Impact Assessment of Potential Restrictions on the Marketing and Use of Dichloromethane in Paint Strippers

Revised Final Report - Annexes

prepared for
European Commission
Directorate-General Enterprise and Industry

RPA

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ANNEX A:

PROJECT SPECIFICATION

Preparation of the Impact assessment on:

Potential restrictions on the marketing and use of dichloromethane in paint strippers

1. General information

It falls within the responsibility of the Chemicals Unit of DG Enterprise and Industry to manage the risks from chemicals and to propose the appropriate legislation on the marketing and use of a specific chemical in the framework of Directive 76/769/EEC if unacceptable risks from this chemical have been identified and if they cannot be adequately controlled by other measures.
A framework contract concerning socio-economic evaluation arising from proposals for risk reduction measures related to specific chemical substances was signed on 09 July 2004 and will be used for this study.
The objective of the present study is to collect the information necessary for assessing the potential impacts of a restriction on the marketing and use of paint strippers containing dichloromethane.

2. Subject of the service requested

Dichloromethane (DCM) is currently one of the most used chlorinated solvents for example in the pharmaceutical industry or in paint removers.

Paint strippers are used by consumers for do-it-yourself activities, professional painters and in industry. They are used to remove various coats of paints especially blistered or cracked coats on wood both indoors and outdoors. DCM is claimed to be one of the most powerful paint stripper solvents available in common use. Paint strippers based on DCM were introduced as an effective and non-flammable replacement for the older paint stripping agents based on solvents such as aromatics, esters and ketones.

DCM is not one of the most dangerous chemicals. It is not a priority substance in the framework of the existing substances regulation (793/93). However, on the other handy DCM is classified as a carcinogen category 3, and is volatile and therefore easily released into the air especially during non-contained applications such as paint stripping.

Several EU Member States have partially already implemented national restrictions on the use of DCM. In 2003, the Commission mandated a report on the effectiveness of vapour retardants in reducing risks to human health from paint strippers containing dichloromethane. The objective of this report was to assess the risks to health related to the use of defined vapour retarded DCM-containing paint strippers and to investigate the performance of their vapour retardants regarding the effectiveness in reducing exposure to DCM during paint stripping. This report was finalised on 1 April 2004 (available on: http://europa.eu.int/comm/enterprise/chemicalsistudies_en.htm). The ETVAREAD report concluded that there is a need for restrictions on the marketing and use of paint strippers containing DCM in order to protect human health. ETVAREAD recommended

containments not bigger than 500 ml for consumers, as well as vapour retardation, spill prevention measures, safety warnings and sales instructions (see p. 68 of the report).

The Scientific Committee on Health and Environmental Risks (SCHER) was asked to assess the overall scientific quality of the ETVAREAD report and to comment on the methodology, finding, conclusions and recommendations in the report. SCHER concluded among other things that it is difficult to judge the influence of vapour retardants as the composition of the tested products is not given. SCHER saw a major concern for susceptible populations such as children and predisposed people. SCHER found that it may be very difficult to obtain sufficient ventilation during winter in a basement room with small windows and no low ventilation ducts. SCHER pointed to the unacceptable high concentration of DCM measured in air obtained using 350 ml paint remover on a 1 m^2 surface and so SCHER concluded that larger volumes and/or areas will give even higher exposure. Finally, SCHER was unable to assess the alternatives since SCHER could not find information on their toxicological properties and on the release of them from the products.

In order to advance the discussion at Community level, the Commission then organised as requested by several stakeholders a consultative Forum which was held on 14 November 2005. Formulators and downstream users could express their opinion, and more information about the products in the market and the needs for end users was gathered. There were two bodies of experience, those of the UK and Germany, with many differences between them. German experience is that the alternatives to DCM are satisfactory, but the UK experience is the contrary. No consensus was possible and it was not possible to draw a final conclusion from this forum.

The objectives of this study are to complete the already available information regarding the current uses of DCM in paint strippers used by consumers for do-it-yourself activities, professional painters and in industry, the problems for human health and the environment, to identify potential alternatives, their risks and benefits, the existing national restrictions, and the possible options for the management of identified risks at Community level. For each of these options the potential health, environmental, and economic impacts should be described.

3. Description of the tasks to be performed

The aim of the study is to collect the necessary information in order to assess the impact of potential restrictions on the marketing and use of DCM-based paint strippers. Recent developments in methodologies for impact assessments shall be taken into account. These are available at: http://europa.eu.int/comm/enterprise/regulation/better_regulation/impact_assessment/docs/sec_2005_79 l_guidelines_annexes.pdf

The study is to focus, starting on the basis of the already existing information, on DCM-based paint strippers anti alternatives and shall cover the following aspects:

- The study should identify the health and environmental risks and incidents already observed in the Member States. In particular, quantitative and qualitative information should be collected on accidents (including information on morbidity and mortality) involving DCM in consumer products and applications and in professional use.

- The study should provide an overview about the national situations of the EU Member States and it should identify the respective scopes of any national restrictions.

- The study should provide production and market data for DCM based paint strippers and their main alternatives in the EU Member States. The study should also assess the different formulations and products of paint strippers that are available on the market regarding their volume, availability, suitability and their efficiency in vapour retardation (The products can contain DCM, Dibasic esters, N-methyl-2-pyrrolidone, toluene or other solvents). It should in particular specify any uses for which there are no suitable alternatives available.

- It should describe the structure of the paint stripping industry with special attention to SME companies. It should provide economic data on the main downstream user industries including an analysis of different products marketed, the share of vapour retarded products and the importance of paint stripping in the EU Member States. It should also examine the extent of use by consumers for amateur use

- Starting from existing measures in the Member States and the measures proposed in the ETVAREAD report, the study should identify all other possible options for risk management with different stringency levels. Further information on views expressed by different stakeholders during the consultative Forum of 14.11.05 and of the Limitations Working Group of 15.2.06 is available upon request.

- For each of the potential risk reduction measures, the study should describe the expected positive and negative impacts on the protection of human health and the environment and particularly in terms of economic, commercial, employment and social consequences, including investment one-off costs, operating costs and impacts on management of risks. It should also investigate the wider implications on trade, competition etc. In this context, as a restriction of dichloromethane would certainly lead to an increase of the volumes of alternative substances on the market and in use, it will be especially relevant to consider also the health and environmental impacts and the performance of alternative solvents.

- The study should provide clear conclusions and recommendations with regard to the risk reduction measure considered most appropriate.

4. Estimated expertise requirement

Risk management, impact assessment and legal expertise from EU Member States are required.
Estimated expertise requirement are:

- Experts on risk management and impact assessment,
- Experts for National analyses,
- 90 w.d. in total including management.

w.d. = 1 working day for 1 expert (remuneration shall be payable to the Contractor only in respect of services actually rendered)

5. Estimated price

The total estimated budget (including travel costs) should not exceed 60.000 Euro
Travels should include 2 meetings of one day in Brussels for 2 persons.

