data set IC 2/EXP2: Dilution at the point of complete mixing. Determination of default value (EU TGD/D14, 2003, chapter 7, p. 12 et sqq.).

EEMs related to occupational health:

EEM IC 4.EX: Exposure scenario to photoresist chemicals from the photolithography process. Exposure route: dermale exposure (OECD ESD No. 9, 2004/D9, p.16).

EEM IC 14A.EX1: Exposure scenario to coatings by spray-application. Exposure route: Inhalation exposure (OECD ESD No. 11, 2004/D11, p. 23).

EEM IC 14A.EX2: Exposure scenario to coatings by spray-application. Exposure route: Dermal exposure (OECD ESD No. 11, 2004/D11, p. 24).

Annex 5: OECD Emission Scenario Documents and related data sets of emission estimation data (mini matrices)

IC 4, Photoresist use in electronics (D9): 5 modules referring to the life cycle stage industrial use. Environmental compartment: water and water/soil/air via waste disposal. Reference: OECD ESD No. 9, 2004.

IC 4	Production	Formulation	Industrial use		Private use	Service life	Waste / recovery
Water				EEM IC 4.4 EEM IC 4.5			
Air							
Soil							
Waste			EEM[1] IC 4.1 – 4.3, EEM IC 4.5				

IC 7, Leather processing (D8): 1 module referring to the life cycle stage industrial use. Environmental compartment: water. Reference: OECD ESD No. 8, 2004.

IC 7	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water	A-/B-tables TGD **R**	A-/B-tables TGD **R**	EEM IC 7.1		May be relevant, but not covered yet	May be relevant, but not covered yet
Air*						
Soil*						
Waste						
	Soil and air: "if relevant, calculation using the A-/B-tables of EU TGD"					

*: general reference given, e.g. "if relevant, calculation using the A-/B-tables of EU TGD"
R: reference to another data source given, e.g. EU TGD

IC 8, Metal cutting fluids (D18): 2 modules referring to life cycle stage waste / recovery. Environmental compartment: water. Reference: Baumann et al., 1999.

IC 8	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water	A-/B-tables TGD **R**	A-/B-tables TGD **R**	Not relevant	Not relevant	Not relevant	EEM IC 8.1 EEM IC 8.2
Air						
Soil						
Waste						

R: reference to another data source given, e.g. EU TGD

[1] EEM: Emission Estimation Module.

IC 8, Metal finishing (D12): 1 module referring to life cycle stage industrial use. Environmental compartment: water. Reference: OECD ESD No. 12, 2004.

IC 8	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water			3.4			
Air						
Soil						
Waste						

IC 8+9, Lubricants and lubricant additives (D10): 7 modules referring to life cycle stages formulation, industrial use, private use, waste disposal. Environmental compartments: air, water, soil, waste. Reference: OECD ESD No. 10, 2004.

IC 8 + 9	Pro-duction	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water		5.2.2	7.7 + 8.5	6.7		8.6
Air		5.2.1	8.5	6.7		
Soil			7.7	6.7		
Waste		5.2.3	7.7	6.7		8.6

IC 10, Photographic industry (D3): 3 modules referring to the life cycles processing and waste/recovery. Environmental compartment: water. (air, soil: A-/B-tables). Reference: OECD ESD No. 5, 2004.

IC 10	Production	Formulation	Industrial use / processing	Private use	Service life	Waste / recovery
Water	A/B-tables TGD **R**	Relevant, but no data!	EEM IC 10.1 EEM IC 10.2	Not relevant	Not dis-cussed	EEM IC 10.3 (baths)
Air*						
Soil*						
Waste						Photographic material: dis-cussed
	5.1.1.1 Air, soil: A-/B-tables of EU TGD					

R: reference to another data source given, e.g. EU TGD
*: general reference given, e.g. “A-/B-tables of EU TGD”

IC 11, Plastic additives (D4): 5x2 (water, air) separate modules referring to the life cycles materials handling, compounding, conversion, service life, disposal. Environmental compartments: water and air. Reference: OECD ESD No. 3, 2004.

IC 11	Pro-duction	Raw materials handling, formulation		Industrial use / processing / conversion	Private use	Service life	Waste / recovery
Water	Not discussed	EEM IC 11.1	EEM IC 11.3	EEM IC 11.5	Not discussed	EEM IC 11.7	EEM IC 11.9
Air		EEM IC 11.2	EEM IC 11.4	EEM IC 11.6		EEM IC 11.8	EEM IC 11.10
Soil							
Waste							

IC 11.R, Additives in rubber industry (D7): 3 modules referring to life cycle stages formulation and processing (combined!) and service life. Environmental compartments: water, air, soil. Reference: OECD ESD No. 6, 2004.

IC 11	Production	Formulation and industrial use	Private use	Service life	Waste / recovery
Water		EEM IC 11R.1			
Air		EEM IC 11R.2			
Soil		EEM IC 11R.2		EEM IC 11R.3	
Waste					

IC 13, Textile finishing industry (D5): 5 modules referring to life stages processing (industrial use) and service life. Environmental compartments: water and air. Reference: OECD ESD No. 7, 2004.

IC 13	Production	Formulation	Industrial use		Private use	Service life	Waste / recovery
Water	*A-/B-tables TGD* ***R***	A-/B-tables TGD **R**	EEM IC 13.1 EEM IC 13.3	EEM IC 13.2		EEM IC 13.5	Not relevant
Air*				EEM IC 13.4			
Soil*							
Waste							
	Soil and air: "if relevant, calculation using the A-/B-tables of EU TGD"						

R: reference to another data source given, e.g. EU TGD
*: general reference given, e.g. "if relevant, calculation using the A-/B-tables of EU TGD"

IC 14, Coatings industries, paints, lacquers and varnishes (D6): 9 modules referring to life cycle stages formulation, 15 modules referring to the life cycle stage application (+ use and disposal). Environmental compartments: air, water, waste, combined. Reference: RPA, 2003 (Draft OECD ESD).

IC 14	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water Air Waste		EEM IC 14.1 – 14.9 (release factors)	EEM IC 14.10 – 14.23	EEM IC 14.12	EEM IC 14.10 – 14.23 (release factors)	EEM IC 14.1 – 14.23 (release factors) EEM IC 14.24
Soil						

IC 14, Coating application via spray-painting in the automotive refinishing industry (D11): 6 modules referring to the life cycle stage industrial use. Environmental compartments: water, air, and water/air/soil via waste. Additional: 2 modules referring to inhalative and dermal exposure of workers. Reference: OECD ESD No. 11, 2004.

IC 14 (IC 16)	Production	Formu-lation	Industrial use			Private use	Service life	Waste / recovery
Water	A-/B-tables TGD **R**	A-/B-tables TGD **R**			EEM IC 14.A5 – 14.A6			
Air				EEM IC 14.A4				
Soil								
Waste			EEM IC 14.A1 – 14.A3					
	Additional: 2 modules referring to inhalative and dermal exposure of workers.							

R: reference to another data source given, e.g. EU TGD

Annex 6: Emission estimation profiles of the central documents

1.1 Reference table

ES Profile No.	Reference Document	IC
D3	OECD ESD No. 5 Photographic Industry 2004	10
D4	OECD ESD No. 3 Plastic Additives 2004	11
D5	OECD ESD No. 7 Textile Finishing 2004	13
D6	RPA Coatings Industry 2003 Draft OECD ESD	14
D7	OECD ESD No. 6 Rubber Additives 2004	11
D8	OECD ESD No. 8 Leather Industry 2004	7
D9	OECD ESD No. 9 Photoresist Use in Semiconductor Manufacturing	4
D10	OECD ESD No. 10 Lubricants and Lubricant Additives	8 + 9
D11	OECD ESD No. 11 Automotive spray application 2004	14 or 16
D12	OECD ESD No. 12 Metal finishing 2004	8
D14	EU TGD Chapter 7 IC-3 2003	2 + 3
D18	Baumann Metal Cutting Fluids 1999 National ESD Germany	8

1.2 Emission Scenario Profile D3 – Photographic Industry IC 10

Set of Emission Scenario data for photochemicals:
3 separate modules, referring to the life cycles stages processing and waste/recovery, environmental compartment water.