6. Estimated time table

It is mandatory to complete the study within the time period of 10 months.
The contractor will provide a work programme including a detailed time scale.

7. Reports and documents

For the purpose of this specific study the following reports will be required:

The Interim report is due after 5 months.
The final report is due after 8 months.

The contractor is asked to submit all required reports in English and electronically to M. Daffern at marja.daffern@cec.eu.int

The **interim report** will indicate the progress to date with sufficient information to permit reorientation if appropriate and required and will contain at least the following information:

- **All information with regard to the quantities of DCM and alternatives used in paint stripping, the structure of the industry and consumer uses**
- **Complete collection of adopted measures of MS with a view dichloromethane based paint strippers**
- **Table of different risk management options**
- **Indications for positive and negative impacts of a restriction on the marketing and use of dichloromethane based paint strippers**
- Comparison between results obtained and the objectives;
- Information on the remaining work to be carried out;

- Any particular problems encountered that would have a notable effect on the tasks to be carried out;
- Clear indications and detailed planning of the work to be carried out during the rest of the period for the completion of the tasks.

The Commission shall have 30 days to approve or reject the interim report and the Contractor shall have 30 days to submit new documents.

The interim report will be deemed to have been accepted by the Commission if it does not expressly inform the contractor in writing of any comments within 30 days of its receipt.

The contractor shall deliver a **final report** containing at a minimum:

- An executive summary setting out the conclusions of the report;
- Analysis and conclusions per MS concerning the impact of a restriction on the marketing and use of dichloromethane based paint strippers;
- A comparison between results and objectives set out in the proposal; description of problems encountered and steps taken to overcome these; consequences of these problems on the results; impact on the validity and completeness of the conclusion.
- Information and clear references on sources of information used and the value of their methodologies as appropriate;
- A summary of the resources spent on the specific contract, including details of travel expenses.

The Commission shall have 30 days to approve or reject the final report and the Contractor shall have 30 days to submit new documents.

The final report will be deemed to have been accepted by the Commission if it does not expressly inform the contractor in writing of any comments within 30 days of its receipt.

8. Required meetings

Attendance at 2 meetings: Kick-off meeting and Presentation of final report in Brussels.

ANNEX B:

INFORMATION FROM MEMBER STATES ON NATIONAL MARKETS FOR DCM, DCM-BASED PAINT STRIPPERS AND DCM-FREE PAINT STRIPPING FORMULATIONS AND RELEVANT REGULATIONS

Note that the information presented here includes predominantly information that has been submitted by Competent Authorities in European countries.

B1. AUSTRIA

B1.1 Past Data on Uses of DCM

A survey undertaken in 1995 (Bundesamt für Umwelt, Wald und Landschaft, 1995) suggests that the following sectors were the main users of DCM in Austria:

- chemical industry: 47%;
- colour and painting industry: 34%;
- metal-industry: 12%; and
- other applications: 7%.

A market survey undertaken in 1995 by Branchenkonzept Metallreinigung, under contract to the Austrian Federal Environment Agency (Bundesministerium für Umwelt, 1995) showed that the main uses of DCM were as follows:

- the pharmaceutical industry (50%) for extraction applications;
- the metal-industry for degreasing;
- the electronic industry;
- in hair sprays cans as solvent; and
- corrosion removal for painting purposes.

In 1997, 848 tonnes of DCM were imported by Austrian companies. From this amount (Austrian Institute for Industrial Ecology, 1998):

- 66% were used in chemical industry (558 tonnes);
- 20% were directly exported without use (173 tonnes);
- 7 % were used in the metal manufacturing industry (61 tonnes);
- 4 % were used in other applications (38 tonnes); and
- 2% were used by commercial companies (18 tonnes).

The majority of the DCM was incinerated after use (58%), 20% were diffuse emissions into the atmosphere, 22% were collected as waste (1% as a mixture and 6% as pure DCM waste). The incineration was performed only by one company.

The Austrian Federal Ministry of Environment classified the users of DCM into three separate categories in order to reduce the diffuse emissions from the use of DCM:

- ***users of DCM in quantities in excess of 35 t/y***: this type comprises mainly companies from chemical industry. The main part of DCM is collected and disposed regularly;

- ***users of DCM in quantities between 5 and 35 t/y***: Only two companies were identified in this type, but 100% of the used DCM escaped in the atmosphere – the share of the total diffuse emissions is with 32 % (44 t/y). In one company, DCM was used for cleaning oily dirty metal plates in an open application. The second company

used DCM in different products with the intention of gradually phasing out this use; and

- ***users of DCM in quantities below 5 t/y***: about 60 companies were present in this type, each of them use only small amounts of DCM. The purpose of DCM was mostly the use as a cleaning agent, but the applications were often very specialised. Substitution was thus expected to involve considerable cost.

In general, the survey of 1997 showed that the use of DCM was decreasing rapidly. At the time, some companies had developed concrete plans to substitute DCM in collaboration with their suppliers (IIE, 1998).

B1.2 Current Situation

As shown in Section 4.4 of the main Report and in Section B1.3 below, the use of DCM in paint strippers is now restricted. According to the Fachverband der Chemischen Industrie Österreichs (2006), the main reason for the restriction was a drive to reduce ozone depletion by regulating the use and emissions of VOCs. Nevertheless, at the Paint Stripping Forum of November 2005 which was held in Brussels, it was suggested that some Austrian contractors formulate their own stripping preparations using DCM (CEFIC, 2005)

B1.3 National Regulatory Measures

When the VOC Directive 1999/13/EC entered into force, Austria had two ordinances in place with partly more stringent and partly less stringent regulations: one for the use of solvents associated with coating activities (Lackieranlagen-Verordnung, BGBl. No. 873/1995), the other for the use of chlorinated and/or fluorinated hydrocarbons (CKW) associated with dry cleaning and surface cleaning (CKW-Anlagen-Verordnung 1994, BGBl. No. 865/1994) (Austrian Federal Ministry of Economics and Labour, 2005).

Ordinance No. 865/1994 aimed to regulate the reduction of emissions of DCM in the workplace with respect to ambient air. This ordinance generally regulates the use of chlorinated hydrocarbons in new and existing plants (according to the Trade Code, FLG No 194/1994) and provides for several measures including provisions for purification plants for waste air, safety measures, storage conditions for chlorinated hydrocarbon, etc. The term "chlorinated hydrocarbon" in the ordinance is defined in such a way that DCM falls within the range of the regulations (OECD, 1996).