EE module IC 10.1: Release of photochemicals by the use of processing solutions (p. 11 – 21).

EE module IC 10.2: Release of ingredients of the emulsion layer of the photographic material during processing. (p. 25 – 26)

EE module IC 10.3: Release of photochemicals during waste disposal of used processing baths by specialised disposal companies (p. 22 – 25).

Releases to water during the formulation of processing chemicals as concentrated liquids: can not be estimated, because industrial data are not available. ******Area for further development of the ESD! ******

Releases during the disposal of used photographic material: only qualitative description in the ESD.

For the environmental targets "air" and "soil" at all stages of the life cycle the reader is referred to IC 10 in the A- and B-tables, Appendix I, Chapter 3 TGD**.**

<table>
<tr><th>IC 10</th><th>Production</th><th>Formulation</th><th>Industrial use / processing</th><th>Private use</th><th>Service life</th><th>Waste / recovery</th></tr>
<tr><td>Water</td><td rowspan="3">A/B-tables TGD
R</td><td rowspan="3">Relevant, but no data!</td><td>EEM IC 10.1
EEM IC 10.2</td><td rowspan="3">Not relevant</td><td rowspan="3">Not discussed</td><td>EEM IC 10.3 (baths)</td></tr>
<tr><td>Air*</td><td rowspan="2"></td><td></td></tr>
<tr><td>Soil*</td><td rowspan="2">Photographic material: discussed</td></tr>
<tr><td>Waste</td><td colspan="5"></td></tr>
<tr><td></td><td colspan="6">Air, soil: A-/B-tables of EU TGD</td></tr>
</table>

R: reference to another data source given, e.g. EU TGD

*: general reference given, e.g. "A-/B-tables of EU TGD"

Reference: OECD 2004/D3: OECD Series on Emission Scenario Documents, No. 5, Emission Scenario Document on Photographic Industry. OECD, Environment Directorate, June 2004.

Remarks:

**Complete IC, no specification.

**For the environmental targets “air” and”soil” at all stages of the life cycle the reader is referred to IC 10 in the A- and B-tables, Appendix I, Chapter 3 TGD.

**ESD focuses on industrial use, waste, and recovery!

Relevant emission path ways of photochemicals are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

**Nice: several representative point sources are described as “reasonable worst cases”, see Table 2, p. 13.

Description of processing baths and **function groups of ingredients.**

Endpoint:

Emission local water! (Elocal_water (kg.d-1)), the follow-up-step to calculate PEClocal water is illustrated in Fig.1, but not performed (see p. 1).

Branch-specific elements:

Carry-over-rate CO (p. 14), replenishment rate (RR), fraction removed / converted during processing / fraction which dissolved during processing from emulsion layer to the bath solution / fraction removed or converted during processing.

1.3 Emission Scenario Profile D4 – Polymers Industry IC 11 (Additives)

Set of Emission Scenario data for plastic additives:

5x2 (water, air) separate modules, referring to the life cycles materials handling, compounding, conversion, service life, disposal, referring to the environmental compartments water and air.

EE module IC 11.1: Release of additives from materials handling to water (p. 32)

EE module IC 11.2: Release of additives from materials handling to air (p. 32)

EE module IC 11.3: Release of additives from compounding to water (p. 32)

EE module IC 11.4: Release of additives from compounding to air (p. 32)

EE module IC 11.5: Release of additives from conversion to water (p. 32)

EE module IC 11.6: Release of additives from conversion to air (p. 32)

and combination of these modules.

EE module IC 11.7: Release of additives during the service life of polymers to water (p. 35)

EE module IC 11.8: Release of additives during the service life of polymers to air (p. 35)

EE module IC 11.9: Release of additives from disposal of a polymer product, to water (p. 36)

EE module IC 11.10: Release of additives from disposal of a polymer product, to air (p. 36)

Releases during service life due to wear/weathering are not considered in this ESD (p. 37).

IC 11	Pro-duction	Raw materials handling, formulation		Industrial use / processing / conversion	Private use	Service life	Waste / recovery
Water	Not discussed	EEM IC 11.1	EEM IC 11.3	EEM IC 11.5	Not discussed	EEM IC 11.7	EEM IC 11.9
Air		EEM IC 11.2	EEM IC 11.4	EEM IC 11.6		EEM IC 11.8	EEM IC 11.10
Soil							
Waste							

Reference: OECD 2004/D4: OECD Series on Emission Scenario Documents, No. 3, Emission Scenario Document on Plastics Additives. OECD, Environment Directorate, June 2004.

Remarks:

Reference to IC 11, polymers industry

Reference to 11 use categories (UCs) 7 [anti-static agents], 10 [colouring agents], 14 [corrosion inhibitors], 20 [fillers], 22 [flame retardants and fire preventing agents], 25 [foaming agents], 39 [biocides, non-agricultural], 43 [process regulators], 47 [softeners], 49 [stabilisers], 52 [viscosity adjustors]).

Reference to biocidal product type 7: film preservatives

Lot of product-groups / chemicals / use category - related data, probably cross use possible

Methodology completely in line with the TGD approach, nevertheless use of the branch-specific wording (compounding (= ”formulation”), conversion (= ”processing”, see p. 32, 6.1.5) etc.).

Covering of five “generic” stages of the life cycle (see p.31): raw materials handling, compounding, conversion, service life, disposal service life is included!!

**Calculation of EU wide emissions and regional emissions (10 % rule) are included as additional options (see p. 38). For estimation of emissions by disposal regional estimates are recommended (p.36).

**Reference is made to the B-tables (table B3.9) of Annex I, Chapter 3, TGD, to calculate daily emission rates (in case of missing data) (p.34).

Relevant emission pathways of plastic additives are described.

Technological data and default values for the determination of the emission rate are given.

Description of point sources:

representative point sources are described.

Detailed description of **processes** and **function groups of ingredients**.

Detailed **categorization of processes** (closed, partially open, open), see p. 22. Comparison to the MC-approach would be worth to do.

Endpoints:

Elocal_air, Elocal_water [kg.yr-1],

total EU wide emissions: RELEASEtot, polymer, formulation/processing to water and air [kg.yr-1], regional emissions, yearly and daily emission rates.

Branch-specific elements within the formulas:

Yes

1.4 Emission Scenario Profile D5 – Textile Processing Industry IC 13

Set of Emission Scenario data for textile finishing industry:

5 modules referring to life stages processing (industrial use) and service life, environmental compartments: water and air.

EE module IC 13.1: Local emission of substances emitted in pre-treatment processes (preparation agents, sizing agents, biozides; from imported fabrics/fibres). Emissions to water. Daily emission rates (chap. 10.1.1, p. 49, OECD).

EE module IC 13.2: Local emission of substances emitted in exhaust processes (basic chemicals, dyestuffs, auxiliaries). Emissions to water. Daily emission rates (chap. 10.1.2, p. 50).

EE module IC 13.3: Local emission of substances emitted in padding processes, printing and coating (basic chemicals, dyestuffs, auxiliaries). Emissions to water. Daily emission rates (chap. 10.1.3, p. 51).

EE module IC 13.4: Local emission of substances emitted in the off-gas of finishing recipes (from a stenter) and emissions of preparation agents. Emissions to air. Daily emission rates (chap. 10.2, p. 52).

EE module IC 13.5: Continental/regional emission of substances from articles during their service life. Emissions to water. Yearly emission rates (chap. 10.3, OECD 2004/D5, p. 55).

Life stages "production" and "formulation": reference to the appropriate A- and B-tables of the TGD (p. 48).

Compartment soil and air: "If relevant, the soil and the air pathway can be calculated by the respective A- and B-tables of the TGD."

Wastewater TP, border to exposure "evaluation": The downstream reduction potential of wastewater treatment plants is not in the scope of the ESD. "This aspect is taken into account in the exposure evaluation" (p. 49).

IC 13	Production	Formulation	Industrial use		Private use	Service life	Waste / recovery
Water	*A-/B-tables TGD* *R*	A-/B-tables TGD **R**	EEM IC 13.1 EEM IC 13.3	EEM IC 13.2		EEM IC 13.5	Not relevant
Air*				EEM IC 13.4			
5.1.1.2 Soil*							
Waste							
	Soil and air: "if relevant, calculation using the A-/B-tables of EU TGD"						

R: reference to another data source given, e.g. EU TGD
*: general reference given, e.g. "if relevant, calculation using the A-/B-tables of EU TGD"

Reference: OECD 2004/D5: OECD Series on Emission Scenario Documents, No. 7, Emission Scenario Document on Textile Finishing Industry. OECD, Environment Directorate, June 2004.

Remarks:

- **Process-type specific modules**: Differentiation according to the type of process (pre-treatment, exhaust processes, padding processes, printing, coating). No additional differentiation according to product-types.
- **Imported substances, emissions from articles**: IC 13.1 regards emissions from articles (which are used as the starting material for textile finishing)(see article 6, REACH).
- **Classification systems**: -
- **Product subcategories: -**
- **Risk management options**: -
- **Broad range of industries / uses**:-
- **General public / professional use**: -
- **Degree of aggregation**: -

Relevant emission path ways for textile chemicals are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

Representative point sources are described, including estimates for the textile production volume/daily (as the starting point to estimate the amounts of chemicals used).

Endpoint:

Daily local emission rates (kg/d) to water and to air (EE modules IC.13. 1 –4), yearly regional and continental emission rates according to service life (EE module IC 13.5).

Variables triggering the emissions: see input variables in table below

Total number of input variables: 4.

Total number of output variables: 1.

Default values: see table below

Variable/parameter (unit)	Symbol	Unit	Default	S/D/O/P
Input:				
Mass of textile processed per day	$Q_{textile}$	t d^{-1}	Chapter 9.1	D
Mass of auxiliary (preparation agents, sizing agents, biocides) per mass of fabric	$Q_{product}$	kg t^{-1}	Table 10	D/S
Content of active substance in preparation	$C_{substance}$	–	1	D/S (1)
Degree of fixation	$F_{fixation}$	–	0 (Table12)	D/S
Output:				
Local emission of substance per day to waste water	$Elocal_{water}$	kg d^{-1}		O

(1) If the content of active substance in the preparation is not available, it should be assumed as 100 %.

Structure of the emission rate formula:

$$\mathbf{Elocal_{water} = Q_{textile} \times Q_{product} \times C_{substance} \times (1 - F_{fixation})}$$

1.5 Emission Scenario Profile D6 – Coatings, lacquers, and varnishes IC 14

Set of Emission Scenario data for chemicals used in the coatings industry: paints , lacquers and varnishes:**

**covering a broad range of industries!

9 modules referring to life cycle stages formulation, 15 modules referring to the life cycle stage application (+ use and disposal). Environmental compartments: air, water, waste (combined modules).

EE module IC 14.1: Emission calculation (release factors) for formulation of organic solvent-borne coatings, standard batch. Emission to air, water and waste (p.35ff, table 4.3, p. 42).

EE module IC 14.2: Emission calculation (release factors) for formulation of organic solvent-borne coatings, large batch (10.000 l). Emission to air, water and waste (p.44ff, table 4.6, p. 46).

EE module IC 14.3: Emission calculation (release factors) for formulation of water-borne, aqueous dispersion coatings, standard batch. Air, water and waste (p.51ff, table 5.6, p. 54).

EE module IC 14.4: Emission calculation (release factors) for formulation of water-borne, aqueous dispersion coatings, large batch. Air, water and waste (p.56ff, table 5.9, p. 57).

EE module IC 14.5: Emission calculation (release factors) for formulation of water-borne, water-reducible coatings and colloidal dispersions, standard batch. Air, water and waste (p.58ff, table 5.12, p. 61).

EE module IC 14.6: Emission calculation (release factors) for formulation of water-borne, water-reducible coatings and colloidal dispersions, large batch. Air, water and waste (p.62ff, table 5.15, p. 63).

EE module IC 14.7: Emission calculation (release factors) for formulation of melt-blend powder coatings, standard batch. Air, water and waste (p.67ff, table 6.1, p. 71).

EE module IC 14.8: Emission calculation (release factors) for formulation of melt-blend powder coatings, large batch. Air, water and waste (p.75ff, table 6.5, p. 76).

EE module IC 14.9: Emission calculation (release factors) for formulation of dry-blend powder coatings, standard batch. Air, water and waste (p.79ff, table 6.7, p. 82).

EE module IC 14.10: Emission estimate for application of wooden furniture coatings, spray application (p.94ff, fig. 3.1, p. 97).

EE module IC 14.11: Emission estimate for application of wooden furniture coatings, flat line application (fig. 3.2, p. 99).

EE module IC 14.12: Emission estimate for application of decorative paints, general public use (fig. 4.1, p. 104).

EE module IC 14.13: Emission estimate for application of decorative paints, professional use (fig. 4.1, p. 104).

EE module IC 14.14: Emission estimate for application in automotive coating, original automotive equipment manufacture (OEM), (fig. 5.2, p. 114).

EE module IC 14.15: Emission estimate for application in automotive coating, refinishing, dry back booth (fig. 5.3, p. 115).

EE module IC 14.16: Emission estimate for application in automotive coating, refinishing, wet back booth (fig. 5.4, p. 116).

EE module IC 14.17: Emission estimate for application of metal packaging coatings, 2-piece-beer/beverage can, external coating (fig. 6.3, p. 123).

EE module IC 14.18: Emission estimate for application of metal packaging coatings, 2-piece-beer/beverage can, internal lacquering (fig. 6.4, p. 123).

EE module IC 14.19: Emission estimate for application of metal packaging coatings, 3-piece-food/ general line can (fig. 6.5, p. 124).

EE module IC 14.20: Emission estimate for application of coil coatings (fig. 7.2, p. 130).

EE module IC 14.21: Emission estimate for application of marine coatings (non-antifoulant) (fig. 8.1, p. 135).

EE module IC 14.22: Emission estimate for application of coatings for aircrafts painting (fig. 9.1, p. 140).

EE module IC 14.23: Emission estimate for application of coatings for rail vehicle painting (fig. 10.2, p. 146).

EE module IC 14.24: Emission estimate for the treatment of coatings wastes (fig. 11.2, p. 150).

IC 14	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water Air Waste		EEM IC 14.1 – 14.9 (release factors)	EEM IC 14.10 – 14.23	EEM IC 14.12	EEM IC 14.10 – 14.23 (release factors)	EEM IC 14.1 – 14.23 (release factors) EEM IC 14.24
Soil						

Reference: RPA (Risk&Policy Analysts Limited), 2003; Emission Scenario Document Chemicals used in the coatings industry: paints, lacquers and varnishes. Draft, June 2003. OECD.