Ordinance No. 872/1995 (Verordnung des Bundesministers für Umwelt über Verbote und Beschränkungen von organischen Lösungsmittel) defines in paragraph 1 (1) the application range for organic solvents including paint strippers. According to paragraph 3 (1), the marketing of formulated products as defined in paragraph 1 (1), containing chlorinated hydrocarbons or benzene, is forbidden (EARSC, 2007).

According to Austrian Federal Ministry of Economics and Labour (2006), in the last 15 years, the Austrian Labour Inspectorate has worked hard to reduce occupational exposure to DCM, especially in SMEs. According to the objectives in of the Austrian occupational health and safety regulations, the aim was mainly to force employers to switch to a substitute solvent or method (e.g. sanding). The other possibility was the use of DCM in closed systems only, which is the preferred method for extraction processes.

As a result, the professional use of DCM is not a key issue for Austria, since the use of products containing DCM and subsequently occupational exposure has decreased to a very low level. However, as the substance is not restricted by EU-legislation, products containing DCM are still available on the Austrian market (Austrian Federal Ministry of Economics and Labour, 2006). As indicated above, CEFIC (2005) also suggests that some professionals still use DCM to manufacture their own paint strippers.

B2. BELGIUM

B2.1 Current Situation

Only limited information has been made available by the SPF Santé Publique (2006) on imports of DCM for the years 2001-2002. This is reproduced in Table B2.1.

Table B2.1: Imports of DCM into Belgium for the Years 2001-2002

2001		2002	
Weight in tonnes	**Value in euro (€)**	**Weight in tonnes**	**Value in euro(€)**
22,645	9,172.700	27,000	8,225,270

Source: SPF Santé Publique, 2006

These figures appear to be high when compared to the information we have obtained from the manufacturers of DCM. We can only assume that it includes DCM in preparations.

B3. CYPRUS

B3.1 Current Situation

Information on the domestic markets for DCM has been provided by the Cypriot Department of Labour Inspection (2006a) and is reproduced here as Table B3.1.

Table B3.1: Markets for DCM in Cyprus for the Year 2005	
Tonnage of DCM manufactured in Cyprus	0
Application category	**Tonnage of DCM used**
Paint stripping	24.56
Pharmaceuticals	0.6 (year 2001)
Extraction processes in the food industry	6.52
Source: Cypriot Department of Labour Inspection, 2006a	

There are no manufacturers of DCM in Cyprus, while there are two manufacturers of DCM-based paint strippers both of which are SMEs.

B3.2 Composition of DCM-based Paint Strippers

The Cypriot Department of Labour Inspection (2006b) has advised that the paint strippers that are manufactured in Cyprus do not contain vapour retardants. However, in subsequent communication with the Department (2006c) it was suggested that this assertion was based on the contents of Safety Data Sheets and it is likely that products manufactured in Cyprus indeed contain vapour retardants. Following that, we contacted the two key Cypriot manufacturers to ask them about their use of vapour retardants. The two companies have a combined production tonnage of just over 20 tonnes. The figure is low in comparison to the 2005 data provided above (the 24.56 tonnes of DCM referred to in Table B3.2 should correspond to a higher tonnage of paint strippers – the companies have now provided more recent up to date information than the information submitted last year by the Cypriot Department of Labour Inspection). In conclusion, both companies do use vapour retardants in their products. However, 20% of one company's production tonnage does not contain vapour retardants in formulations used for surface preparation before dip tank stripping and for the cleaning of equipment (for example, the nozzles of spraying equipment).

Table B3.2 presents the composition of DCM-based paint strippers available on the Cypriot market.

Table B3.2: Typical Composition of DCM-based Paint Strippers that do not Contain Vapour Retardants in Cyprus (information submitted by Competent Authorities)		
Component	**CAS Number**	**Percentage in formulations**
Ammonia	1336-21-6	0.45-5
Methanol	67-56-1	10-15
Source: Cypriot Department of Labour Inspection, 2006a		

B3.3 Alternatives

According to the Cypriot Department of Labour Inspection (2006a), there are seven manufacturers of alternative paint stripping formulations in Cyprus. No information is available on the tonnages involved.

B4. THE CZECH REPUBLIC

B4.1 Current Situation

According to the Czech Ministry of Environment (2006), there is no production of DCM in the Czech Republic higher than 10 tonne per year. The total quantity of the substance used in the country is about 700 tonne per year - all imported from EU countries.

The total number of workers using DCM in the workplace, as indicated in the National Exposure Database, is 274 (of whom 117 are women) in 40 companies, incl. 20 paint strippers (as of 30 October 2006) (Czech National Institute of Public Health, 2006).

As advised by the Association of Paint Manufacturers of the Czech Republic (AVNH, 2006), no member of the association produces paint strippers. Only one member of the Association distributes a paint stripper imported from Germany.

One company which is not member of the association distributes approximately 50 tonnes of two paint stripper types with an average annual DCM consumption of 25 tonnes (by an external manufacturer). The associated revenue is small considering the total turnover of this company (AVNH, 2006).

B5. DENMARK

B5.1 Past Data on Uses of DCM

The Danish Register of Chemical Products and Substances recorded in 2002 23 chemical paint/lacquer removers containing DCM (MST, 2002). In total, 85 paint/lacquer removers were registered, containing 65 different substances not covered by confidentiality requirements. A total of 168 substances were registered with the Product Data Division at the National Working Environment Authority, including those substances covered by confidentiality requirements in the Register of Products.
The total quantity of paint/lacquer removers registered had fallen by 216 tonnes since the start of 1995 (from 374 down to 158 tonnes. Consumption of registered paint/lacquer removers containing DCM had been constant since 1995 (MST, 2002).

According to the Product Data Division, the production of DCM-based paint/lacquer removers in Denmark was on the decline. Imports, on the other hand, had increased since 1995. However, the statistical uncertainty in these estimates was not insignificant (MST, 2002). The total consumption of DCM for paint/lacquer removers in 1998 was estimated to be at the same levels as in 1995 (equivalent to 110 tonnes a year). The total consumption of paint/lacquer removers was estimated to be up to 200 tonnes a year (MST, 2002).

B5.2 Current Situation – Information from the SPIN Database

The use of DCM in paint strippers has decreased from 71.9 tonnes in 2000 to 18.2 tonnes in 2004 (Danish Working Environment Authority, 2006a). .

The major suppliers in Denmark have, on a voluntary basis, agreed not to market DCM-containing pain strippers for private consumers.

As explained in Section B5.3 below, if a professional user wants to use a DCM-based paint stripper, they need an approval given by the Danish Working Environment Authority. The Authority has so far received no applications. In the case of an application, the Authority believes that an approval would probably not be given due to the availability of less hazardous alternatives. On this basis, the Danish authorities believe that DCM in paint strippers is only used sporadically in Denmark at present, if at all (Danish Working Environment Authority, 2006a).

Information on the use of substances in preparations - notified to the Product Registers in the Nordic countries may be found in the SPIN database (www.spin2000.net) and the relevant figures for Denmark are reproduced below.

Table B5.1: Registered Quantities of DCM Use in Denmark in 2004 – SPIN Database Data			
Code	**Type of Use**	**Number of preparations**	**DCM tonnage**
O15000	Solvents	7	47.9
M10000	***Paint, varnish and ink removers***	***13***	***18.2***
R10000	Cleaning/washing agents	5	10.4
L05000	Laboratory chemicals	5	7.5
L10000	Adhesives	6	0.0
Source: SPIN Database Internet site (http://www.spin2000.net/spin.html)			

B5.3 National Regulatory Measures

B5.3.1 National Legislation on Professional Use of DCM-based Paint Strippers

DCM is on the Danish EPA's list of undesirable substances and is suspected of being carcinogenic (MST, 2002).

Apart from the general legislation arising from the Danish implementation of the Chemical Agents Directive (98/24/EC), Denmark has in place two sets of specific regulations focusing on the professional use of DCM:

- ***DCM regulated as a carcinogen***: the Danish implementation of the carcinogens directive (2004/37/EC) has been extended to cover Carc. Cat. 3 substances, including DCM (as well substances classified by IARC in groups 1, 2A and 2B). Furthermore, the implementation includes specific regulations of many of these substances. For DCM this includes:

Table B5.2: Danish Regulations on DCM in Products – Implementation of Directive 2004/37/EC			
Substance/ CAS Number	**Content in products**	**Special provisions**	**Additional remarks**
DCM 75-09-2	0.1%	s.17, s.18 (2), s.25, s. 34, s.35	Industrial use, including synthesis, extraction and metal degreasing.
		s. 17	Laboratory work
		s. 27	Asphalt products
		s. 27	Detergents
		ss. 29-32	Photographic liquids
		s. 18 (2), ss. 29-32	***Diluents, paints and lacquers, printing ink, joint fillers, acids, varnish removers and glues including cold-water adhesives***
		s. 17, s. 18 (2), s. 25, s. 34	Cleaning of hardened polymer from special implements (e.g. nozzles)
		ss. 29-32	*Other use*
Source: Danish Working Environment Authority, 2006a			

S18 means that the workplace shall be demarcated and provided with appropriate warning and safety signs including 'no smoking' signs. Ss. 29-32 means that the user shall apply for an approval from the Danish Working Environment Authority before use (Danish Working Environment Authority, 2006a) and as can be seen in Table B5.2, this applies to:

- diluents, paints and lacquers, printing ink, joint fillers, acids, varnish removers (including as paint stripper) and glues including cold-water adhesives;
- photographic liquids; and
- other use.

The approval process does not apply to other uses of DCM as presented in the table; in all these cases, other specific regulatory restrictions exist (Danish Working Environment Authority, 2006b).

The implementation of the regulation for private consumers is the responsibility of the Danish Environmental Agency. The Danish Working Environment Authority has suggested, however, that a voluntary agreement was made by industry not to market DCM-based paint strippers to private consumers. As a result, DCM-based paint strippers are not found in Danish DIY stores as far as the Authority can ascertain (Danish Working Environment Authority, 2006b);

- ***the Danish legislation on code numbered products***: the Danish MAL-code number system covers, among others, restrictions on working with paints, glues, fillers and products used for preparatory and finishing operation in connection with the above mentioned products including paint strippers.

  A DCM containing paint stripper will have a code number of 5-6 which is the highest number on the scale. Therefore, there is a requirement for substitution by a less hazardous product with a lower code-number where that is available on the market (Danish Working Environment Authority, 2006a). The lowest code-number is 00-1, which is used for the new water-based paints, and the highest code-number is 5-6 which is used for the pure solvent benzene, which is considered carcinogenic. A MAL-code on 5-6 indicates that fresh air mask, gloves and suit are required (Danish Working Environment Authority, 2006b).

  The MAL-code (paint-code) makes it easy to identify how hazardous a paint, glue or printing ink is. Since 1982, the Danish painters have used the code for substitution (selecting the right paints) and for using the right PPE. The code-number makes the painters aware of what they are working with. They do not necessarily have information about the ingredients of the paint but they are thus informed about the hazardous properties of the paint from the code-number and whether it contains carcinogenic, allergenic or neurotoxic substances. .

  The MAL-code system has acted as a competition parameter to create the most friendly paints to health and environment. It has resulted in the old solvent-based paint being replaced with water-based paint. In addition, it has given the Danish

producers a competitive advantage in the international market, where there is an increasing interest for the new water-based products (Danish Working Environment Authority, 2006b).

B5.3.2 Danish Tax on Chlorinated Solvents

The Danish product tax on chlorinated solvents came into force on January 1, 1996. This tax was introduced prior to the creation of the Solvent Emissions Directive, at a time when there was much more scope for the use of economic instruments (RPA, 2002).

The tax applies to the three most commonly used chlorinated solvents, including DCM, and amounts to 2 DKK/kg of chlorinated solvent. This corresponds to a consumer price increase of about 25%. At the time of implementation, it was estimated that the use of these chlorinated solvents together accounted for 95% of the total domestic use of chlorinated solvents (RPA, 2002).

The tax applies to the chlorinated solvents in their pure form. It also applies in cases where the chlorinated solvents are found in other goods if their concentration exceeds 1% by weight, with imports of products like glue, paint and detergents accounting for around 1,000 t/y of chlorinated solvents. Motivated by concerns over competitiveness the tax on substances and products sold for export is refunded (RPA, 2002).

Producers and importers of chlorinated solvents, plus importers of products that contain these solvents, pay the tax to the regional offices of the Department of Customs and Excise. Companies that produce (or regain and sell) the three taxable solvents must register with the Customs authorities. Registered enterprises are liable to the tax once the solvents in question leave the premises. Imports of products that contain dutiable solvents must be accompanied by a declaration from the manufacturer on the amount of solvent within the products (RPA, 2002).

B6. ESTONIA

B6.1 Current Situation

Information on the domestic markets for DCM has been provided by the Estonian Health Protection Inspectorate (2006a) and is reproduced here as Table B6.1.

Table B6.1: Markets for DCM in Estonia for the Year 2005	
Tonnage of DCM manufactured in Estonia	0
Application category	**Tonnage of DCM used**
Paint stripping	6.15
Other (industrial use not exactly paint stripping use, including electrical industry)	12.5
Source: Estonian Health Protection Inspectorate, 2006a	

The Estonian Health Protection Inspectorate indicates that there are two DCM-based paint stripping products available on the Estonian market which are used in both professional and consumer uses. The tonnage used by tradesmen in 2005 was 2 tonnes and the tonnage for consumer uses was 4.15 tonnes. DCM is not used in the pharmaceuticals industry in Estonia.