Remarks:

- In the document, the notion of “manufacture” stands for the stage where chemicals are combined in a process of blending and mixing, to obtain a stable product or preparation. This corresponds to the term “formulation” in the TGD.
- **Classification systems**: For coatings, different types of classification are possible (type of coated object, curing method, role in a multi layer coating film, material of the coated substrate, binder system, solvent used, nature of the coating, application method) (p.12).. For emissions during formulation, the solvent used was chosen as classification system; for emissions during application and disposal the type of the coated subject was chosen (p.12).
- **Product subcategories** are used for certain types of applications (e.g. tab. 4.3, p. 103).
- **Risk management options**: Measurements for prevention and abatement of emissions are described (formulation: p. 33ff., application and disposal:p.92). For different emission treatment techniques values of efficiency are estimated (e.g. Tabl. 4.8, p. 47 / tab. 5.8, p.55 / tab. 5.11, p. 58 / tab. 5.14, p.62 / tab. 5.17, p.64 / tab. 6.7, p. 77 / tab. 6.9, p.83 /).
- **Broad range of industries / uses**: the ESD covers eight application fields (from the internal lacquering of a bear can to the outer lacquering of an aircraft).
- **General public / professional use**: For decorative paintings, a distinction between general public and professional use is made (see EC module IC 14.12 and 14.13).
- **Degree of aggregation**: It should be possible to aggregate certain release tables and emission estimates (e.g. standard batch/ large batch-formulations).

Relevant emission path ways for paints, lacquers and varnishes are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

Representative point sources are **not** described.

Endpoint:

Release factors in %, example calculations of emissions (total amount in kg. In some cases: amount / year, e.g. p. 118).

1.6 Emission Scenario Profile D7 – Polymers Industry IC 11 (Rubber)

Set of Emission Scenario data for chemicals used in rubber industry:

3 modules referring to life cycle stages formulation and processing (combined!) and service life. Environmental compartments: water, air, soil.

EE module IC 11R.1: Emission scenario for release of additives during formulation / processing of rubber. Emission to waste water (p.25).

EE module IC 11R.2: Emission scenario for release of additives during formulation / processing of rubber. Emission to air and soil (p.30f).

EE module IC 11R.3: Emission scenario for release of rubber additive breakdown production by abrasion of tyres. Emission to soil (p.31f).

IC 11	Production	Formulation and industrial use	Private use	Service life	Waste / recovery
Water		EEM IC 11R.1			
Air		EEM IC 11R.2			
Soil		EEM IC 11R.2		EEM IC 11R.3	
Waste					

Reference: OECD 2004/D7: OECD Series on Emission Scenario Documents, No. 6, Emission scenario document on additives in rubber industry. OECD, Environment Directorate, June 2004.

Remarks:

- **Function of additive and type of rubber product are named as two of the main information necessary to have proper emission estimations** (p.6)!
- **IC, UC, BPT**: Clear indication which IC, UCs and biocidal product types are covered by this document (table p.6). It would be useful to have such a table in each document.
- **Priority setting**: The water pathway is predominant. For most additives, the air pathway is of minor importance (p.9).
- **Need for further work**: “Releases from leachates in landfill and to sea or freshwater are not covered yet and need to be considered in the next version” (p.7).
- **Structure, Life-cycle phases**: In the document, the two life-cycle stages “formulation” and “industrial use” are not separated. Reasoning: “.they can often not be separated (p.9)”.
- **Classification systems**: Different types of rubber systems are named, using the wording of the rubber industry (table 3, p.11, table 4). Rubber types and additive types are described. Technical functions of the additives used are given (table 5, p.18).

- **Product subcategories**: see above, ("classification systems").
- **Additive specific default values**: For the fraction of the additive remaining in the product, additive specific default values are given.
- **Risk management options**: Rubber industry specific measurements for prevention and abatement of emissions are described qualitatively (see p.21, art. 37).
- **Branch-specific parameters and factors**: Figures for water consumption per production volume are valid only for rubber production (p.23). The term "parts per hundred rubber" (phr) is specific for the rubber industry.

Relevant emission path ways for additives in the rubber industry are described.

Technological data and default-values for the determination of the emission rate are given.

Representative point sources are described in detail.

Endpoints:

Determination of $Elocal_{water}$ resp. $Elocal_{air}$, in addition $Eregional_{breakdown\text{-}product}$. For emissions to water an example is given to calculate $Clocal_{water}$ and $PEClocal_{water}$ (see p. 33f). An example for the calculation formula used in the document is given below.

EE module IC 11R.1:

The emission rate [kg/d] into wastewater is calculated from equation (1) as shown:

$$Elocal_{water} = Q_{prod} \cdot \frac{Q_{additive}}{100 \cdot F_{recipe}} \cdot \left(1 - F_{remaining}\right) \qquad (1)$$

1.7 Emission Scenario Profile D8 – Leather processing industry IC 7

Set of emission scenario data for chemicals used in leather processing:

1 module referring to the life cycle stage industrial use. Environmental compartment: water.

EE module IC 7.1: Emission scenario for release of chemicals used in leather processing. Emission to waste water (p.27).

IC 7	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water **Air*** **Soil*** **Waste**	A-/B-tables TGD **R**	A-/B-tables TGD **R**	EEM IC 7.1		May be relevant, but not covered yet	May be relevant, but not covered yet
	Soil and air: "if relevant, calculation using the A-/B-tables of EU TGD"					

*: general reference given, e.g. "if relevant, calculation using the A-/B-tables of EU TGD"
R: reference to another data source given, e.g. EU TGD

Reference: OECD 2004/D8: OECD Series on Emission Scenario Documents, No. 8, Emission scenario document on leather processing. OECD, Environment Directorate, June 2004.

Note: This ESD contains in addition information regarding biocides used in leather industry (Chapt. 3.2, p.18f). (Biocides are not in the scope of the ESD Matrix project).

Remarks:

- **Life-cycle stages not covered:** According to the document, releases may occur also during other life-cycle stages, e.g. the final use of the leather articles and the disposal of leather articles. No precise quantitative release estimations can be proposed for the time being (p.21, art.58-60). See also p.27, art. 76.
- **Need for further work**: For the stages "service life or article" and "disposal" the need to cover them is stated (p.6).
- **Reference to A/B-tables of TGD:** Reference to the A/B-tables is given for life cycle stages "production" and "formulation".
- **"Intended use of chemical" (e.g. dyestuff) and "step of process" are named as two of the main information necessary to have proper emission estimations** (p.6)! This allows selection of the appropriate factors of table 4 (process- and chemical-specific, see p. 17).
- **IC, UC, BPT:** The documents refer to IC 7. Specific UCs or biocidal product types(BPTs) are not named.
- **Classification systems**:

1. The production process is split in four "main categories" or "main steps" (e.g. Hide and skin storage and beamhouse operations, Tanyard operations etc. , see p.9, art.5 / p.11, art.10).

2. Tanning agents are categorized in three main groups (Mineral tannages, vegetable tannages et al., see p.14, art.26).

- **Specific default values:** Process-specific and chemicals-specific default values are presented (fraction of remaining mass from raw hide, consumption (kg/t), fraction of the chemical in the formulation, degree of fixation).
- **Risk management options**: Measurements for prevention and abatement of emissions to air and water in the leather industry are described qualitatively (see p.20.21, art. 56,57). There are no default values given.
- **Branch-specific values and factors:** Figures for water consumption per production volume are specific for tanneries. The factor "fraction of remaining mass from raw hide" is branch-specific.

Relevant emission path ways for additives in the leather industry are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

Representative point sources: described in detail. It includes the daily production volume, default values for the fraction of remaining mass from raw hide as well as assumptions on number of working days.

Endpoint:

Determination of $Elocal_{x\text{-}water}$: local emission of chemical to waste water per day for a specific process step "x" (see p. 28f, formula given below).

EE module IC 7.1, model calculation:

$$\mathrm{Elocal}_{\text{x-water}} = Q_{rawhide} \times F_{remaining-mass} \times Q_{chemical-formulation} \times F_{chemical} \times \left(1 - F_{fixation}\right) \times F_{daily-production} \times (1 - F_{on-site-treatment})$$

1.8 Emission Scenario Profile D9 – Electrical / electronic industry IC 4

Set of emission scenario data for photoresist used in semiconductor manufacturing

5 modules referring to the life cycle stage industrial use. Environmental compartment: water and water/soil/air via waste disposal.