The Estonian Health Protection Inspectorate (2006a) estimates the number of relevant companies in the Estonian market as::

- one manufacturer of DCM-based paint strippers; and
- two suppliers of DCM-based paint strippers that supply products for both professional and consumer uses.

B6.2 Composition of DCM-based Paint Retardants

Table B6.2 presents the composition of DCM-based paint strippers available on the Estonian market that do not vapour retardants. The Estonian Health Protection Inspectorate (2006a) has advised that there are no vapour-retarded products on the market. We have not obtained further clarification on the basis of this assertion.

Table B6.2: Composition of DCM-based Paint Strippers that do not Contain Vapour Retardants and are available on the Estonian Market (consultation with Competent Authorities)					
Component	**CAS Number**	**Percentage in formulation**			
		Paint stripper (Finland)	**Paint stripper (Holland)**	**Paint stripper (Latvia)**	**Paint stripper (Estonia)**
		Professional use	**Professional use**	**Consumer use**	**Consumer use**
DCM	75-09-2	✓	✓	✓	✓
Trichloroethylene	79-01-6	✓			
Methanol	67-56-1		✓		✓
Naphtha (petroleum), hydrotreated heavy	64742-48-9		✓		
Toluene	108-88-3			✓	
Xylene	1330-20-7				✓
Source: Estonian Health Protection Inspectorate, 2006a					

B6.3 Container Issues

The market situation with regard to the available sizes of containers in the Estonian market is outlined in Table B6.3.

Table B6.3: Available Size for Containers of DCM-based Paint Strippers in Estonia		
Use area	**Available sizes of containers**	**Predominant ('most popular') size**
Professional use	1,000, 2,500, 5,000, 10,000ml	2,500, 5,000 ml
Consumer (DIY) use	350, 500, 750, 1,000ml	350, 1,000 ml
Source: Estonian Health Protection Inspectorate, 2006a		

Consumer products are available in containers with a double fitting cap (Estonian Health Protection Inspectorate, 2006b). There is no national legislation requiring the use of spill-proof containers and consumers do not receive any advice by sales people to purchase DCM-based paint strippers in spill-proof containers (Estonian Health Protection Inspectorate, 2006a).

B6.4 Alternatives

There are no alternative formulations available on the Estonian market (Estonian Health Protection Inspectorate, 2006a).

B7. FINLAND

B7.1 Current Situation

Information on the domestic markets for DCM has been provided by the Finnish National Product Control Agency for Welfare and Health (2006) and is reproduced here as Table B7.1.

Table B7.1: Markets for DCM in Finland for the Year 2005	
Tonnage of DCM manufactured in Finland	0
Application category	**Tonnage of DCM used**
Paint stripping	72 tonnes
Adhesives	54 tonnes
Aerosols	1 tonne
Detergents/dry cleaning	14 tonnes
Other (degreasing agent in general)	22 tonnes
Source: Finnish National Product Control Agency for Welfare and Health, 2006	

According to the Finnish Product Register, there are 99 paint strippers on the Finnish market of which 34 (trade names) contain DCM. There are 25 companies (importers from EU and from non-EU countries, manufacturers and formulators) who have supplied information to the Register. It is not possible to separate which are intended for industrial, professional or consumer use (Finnish National Product Control Agency for Welfare and Health, 2006).

In the last 10 years, the use of DCM-based paint strippers has decreased in Finland according to the information from the Finnish Institute of Occupational Health; however, the percentage of this decrease is not known (Finnish National Product Control Agency for Welfare and Health, 2006).

B7.2 Composition of DCM-based Paint Strippers

Table B7.2 presents the information that has been submitted by the Finnish National Product Control Agency for Welfare and Health (2006) on the components of DCM-based paint strippers that are available on the Finnish market. This was a list of chemical substances accompanied with the note that, if vapour retardants are not classified as dangerous, the Finnish product register information might not include information on them. Thus, the information provided relates to both products that 'do not contain' and 'contain' vapour retardants. However, it has to be noted that the substances indicated as components of DCM-based paint strippers appear to be the same as the components of several alternative formulations (for example N-methyl-2-pyrrolidone, alkalis, benzyl alcohol and dibasic esters). Common components such as methanol are missing. No

information was provided on the percentage of these substances in the relevant formulations.

Table B7.2: Components of DCM-based Paint Strippers available on the Finnish Market	
Component	**CAS Number**
N-methyl-2-pyrrolidone	872-50-4
Benzyl alcohol	100-51-6
Sodium hydroxide	1310-73-2
Potassium hydroxide	1310-58-3
Ethanol	64-17-5
Propan-1,2-diol	57-55-6
2(2-buthoxyethoxy)ethanol	112-34-5
Dimethyl glutarate	1119-40-0
Dimethyl adipate	627-93-0
etc. (7 substances in less than 5 products)	
Source: Finnish National Product Control Agency for Welfare and Health, 2006	

B7.3 Alternatives

Table B7.3 outlines the information on alternatives that has been submitted by the Finnish National Product Control Agency for Welfare and Health (2006).

Table B7.3: Typical Components of Alternative Formulations available on the Finnish Market		
Composition of alternative DCM-free paint strippers	**CAS Number**	**Percentage in formulation**
N-methyl-2-pyrrolidone Sodium hydroxide	872-50-4 1310-73-2	50% 3 %
2-(2-buthoxyethoxy)ethanol Sodium hydroxide	112-34-5 1310-73-2	15 % 2 %
N-methyl-2-pyrrolidone 1,2-ethandiol (ethylene glycol) Potassium hydroxide	872-50-4 107-21-1 1310-58-3	75 % 20 % 5 %
Benzyl alcohol Distillates (petroleum), catalytic reformer Glycolic acid Propan-1,2-diol	100-51-6 68477-31-6 79-14-1 57-55-6	40 % 10 % 5 % 5 %
Source: Finnish National Product Control Agency for Welfare and Health (2006)		

Consultation suggests that there are a total of 64 DCM-free paint stripping formulations currently available on the Finnish market (Finnish National Product Control Agency for Welfare and Health, 2006).

B8. FRANCE

B8.1 Current Situation

Information on the domestic markets for DCM has been provided by the French Ministry of Labour (2006a) and is reproduced here as Table B8.1. The information is based on the ORFILA[1] database. Forty-two new preparations were recorded in the database since 2000.

Table B8.1: Markets for DCM in France for the Year 2005

Application category	Tonnage of DCM used
Paint stripping	8,975
Adhesives	3,250
Detergents/dry cleaning	395
Agrochemical products	265
Unknown uses	455

Source: French Ministry of Labour, 2006a

CEFIC (2005) has also provided an account of the DCM tonnages presented by the INRS (Institut National de la Recherche Scientifique) at the November 2005 Forum held in Brussels. According to CEFIC, the INRS data suggest that:

- the total French market for DCM is 13,000 tonnes;
- of which 10,000 tonnes are for stripping;
- of which 3,500 tonnes are for paint stripping (note that this figure does not correspond well to the tonnage presented in Table 2.6 of the main report. This could relate to the use of recycled DCM in the manufacture of paint strippers or the sale on the French market of products manufactured elsewhere).

B8.2 Composition of DCM-based Paint Strippers

B8.2.1 Information for Consumer Use Products

The National Database of Products and Preparations (BNPC) contains 716 compositions containing DCM (0.85% of the preparations available), from which three classes of concentrations were defined (<10%; 10 - 50%; and >50%). Paint and varnish strippers containing DCM represent 401 compositions in the BNPC, of which 354 contain more than 50% of DCM. These results are summarised in Table B8.2 below.

[1] French database which contains declarations of chemical preparations on the French market over the last 26 years (French Ministry of Labour, 2006a).

Table B8.2: Distribution of the Preparations containing DCM by Use and Class of Concentration in France				
Uses	**Concentration class for DCM**			**Total**
	< 10%	**10 - 50 %**	**> 50 %**	
Paint strippers	6	41	354	**401**
Glue	11	15	3	**29**
Solvents, other uses	55	87	22	**164**
Insecticides	36	80	6	**122**
Total	**108**	**223**	**385**	**716**
Source: French Ministry of Labour, 2006a (as of 31 August 2006)				

Paint strippers and varnishes account for 56% (401 out of 716) of the preparations containing DCM and 92% when the compositions contain more than 50% of DCM (354 out of 385). Among paint strippers, 88% contain more than 50% of DCM.

B8.2.2 Information on Products for Industrial and Professional Use

Table B8.3 outlines the components of a sample of 60 DCM-based products on the ORFILA database.

Table B8.3: Composition of DCM-based Paint Strippers on the French Market	
Components	**Percentage of formulations**
Solvent types	
Methanol (6-20% concentration)	33% of DCM-based paint strippers
Toluene (or toluene + alcohol) (3-15% of concentration)	33% of DCM-based paint strippers
Co-solvent/thinner types	
Essentially hydrocarbons, such as alcohol and toluene	Unspecified
Vapour retardants types	
Paraffin wax (0.5-1% concentration)	All DCM-based paint strippers
Activator types	
Formic or sulphonic acid, often mixed with phenol (5-15% concentration)	66% of DCM-based paint strippers
Ammonia, potash or soda (5% concentration)	
Ethanolamine (1-2% concentration)	
Phenol (3-17%)	25% of DCM-based paint strippers
Thickener types	
Hydroxypropylmethylcellulose, hydroxypropylcellulose, hydroxyethylcellulose	33% of DCM-based paint strippers
Polyacrylic acid	
Acrylic resin	1 product out of 30
Latex type polymers	
Sugars	Remaining formulations
Source: French Ministry Labour, 2006a	

Consultation with paint stripper manufacturers revealed that some formulations sold in France may not contain vapour retardants but that these are subsequently added by the downstream user. The French authorities cannot be 100% sure if this is indeed the case, however, the information from the ORFILA database shows that vapour retardants are widely used (French Ministry Labour, 2006b).

The concentration of key components of products available on the French market for those involved in industrial and professional uses is summarised in Table B8.4. The composition for products available to consumers may differ; however, the French authorities did not provided relevant information within the timeframe of this study.

Table B8.4: Concentration of Components of DCM-based Paint Strippers available on the French Market for Industrial and Professional Use

Component	CAS Number	Percentage in formulations
DCM		52-95 %
Methanol (in 1/3 of preparations)	67-56-1	6 - 10 %
Toluene (in 1/3 of preparations)	108-88-3	3 - 15 %
Vapour retardants (in 100% of preparations*)		0.5 - 1 %
Anionic surfactants (in 100% of preparations)		
Formic, sulphonic, acetic or hydrofluoric acid (in 2/3 of preparations)		5 - 18 %
Ammonia, soda or potash		5 %
Phenol (in 1/4 of preparations)	108-95-2	3 - 17%
Ethanolamine	141-43-5	1 - 2%

Source: French Ministry of Labour, 2006a
** All 60 relevant products in the ORFILA database contain vapour retardants.*

B8.3 Alternatives

According to information submitted by the French Ministry of Labour (2006a), there are three main types of alternative formulations available on the French Market:

- DBE- based products;
- 1,3-dioxolane-based products; and
- aqueous products; these are acid aqueous solutions (i.e. mixture of water, benzyl alcohol, anisole, amylacetate and formic acid) or basic solutions (ex: mixture of water, benzyl alcohol, methylbenzotriazole, tetrapropylbenzene, ammonia and diethanolamine borate) (French Ministry of Labour, 2006b).

Non-chemical alternatives may include (French Ministry of Labour, 2006a):

- stripping with ice granules or CO_2;
- sanding and other high pressure blasting; and
- laser stripping.

Some of these alternatives are evidently unsuitable for day-to-day use by consumers in DIY operations.

B8.4 Details of Industrial Paint Strippers in France

B8.4.1 Introduction

A study was co-ordinated by the French Ministry of Health to help establish a summary of all products used in industrial paint stripping, which used databases from ORFILA, manufacturers or suppliers and through laboratory analysis. Paint strippers are concentrated formulations that are more or less complex, which also contain solvents, waxes, surfactants, thickeners, acids and corrosion inhibitors, and one or more of the following substances (French Ministry of Labour, 2006a):

- DCM (50% of paint strippers);
- soda or potash (25% of paint strippers are alkaline with a pH of >13); and
- mineral or organic acids: phosphoric, hydrochloric, hydrofluoric, nitric or sulphuric (90% of products used in metallurgy and 70% of oven strippers).