EE module IC 4.1: Emission scenario for release of photoresist from transport container residues. Emission collected as waste (p.13).

EE module IC 4.2: Emission scenario for release of photoresist from equipment cleaning.Emission collected as waste (p.13).

EE module IC 4.3: Emission scenario for release of photoresist from dispensed photoresist. Emission to waste (p.14).

EE module IC 4.4: Emission scenario for release of photoresist from developing the wafer. Emission collected as waste water (p.15).

EE module IC 4.5: Emission scenario for release of photoresist from etching and stripping of wafer. Emission collected as waste (p.15).

This ESD contains in addition an exposure scenario referring to the dermal exposure of workers from the photolithography process. Occupational exposures are not typically included in OECD Emissions Scenario Documents (see p. vi). This modules is not further analysed in the matrix project.

EE module IC 4.EX: Exposure scenario to photoresist chemicals from the photolithography process. Exposure route: dermale exposure (p.16).

IC 4	Production	Formulation	Industrial use		Private use	Service life	Waste / recovery
Water				EEM IC 4.4 EEM IC 4.5			
Air							
Soil							
Waste			EEM[1] IC 4.1 – 4.3, EEM IC 4.5				

[1] EEM: Emission Estimation Module

Reference: OECD 2004/D9: OECD Series on Emission Scenario Documents, No. 9, Emission scenario document on photoresist use in semiconductor manufacturing. OECD, Environment Directorate, June 2004.

Remarks:

- **IC, UC:** The documents refer to IC 4 (electrical/electronic industry) and to non-volatile chemicals present within photoresist materials used in manufacture of semi-conductors.
- **No subcategories!**: "The estimation methods included within this scenario are applicable to any photoresist chemicals, regardless of their function within the photoresist formulation." No specific UCs are stated.
- **Reference to A/B-tables of TGD: No** reference to the A/B-tables is given in the document.
- **Risk management options**: Working conditions are described qualitatively: clean room conditions, use of closed systems (see p.16)). There are no default values given for specific risk management options.
- **Branch-specific values and factors:** Figures for the representative point source are branch-specific, as well as default values for the number of the application steps, the amount of photoresist applied/application, the fraction of the photoresist that adheres to the wafer and further variable (see table B-2, op.34.

Relevant emission path ways for photoresists in semiconductor-manufacturing are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

Representative point sources: described in detail. It includes the daily production volume, default values for the number of the photolithography application steps, the amount of photoresist applied/application, the range of operating characteristics (hrs/day, days/year), the daily use rate of the chemical of interest as well as the number of operating days/year.

Endpoint:

Determination of daily emission rates for a given site (p.13). (For the human exposure modules, the daily potential dose rate (EXP_{dermal}) is estimated as endpoint).

EE module IC 4.1, model calculation (p.13):

$$Elocal_{container\_residure\_disp} = Q_{chem\_day} \times F_{container\_disp} \qquad \text{(Eq. 3-4)}$$

Where:

$Elocal_{container\_residue\_disp}$	Daily release of chemical of interest from container residue (kg/site-day)
Q_{chem_day}	Daily use rate chemical of interest (kg/site-day)
$F_{container\_disp}$	Fraction of photoresist residue in container to incineration or landfill (default = 0.006) (19)

This release rate is applicable over $TIME_{apply\_days}$ (default: 360 (Table 3-1)) for N_{sites}.

1.9 Emission Scenario Profile D10 – Metal extraction, refining, and processing industry IC 8 / Mineral oil and fuel industry IC 9 (Lubricants)

Reference: OECD 2004/D10: OECD Series on Emission Scenario Documents, No. 10, Emission scenario document on lubricants and lubricant additives. OECD, Environment Directorate, November 2004.

OECD ESD 10 – Lubricants (11/2004) – ENV/JM/MINO (2004)21

The Emission Scenario Profile is currently not presented in the standard template. This will be revised after the meeting of the OECD Task Force on Environmental Exposure Assessment held in Paris on 13rd and 14th October 2005.

ESD 10 Processes in IC 8 and IC 9	See also ESD	Level of preparation info	Relevant UC
Formulation of additive packages		Rough	UC 29 (heat transfer) UC 30 (hydraulic fluids plus additives) UC 35 (lubricants and additives)
Formulation of lubricants		Detailed	
Use through service life in automotive			
Use through service life in hydraulic systems (vehicles and sites)			
Use through service life in metal cutting			
Waste oil treatment			
Recycing of lubricants			

IC 8 + 9	**Production**	**Formulation**	**Industrial use**	**Private use**	**Service life**	**Waste / recovery**
Water		5.2.2	7.7 + 8.5	6.7		8.6
Air		5.2.1	8.5	6.7		
Soil			7.7	6.7		
Waste		5.2.3	7.7	6.7		8.6

ESD 10 for IC 9 **Drivers formulation**	Parameter algorithm	covered in ESD	Emission reduction measures Abatement factor	Defaults available
(1) Physico-chemical properties		Yes		Yes
(2a) Used amount per time (2b) Frequency and duration of use	Qprod Temis	Yes		Yes Yes
Reference for amount	Capacity of plant			
(3) Losses **to waste water and waste**	Fx	Yes	kg/day	Yes
Quantified drivers	• Product losses from vessel operation • Use of product losses for lower specifications • Losses due to spillage • Water discharge from plant • Residual amount in drums			yes Yes Yes Yes Yes
Integrated pollution prevention	• dedicated vessels and pipes to minimise product waste • use losses for lower specification • good housekeeping			See drivers
(4a) On-site emission control	$Fabat_1$	Yes		Yes
Techniques employed	• oil separator			Yes
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$	Yes		No

ESD 10 for IC 9 **Drivers industrial and professional use – hydraulic**	Parameter algorithm	covered in ESD	Emission reduction measures Abatement factor	Defaults available
(1) Physico-chemical properties		No		No
(2a) Used amount per time (2b) Frequency and duration of use	Qprod Temis	Yes		Yes Yes
Reference for amount	Annual volume of lubricant on market			
(3) Losses **to surface water/soil, to waste water, waste**	Fx	Yes		kg/day
Quantified drivers	• replacement, reconditioning rate • losses in use • recovery of losses depending on use type • types of use or treatment for waste oil			Yes Yes Yes Yes
Integrated pollution prevention	• inspection and maintenance in larger systems • good housekeeping			No
(4a) On-site emission control	$Fabat_1$	No		No

ESD 10 for IC 9 **Drivers industrial and professional use – hydraulic**	Parameter algorithm	covered in ESD	Emission reduction measures Abatement factor	Defaults available
Techniques employed				
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$	Yes		No

ESD 10 for IC 9 **Drivers industrial use - cutting**	Parameter algorithm	covered in ESD	Emission reduction measures Abatement factor	Defaults available
(1) Physico-chemical properties		Yes		Yes
(2a) Used amount per time	Qprod	Yes		Yes
(2b) Frequency and duration of use	Temis			Yes
Reference for amount	System capacity of a large metal working plant and i) daily losses and intermitted release once a year			
(3) Losses **to air, waste water, waste**	Fx	Yes		kg/day
Quantified drivers	• (non) emulsifiable fluids			Yes
	• losses due to misting/evaporation			Yes
	• losses due to leaks			Yes
	• losses due to drag-out			Yes
	• other overall losses			Yes
	• rate of reprocessing			Yes
	• split in waste treatment type			Yes
Integrated pollution prevention	• inspection and maintenance			No
	• good housekeeping			
(4a) On-site emission control	$Fabat_1$	yes		Yes
Techniques employed	• water-oil separation			No
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$	Yes	• treatment of emulsions	Yes

ESD 10 for IC 9 **Drivers private use**	Parameter algorithm	covered in ESD	Emission reduction measures Abatement factor	Defaults available
(1) Physico-chemical properties		No		No
(2a) Used amount per time	Qprod	Yes		Yes
(2b) Frequency and duration of use	Temis			Yes
Reference for amount	Annual volume of lubricant on market			
(3) Losses to **air, surface water/soil, waste water and waste**	Fx	Yes	t/y	Yes
Quantified drivers	• losses through filling			Yes

ESD 10 for IC 9 **Drivers private use**	Parameter algorithm	covered in ESD	Emission reduction measures Abatement factor	Defaults available
	• losses through leakage in use • incomplete combustion • degradation of certain components during use (e.g. antioxidisers) • types of use or treatment for waste oil			Yes No Yes Yes
Integrated pollution prevention	Not specified			No
(4a) On-site emission control	$Fabat_1$	No		No
Techniques employed	•			
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$	Yes		Yes

1.10 Emission Scenario Profile D11 – Paints, lacquers, and varnishes industry IC 14 (automotive industry)

Set of emission scenario data for coating application via spray-painting in the automotive refinishing industry:

6 modules referring to the life cycle stage industrial use. Environmental compartments: water, air, water/soil/air via waste disposal. Additional: 2 modules referring to inhalative and dermal exposure of workers.

EE module IC 14A.1: Emission scenario for release of coatings by spray-application from captured overspray. Emission collected as waste (p.19).

EE module IC 14A.2: Emission scenario for release of coatings by spray-application from gun cleaning. Emission collected as waste (p.19).

EE module IC 14A.3: Emission scenario for release of coatings by spray-application from container residue. Emission collected as waste (p.20).

This module is likely to be useful for many other branches!

EE module IC 14A.4: Emission scenario for release of coatings by spray-application from overspray. Emission to air (p.21).

EE module IC 14A.5: Emission scenario for release of coatings by spray-application from clean-up of mixing apparatus and guns. Emission to water (p.21).

EE module IC 14A.6: Emission scenario for release of coatings by spray-application from clean-up of mixing apparatus and guns using water back booths. Emission to water (p.21).

This ESD contains in addition two exposure scenario referring to the inhalative and the dermal exposure of workers during spray-painting. Occupational exposures are not typically included in OECD Emissions Scenario Documents (see p. vi). These modules are not further analysed in the matrix project.

EE module IC 14A.EX1: Exposure scenario to coatings by spray-application. Exposure route: Inhalation exposure (p.23).

EE module IC 14A.EX2: Exposure scenario to coatings by spray-application. Exposure route: Dermal exposure (p.24).

This module contains a categorization of types of contact (routine contact, incidental contact and others), which may be useful for other exposure situations too (p.59).

<table>
<tr><th>IC 14 (IC 16)</th><th>Production</th><th>Formu-lation</th><th colspan="3">Industrial use</th><th>Private use</th><th>Service life</th><th>Waste / recovery</th></tr>
<tr><td rowspan="4">Water
Air
Soil
Waste</td><td rowspan="4">A-/B-tables TGD
R</td><td rowspan="4">A-/B-tables TGD
R</td><td rowspan="3"></td><td rowspan="2"></td><td>EEM IC 14.A5 – 14.A6</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>EEM IC 14.A4</td></tr>
<tr><td rowspan="2">EEM IC 14.A1 – 14.A3</td></tr>
<tr><td></td></tr>
<tr><td></td><td colspan="9">Additional: 2 modules referring to inhalative and dermal exposure of workers.</td></tr>
</table>

R: reference to another data source given, e.g. EU TGD

Reference:

OECD 2004/D11: OECD Series on emission scenario documents, No. 11, Emission scenario document on coating application via spray-painting in the automotive refinishing industry. OECD, Environment Directorate, November 2004.

Remarks:

- **IC, UC:** The documents do not name ICs or UCs explicitly. It refers to automotive refinishing and coating applications. Therefore IC14 (Paints, lacquers and varnishes industry) and IC 15 (Engineering industry: civil and mechanical) are addressed. Reference is given to the North American Industry Classification System (NAICS) (NAISC code: 811 121).
- **No subcategories!** Only a distinction between non-volatile and volatile compounds is made. Different types of coatings are described (primer, base coat, clear coat) as well as function of the components (pigments, binders, solvents, additives) (p.12). This differentiation due to functions has no influence on the emission scenarios developed. “The estimation methods in this scenario are applicable toany non-volatile coating component regardless of its function within the coating formulation” (p.4).
- **Reference to A/B-tables of TGD:** No reference to the A/B-tables is given in the document.
- **Risk management options**: Working conditions are described qualitatively: clean room conditions, use of closed systems (see p.16)). There are no default values given for specific risk management options.
- **Branch-specific values and factors:** Many branch-specific default-values are included, e.g. number of automotive refinishing operation days per year, spray gun transfer efficiency.

Relevant emission path ways for coating applications via spray painting in automotive refinishing are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

Representative point sources: described in detail.

Endpoint:

Determination of daily emission rates for a given site ("daily site release of chemical of interest). (For the human exposure modules, the potential daily exposures ($EXP_{inhalation}$, EXP_{dermal}) are estimated as endpoints).

1.11 Emission Scenario Profile D12 – Metal extraction, refining, and processing industry IC 8

Reference: OECD 2004/D12: OECD Series on Emission Scenario Documents, No. 12, Emission scenario document on metal finishing. OECD, Environment Directorate, November 2004.

OECD ESD 12 – Metal Finishing (11/2004) – ENV/JM/MINO (2004)23

The Emission Scenario Profile is currently not presented in the standard template. This will be revised after the meeting of the OECD Task Force on Environmental Exposure Assessment held in Paris on 13rd and 14th October 2005.

ESD 12 Processes in IC 8	See also ESD	Level of preparation info	Relevant UC
Cleaning/degreasing		Detailed for metals No for organic	UC 9 Cleaners UC 12 conductive agents UC 17 plating UC 50 (surfactants, wetting agents, phosphatising)
Anodising			
Conversion Coating			
Electroless plating			
Electroplating			
Galvanising			
Mechanical plating			
Metal spraying			
Painting	IC 14 – ESD…		
Vacucum deposition			
Vitreous enamelling			
General: Making up process solutions Maintenance of cleaners Waste disposal			

IC 8	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water			3.4			
Air						
Soil						
Waste						

ESD 12 for IC 8 Drivers	**Parameter algorithm**	**Covered in ESD**	**Emission reduction measures Abatement factor**	**Defaults available**
(1) Physico-chemical properties		No		No
(2a) Used amount per time	Qprod	Yes		Yes
(2b) Frequency and duration of use	Temis			Yes
Reference for amount	Surface area processed per time driven by automated, semi-automated or manual plants			
(3) Losses **to waste water**	Fx	Yes	kg/day	Yes
Quantified drivers	• Drag out and rinsing (water use) • Recycling rates from rinsing process solutions • Discharge of spent baths • Disposal of spent baths			Yes Yes Yes No
Integrated pollution prevention	• Reduce loss of process solutions (maintenance; minimise drag-out) • Multi stage rinses, avoid dilution • Replacement zinc cyanide by alkaline/acid • Replacement of Cr VI by Cr III • Use of powder or water based paints			No
(4a) On-site emission control	$Fabat_1$	Yes		No
Techniques employed	• Neutralisation, removal • Neutralisation, removal of particles and phosphate • Oxidation of cyanides, reduction of chromium • Hydroxide precipitation + settlement/filter • Recovery of metals by evaporation, reversed osmosis, ion exchange, electrolytical recovery, electrodialysis • Air extraction systems (steam, vapour, fumes) partly including integrated adsorption of solvents, after burners or water wash units.			
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$	Yes		No

1.12 Emission Scenario Profile D14 – Chemical industry: Basic chemicals and chemicals used in synthesis IC 2 and IC 3

Set of emission scenario data for HPV intermediates used in synthesis:

This document contains no complete emission estimation modules. It describes emission factors to wastewater and evaluates the river flow receiving wastewater. Life cycle stages: production and processing. Environmental compartment: water.