B8.4.2 Alkaline Paint Stripping Formulations

Twenty five percent of alkaline strippers (pH >13) are used hot. Potash or soda based (in 9 out 17 products) products are aqueous solutions; otherwise they are powders or pastes that are essentially used in buildings. The typical composition of strippers is as follows:

Table B8.5: Components and Composition of Hot Alkali Strippers used in the Removal of Inks, Paints and Varnishes (France)

Component	Content	No. of products concerned
Potassium hydroxide Sodium hydroxide	20-40% 7 to ca. 100%	
Hydrocarbons		
N-methyl-2pyrrolidone		
Phosphates, colorant, surfactants		
Sodium salts (metasilicate, carbonate, gluconate, alkyl sulphate, linear sulphate) that ensure an adequate alkalinity is in the product		
An activator: phenol or mono-, di-, or tri-ethanolamine	1-20%	30% of formulations
Another solvent: glycol ether such as ethoxyethoxyethanol (up to 12% in the product), methanol (up to 73% in the product) or furfurylic alcohol (32%)		
A surfactant		20% of formulations
A thickener made from cellulose or xanthane gum so that the product can be applied with a paint brush, roller or vaporisation		17% of formulations
Source: French Ministry of Labour, 2006a		

B8.4.3 Solvent-based Paint Stripping Formulations

Other stripping products are made of petroleum, oxygenated solvents or mixtures of solvents (French Ministry of Labour, 2006a).

- Examples of these petroleum based mixtures:

Example A	*Example B*
• xylene (44%) • toluene (17%) • ethylglycol • butyl and ethyl acetates	• methyl ethyl ketone • toluene • co-solvents (for use for easier removal of layers of older coatings)

- Acidic aqueous solutions (with a pH of 2):
  - water and benzyl alcohol (20%)
  - anisole (25%)
  - amyl acetate (10%)
  - formic acid (5%)
- Alkaline aqueous solutions (with a pH of 12):
  - water and benzylic alcohol (40%)
  - methylbenzotriazole
  - tetrapropylbenzane
  - ammonia and diethanolamine borate
- Oxygenated solvents or mixtures of solvents

Example A	*Example B*	*Example C*
Dimethylsulphoxide (26.5%) (with a pH of 13) OR Methyl ethyl ketone (40%) (with a pH of 13) OR Triethanolamine (5%)	• NMP (40-50%) • co-solvent (gamma-butylorlactone or hydrocarbon, less expensive thinner)	• DBE (dibasic esters: succinate, glutarate and dimethyl adipate)

N-methyl-2-pyrrolidone and dibasic esters result in a slower stripping speed: up to 24 hours may be needed to obtain a good result.

There is always the addition of a co-solvent (alcohol or xylene), sometimes a thickener (cellulose), an activator (soda or amine), a corrosion inhibitor, a vapour retardant (with limited efficiency since paraffin waxes are very soluble in petroleum solvents), and wetting agents when surfactants are used (so that the stripper can be washable in water) (French Ministry of Labour, 2006a).

B8.5 National Regulatory Controls

We have been informed about the existence of national legislation in France prohibiting the sale of DCM-based paint strippers to consumers unless the product is locked in a secure cabinet inside DIY retail outlets to ensure that consumers received appropriate information on the use of the product. We have contacted the French authorities to enquire about the details of this system but have not received any detail on this issue within the timeframe of this study.

B9. GERMANY

B9.1 Current Situation

We have limited information on the situation in Germany. Table B9.1 shows the available information for the supply chains of DCM-based paint stripper manufacturers in Germany.

Table B9.1: Structure of Supply Chains for DCM-based Paint Stripper Manufacturers in Germany

Company	Size	No. of direct customers	No. of suppliers
Company A	SME	All supplying activities undertaken by the manufacturer	
Company B		The manufacturer supplies DCM-based paint stripper only to wholesalers and to industrial or professional end-users.	

Source: Consultation

B9.2 Composition of DCM-based Paint Strippers

Table B9.2 presents the available information on the compositions of products manufactured by companies that have responded to the RPA questionnaire. Only two companies have submitted a completed questionnaire so far.

Table B9.2: Composition of DCM-based Paint Strippers that Contain Vapour Retardants in Germany (CONFIDENTIAL INFORMATION)

Component	CAS Number	Percentage in formulation (where available)	
		Company A	Company B
DCM	75-09-2	✓	50-75
Methanol	67-56-1	✓	
N-nethyl-2-pyrrolidone	872-50-4	✓	
N,N-dimethyformamide	68-12-2	✓	
Acids of any kind (e.g. formic acid)	various	✓	
Propan-2-ol	67-63-0		10-20
1-methoxy-2-propanol	107-98-2		1-5
Isobutanol	78-83-1		1-5
Ammonia solution	1336-21-6		< 0.5
Formic acid	64-18-6		1-5
Water, surfactant, wax, thickener			5-10
Noticeable changes in last 5 years and other notes		*Note the presence of n-methyl-2-pyrrolidone in this formulation*	*No changes*

Source: Consultation

B9.3 Container Issues

For both DCM-based and DCM-free paint strippers, the container sizes that are available on the market for German professional users include: 0.75 kg; 2.5 kg, 5 kg; 10 kg; and 30 kg (TIS, 2006).

B9.4 Alternatives

The Berufsgenossenschaft der Bauwirtschaft (2005) has issued a list of alternative paint strippers available on the German market. This includes a total of 63 products (paint strippers and graffiti removers) available from 28 companies. This list does not claim to be complete. Six groups have been created for the available commercial paint strippers and designated with a product-code.

- Category M-AL10 (caustic strippers, alkaline, irritant);
- Category M-AL20 (caustic strippers, alkaline, corrosive);
- Category M-AB10 (paint strippers, solvent-based, DCM-free);
- Category M-AB20 (paint strippers, solvent-based, skin sensitive, DCM-free);
- Category M-AB30 (paint strippers, DCM-based, methanol-free); and
- Category M-AB40 (paint strippers, DCM-based, methanol-based).

In the list provided in Berufsgenossenschaft der Bauwirtschaft (2005), there are 10 products under the M-AB10 category and 36 products under the M-AB20 category. A further 17 products are not allocated under any category.

B9.4.1 Components of Alternative Paint Stripping Formulations

Tables B9.3 to B9.7 provide information on the composition of a wide array of alternative products that are available on the German market.

The information in Tables B9.3 to B9.6 was provided to us by a manufacturer of DCM who conducted an Internet search. The composition data were taken from Material Safety Data Sheets and technical datasheets available on the Internet. Products of companies with MSDS/TDS available through the Internet were added to the list. A known Internet search engine was used in June 2005 and the data were presented at the meeting of the German TRGS 612 working group on 11 June in Kassel, Germany. The information may overlap with the information from the Berufsgenossenschaft der Bauwirtschaft (2005) and should not be considered to be comprehensive. However, it does provide a good overview of the identities and percentages of different components in the DCM-free paint stripping formulations.

The tables show which of these chemical substances are most commonly used in the formulation of alternative paint strippers. The ones most commonly included are:

- n-methyl-2-pyrrolidone (in 63% of all identified preparations);
- naphtha, hydrotreated heavy (in 21% of all preparations)

- n-butyl acetate (in 17% of all identified preparations);
- D-limonene (in 17% of all identified preparations);
- dipropylene glycol mono methyl ether (in 13% of all identified preparations);
- xylene (in 13% of all identified preparations); and
- methyl ethyl ketone (in 13% of all identified preparations).