EE data set IC 2/3.1: Release factors for the emission of HPV intermediates during production. Emission to water.

EE data set IC 2/3.2: Release factors for the emission of HPV intermediates during processing. Emission to water.

This ESD contains in addition derivation of default values for effluent discharge rates of sewage treatment plants and dilution factors (at the point of complete mixing). These data are primarily relevant for exposure assessment. They are not further analysed in the matrix project.

EE data set IC 2/EXP1: Effluent discharge rate for STP in France and Germany. Determination of default value (p.12ff)..

EE data set IC 2/EXP2: Dilution at the point of complete mixing. Determination of default value (p.12ff)

	Production	Formulation	Industrial use	Private use	Service life	Waste /recovery
Water	EE IC 2/3.1 EE IC 2/3.2					
Air						
Soil						
Waste						

Reference: TGD (2003): Technical guidance document in support of commission directive 93/67/EEC on risk assessment for new notified substances and commission regulation (EC) No 1488/94 on risk assessment for existing substances. Part I-III <http://ecb.jrc.it/cgi-bin.reframer.pf?A=ECB&B=/TGD/>, chapter 7, p. 7 – 20.

Remarks:

- **IC, UC:** The documents refer to IC 2 and 3. It should be used only for HPV intermediates (p.11).

- **Wet- and dry-processes as decisive subcategories.** In the documents, several parameters are listed which influence emissions during production and use of intermediates (physico-chemical properties, type of reaction, batch or continuous production, on or on/off site handling). The differentiation between wet and dry processes is considered to be the only discriminating factor (p.11).
- **Reference to A/B-tables of TGD:** No reference to the A/B-tables is given in the document.
- **Risk management options**: Treatment at the plant is already included in the factors! (activated carbon and precipitation are given as examples) (p.12).
- **Branch-specific values and factors:** No branch-specific values are given.
- **Default values for releases, effluent discharge rates of STPs and dilution at the point of complete mixing:** they have been determined on the base of statistical evaluations of data from France and Germany.

Relevant emission path ways: not in the scope of the document.

Description of point sources:

Representative point sources: not describes.

"Endpoint":

Default values (see last bullet point above)

- release factors to water, for production
- release factors to water, for processing
- $EFFLUENT_{STP}$
- DILUTION

1.13 Emission Scenario Profile D18 – Metal extraction, refining, and processing industry IC 8 (metal cutting)

Set of Emission Scenario data for metal cutting fluids:

2 modules, referring to life cycle waste/recovery, environmental compartment: water.

EE module IC 8.1: Release of a water-miscible cooling lubricant **emulsion** in the watery phase during waste/ recovery treatment (p. 15 –17).

EE module IC 8.2: Release of an aquaeous cooling lubricant **solution** in the watery phase during waste/ recovery treatment (p.19).

Non-water miscible cooling lubricants: no discharge into water at all ! □

Industrial use: no relevance for emissions to water!

IC 8	Production	Formulation	Industrial use	Private use	Service life	Waste / recovery
Water	A-/B-tables TGD **R**	A-/B-tables TGD **R**	Not relevant	Not relevant	Not relevant	EEM IC 8.1 EEM IC 8.2
Air						
Soil						
Waste						

R: reference to another data source given, e.g. EU TGD

Reference: Baumann, W.; Gräfen, M.; Pollkläsner, D.; Institute for Environmental Research, University Dortmund; Emission Scenario Document Metal Extraction, Refining and Processing Industry IC 8. Subcategory Metal Processing. Assessment of the environmental releases of chemicals used in metallcutting and –forming fluids. 11/19/99.

Remarks:

**Subcategory within an IC! (Metal Processing); Specification: metallcutting and –formig fluids.

A very specialised ESD, compared to the one on paints and varnishes! *

**Detailed figure 2: life cycle of an cooling additive and sources for the relevant data!
Reference to A/B-Tables TGD!

Short summary: Emission scenario document consisting of a generic exposure evaluation of the environmental concentration of cooling lubricants from the metal working industry into the hydrosphere.

The emission scenario treats the discharge of water miscible and non-water miscible cooling lubricants during the processing stage and during waste disposal (special disposal treatment plants are regarded).

Relevant emission path ways of **cooling lubricant classes** are described.

Technological data and default-values for the determination of the emission rate are given.

Description of point sources:

Representative point sources are described as “reasonable worst case”.

**Composition of selected cooling lubricants (fig.6, p.22)

Endpoint:

PEC local water! Combination of emission module (giving Elocal water (kg d-1), the sewage treatment plant module and the effluent in surfaced water module.

Annex 7: The REACH Supply Chain Model and the IC/UC-System of current TGD

For further information regarding the generic supply chain model for REACH, see chapter 3 of the Matrix Summary Report.

1. Background

Producers or importers of dangerous substances with a market volume of more than 10 t/a are requested to carry out a chemicals safety assessment, including exposure scenario and exposure estimation. The exposure scenario defines the (optional) conditions of safe use (including risk management). The exposure estimation is needed to demonstrate that the uses and risk management options in the exposure scenario are suitable to limit exposure to a level well below the PNEC.

The exposure assessment shall include all life cycle stages further down the supply chain. Since the knowledge of the manufacturer is limited, exposure estimation should be built on four elements:

(a) a generic definition of factors driving the emission across all chains;

(b) a supply chain specific (and possibly life cycle stage specific) “expression” of these drivers determined by types of use and conditions of use;

(c) an algorithm to translate uses and risk management measures into quantitative estimates of emissions and PECs;

(d) tools to enable and to encourage the actors in the supply chain to contribute relevant information in a “common language”.

Based on these considerations, the current IC/UC structure of the EU TGD needs some further development and possible also some changes in its basic set-up.

2. Basic Supply Chain Model

The EU TGD supply chain model (Figures 3 and 4 in volume II) can be used as the basis for exposure estimation under REACH. However, some modifications may be needed:

- The upper part of the chain should be constructed according to the registration duties under REACH. The manufacture of substances by synthesis (or oil refinery) includes the use of intermediates. Hence, production and use of intermediates takes place before “formulation (blending)”. Particular attention should be paid to proper allocation of the manufacture of “pre-polymers” or “no-longer polymers” which often takes place in “formulating industries”. It may be useful to split the life cycle stage “formulation” in two sub-stages, in order to reflect the reality in the supply chain that formulators often use preparations as input for their products. Some efforts should possibly be taken to discuss this issue with the chemical industry (at least in the two supply chains selected for the project).
- For organising a sufficient information flow on exposure scenarios and exposure estimates down and up the supply chain, “formulation” is a key process. Whereas the current

EU TGD has its focus on emissions from mixing or blending, the "distribution"- function of the formulator becomes much more important under the REACH System: The formulators decide at the end, in which (semi)finished articles and processes a substance will be used further down the chain. The, professional or industrial manufacturer of articles and private persons or professional service providers use preparations and will have limited knowledge on the contained substances, also in future. The current IC/UC structure in the EU TGD does not reflect this prominent role of the formulating industries (see attachment) well.

- Industrial processing is connected with losses of preparations (and the substances in it) via air emission, waste water or industrial waste. IPPC standards aim at minimising the primary losses from processes (prevention) and optimising the overall efficiency of secondary abatement techniques. This usually includes choices to which extent abatement takes place at production site, at public waste water treatment or at special waste treatment facilities (including recycling). Where and at which rate the emission takes place at the end, is a question of environmental legislation and costs. This kind of "industrial waste processing" is not yet well reflected in the EU TGD supply chain model and the subsequent methodology.
- Substances having been processed into or onto articles may be emitted into the environment during service life (and in subsequent waste treatment or disposal). From large volume chemicals used in/on a matrix (polymer, metal, wood, fibres) relevant losses during service life may occur. However a generic set of drivers for these emissions is not yet defined in the EU TGD or the ESDs.

Based on these considerations a modified IC/UC approach and a set of generic emission drivers is proposed (see section 4).

3. How to identify a suitable emission scenario?

From the perspective of the substance manufacturer the identification of the appropriate standard emission scenario may include the following steps. A-tables should only be used if no (computerised) emission scenario is available.

Table 1 Possible classifiers for uses of substances and allocation of A-tables

Possible classifiers for uses of substances					ES, A-table
Inter-mediate					A1.1
	Type of "performance package"				A 2.1
		Type of final preparation			A 2.1
			Category of manu-facturing industry		A 3.1 to 3.16
				Category of private, domestic, professional use	A 4.1 to 4.6
		Generic function of component	Process type Application type		

Possible classifiers for uses of substances				ES, A-table
			Type of (semi)finished) article	

The substance manufacturer usually sells his substance to a

- a substance manufacturer,
- to the formulator of a performance package,
- to the formulator of a preparation for final industrial, professional or private use.

Usually he can determine which type of preparations (paints, lubricant, textile auxiliaries, cleaners) his customer produces. These preparations can be used in one or more industrial categories.

A combination of preparation-types and industrial categories may therefore be used as identifiers for the appropriate emission scenario. Within the scenario further specific emission drivers may be identified:

- process type and type of application,
- type of substance function, if relevant for emission.

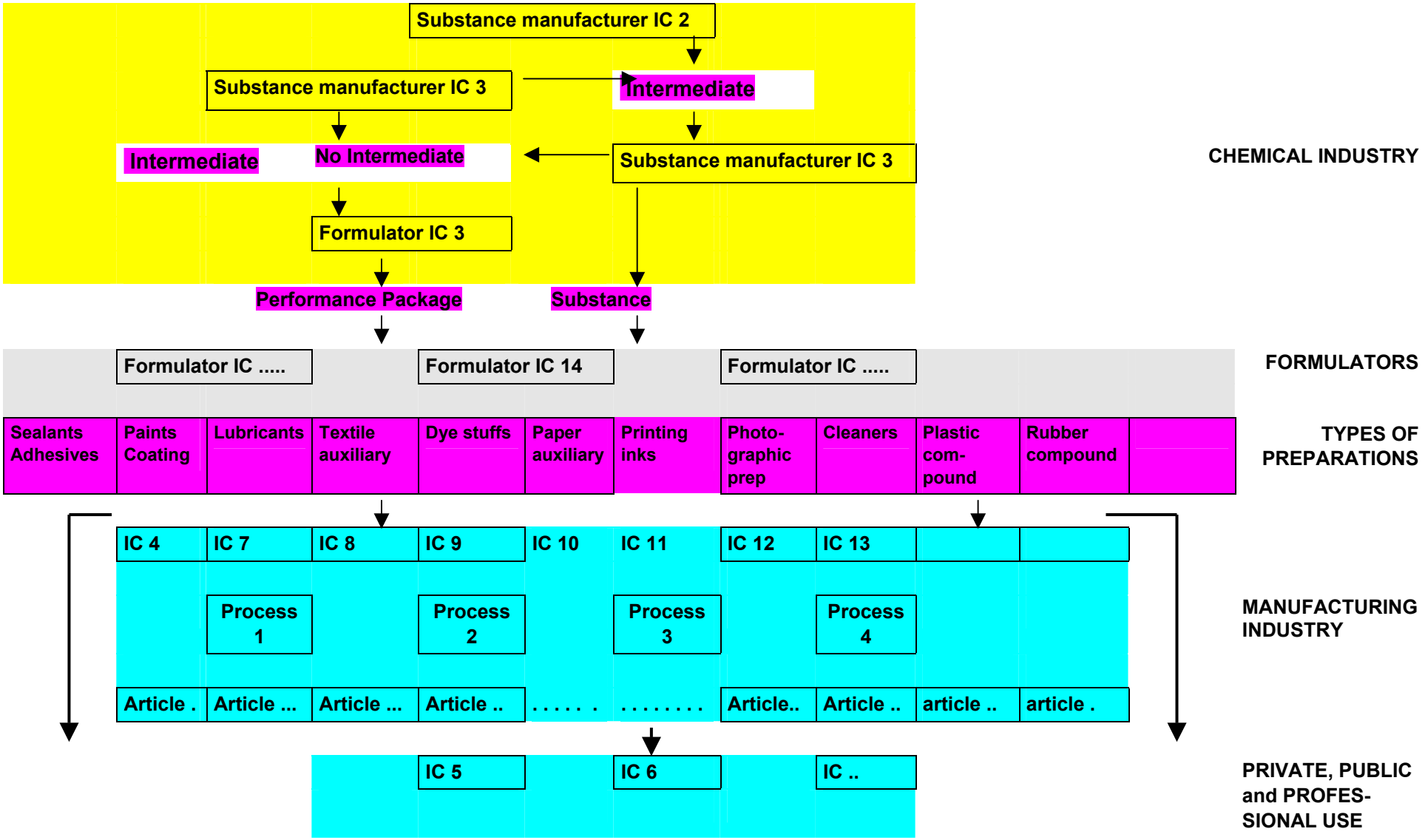
4. Six generic emission drivers related to the environment

Driver		Factor covered in ESD	Defaults available
(1) Physico-chemical properties of substances			
(2a) Used amount per time (2b) Frequency and duration of use	Qprod Temis		
(3) Partitioning between manufactured good (preparation, (semi)finished article) and losses; driven by • Technology • IPPC[1]	Fx		
(4a) On-site emission control measures including partitioning between air/water and external waste treatment	$Fabat_1$		
(4b) External emission control measures at industrial waste (water) treatment site.	$Fabat_2$		
(5) Losses from articles during service life driven by type of use, conditions of use and matrix type • Service life time • Erosion intended/not intended • Surface:volume ratio of matrix • Physico-chemical conditions mitigating losses (temperature weathering, water contact)			
(6a) On-site emission control measures, including partitioning between air/water and external waste treatment in disposal of articles after service life (municipal STP).			
(6b) External emission control measures at secondary waste			

Driver		Factor covered in ESD	Defaults available
disposal site.			

[1] The integrated prevention part belongs to driver 3, the integrated pollution control part belongs to driver 4a.

Attachment: REACH Supply Chain Structure and EU TGD IC/UC



Annex 8: Further documents with relevance for emission estimation

In addition to the TGD and the OECD ESDs analysed in project phase B1, further data sources with relevance for emission estimation exist for several branches. Examples are:

- (Bausteine-Konzept for the estimation of air emissions from textile industry);
- CLEANTOOL: integrated assessment tool for cleaning processes in the metal industry (Kooperationsstelle Hamburg);
- ConsExpo: Advanced model for consumer exposure, developed by RIVM;
- COSHH Essentials (control guidance sheets, risk management, working place);
- EASE: model for identifying and assessing exposure scenarios at the workplace;
- EIS ChemRISK: European compilation of models for consumer exposure assessment;
- HERA: Humans and Environmental Risk Assessment on ingredients of household cleaning products;
- LRI ExpoFacts: CEFIC's Long range initiative on European data relevant for exposure assessment;
- RISK OF DERM: "Risk assessment for occupational dermal exposure to chemicals";
- TRGS 430, standard exposure scenarios for isocyanates;
- Risk Assessment Reports of the European Community for hazardous substances (e.g. RAR on Bisphenole A, DEHP and others).

Further OECD ESDs not analysed so far, ESD drafts (not yet OECD-published) etc.:

- Industrial surfactants
- Pulp and paper industry
- Printing industry
- Chemical industry
- Blending of fragrance oils into consumer and commercial products
- Transport and storage of chemicals
- Canadian scenarios on mills (wool, woven, carpet, knit)
- OPPT generic scenarios of US EPA / Excel Spreadsheets of Environment Canada

Note: This list gives examples and does not aim to give a complete picture of all documents.