The fact that these substances are used in a considerable variety of alternative paint stripping preparations does not mean that the relevant tonnages are necessarily equally significant.

Table B9.7 displays a more detailed list of possible components of alternative paint stripping formulations. There are two main sources for this list:

- the list of substances presented in the German TRGS 612 (BMAS, 2006); and

- information on the composition of alternative paint stripping formulations available on the German market which was made available to us by a manufacturer of DCM. This information is presented in tabular format in Annex C to this report.

We have taken the information from the TRGS 612 and cross-checked the classification of the substances below in the ClassLab database of the European Chemicals Bureau Internet site[2]. Where the information from Annex 1 to Directive 67/548/EEC was different to what the TRGS provided, we have taken forward the version available in Annex 1. For the substances that were included in the submission of the DCM manufacturer, we also checked the ClassLab database and added the relevant classification details. Finally for the substances for which no classification was found in Annex 1 to Directive 67/548/EEC, no classification is provided.

The information provided in the TRGS 612 on the vapour pressure for a number of substances, has also been included.

[2] http://ecb.jrc.it/classification-labelling/CLASSLAB_SEARCH/classlab/search.php

Table B9.3: Composition of Alternative Paint Strippers in Germany (Table 1 of 4)										
	NMP	**Acetone**	**n-Butyl acetate**	**DMSO**	**2-Butoxy ethanol**	**2-(-2-Butyl ethoxy) ethanol**	**1-Methoxy-2-propanol**	**2-Methoxy-1-methyleth yl acetate**	**bis(2-ethylhexyl)sulphosuc cinate sodium salt**	**Gamma-butyrolact one**
CAS Number	***872-50-4***	***67-64-1***	***123-86-4***	***67-68-5***	***111-76-2***	***112-34-5***	***107-98-2***	***108-65-6***	***577-11-7***	***96-48-0***
Boiling range		56.5 °C	124-128 °C	189 °C	171 °C		119-122 °C			
Flash point		-19 C		87 C			33 C			
Product name										
Company 1- Product 1	25 - 50									
Company 1- Product 2		10-25	10-25	10-25						
Company 1- Product 3				10-25			10-25	10-25		
Company 1- Product 4	2.5 - 10								< 2.5	
Company 1- Product 5	10 - 25									10 - 25
Company 1- Product 6										
Company 1- Product 7										
Company 1- Product 8	2.5 - 10									
Company 1- Product 9	2.5 -10									
Company 2 - Product 1	10 - 25		10 - 25							
Company 3 - Product 1	20-25									
Company 3 - Product 2	20-25									
Company 3 - Product 3	20-25									

Table B9.3: Composition of Alternative Paint Strippers in Germany (Table 1 of 4)										
	NMP	**Acetone**	**n-Butyl acetate**	**DMSO**	**2-Butoxy ethanol**	**2-(-2-Butyl ethoxy) ethanol**	**1-Methoxy-2-propanol**	**2-Methoxy-1-methyleth yl acetate**	**bis(2-ethylhexyl)sulphosuc cinate sodium salt**	**Gamma-butyrolact one**
CAS Number	***872-50-4***	***67-64-1***	***123-86-4***	***67-68-5***	***111-76-2***	***112-34-5***	***107-98-2***	***108-65-6***	***577-11-7***	***96-48-0***
Company 3 - Product 4	3-5		15-20		3-5	10-15		15-20		
Company 4 - Product 1	7.0-10.0									
Company 4 - Product 2	2.5-10									
Company 5 - Product 1	30-60									
Company 5 - Product 2										
Company 5 - Product 3										
Company 5 - Product 4										
Company 5 - Product 5										
Company 5 - Product 6										
Company 5 - Product 7	30-60									
Company 6 - Product 1	10 - 25		10 - 25				10 - 25			
Substance is found in .....% of strippers listed in this table	**63%**	4%	17%	8%	4%	4%	8%	8%	4%	4%
Source: Consultation										

Table B9.4: Composition of Alternative Paint Strippers in Germany (Table 2 of 4)										
	Benzyl formate	**Benzyl alcohol**	**Benzo thiazol-2-thiol**	**Propane dioic acid**	**Diethylene Triamine Penta(methylene phosphonic acid)**	**Dipropylene glycol mono methyl ether**	**Bitter Orange Oil**	**D-Limonene**	**2-(2-aminoethoxy)-ethanol**	**Naphtha, Hydrotreated Heavy**
CAS Number	***104-57-4***	***100-51-6***	***149-30-4***	***141-82-2***	***15827-60-8***	***34590-94-8***	***8028-48-6***	***5989-27-5***	***929-06-6***	***64742-48-9***
Boiling range										
Flash point										
Product name										
Company 1- Product 1										
Company 1- Product 2										
Company 1- Product 3										
Company 1- Product 4										2.5 - 10
Company 1- Product 5										
Company 1- Product 6		25 - 50	< 2.5	2.5 - 10	< 2.5					
Company 1- Product 7		50 - 100								
Company 1- Product 8										
Company 1- Product 9						25 - 50	< 2.5			
Company 2 - Product 1						10 - 25			1 - 5	
Company 3 - Product 1								<1.0		1-2
Company 3 - Product 2								<1.0		1-2
Company 3 - Product 3								<1.0		1-2

Table B9.4: Composition of Alternative Paint Strippers in Germany (Table 2 of 4)										
	Benzyl formate	**Benzyl alcohol**	**Benzo thiazol-2-thiol**	**Propane dioic acid**	**Diethylene Triamine Penta(methylene phosphonic acid)**	**Dipropylene glycol mono methyl ether**	**Bitter Orange Oil**	**D-Limonene**	**2-(2-aminoethoxy)-ethanol**	**Naphtha, Hydrotreated Heavy**
CAS Number	***104-57-4***	***100-51-6***	***149-30-4***	***141-82-2***	***15827-60-8***	***34590-94-8***	***8028-48-6***	***5989-27-5***	***929-06-6***	***64742-48-9***
Company 3 - Product 4										15-30
Company 4 - Product 1										
Company 4 - Product 2										
Company 5 - Product 1										
Company 5 - Product 2										
Company 5 - Product 3	1-10	10-30								
Company 5 - Product 4		30-60								
Company 5 - Product 5		30-60								
Company 5 - Product 6		>60						1-10		
Company 5 - Product 7										
Company 6 - Product 1						10 - 25				
Substance is found in .....% of strippers listed in this table	4%	25%	4%	4%	4%	13%	4%	17%	4%	21%
Source: Consultation										

Table B9.5: Composition of Alternative Paint Strippers in Germany (Table 3 of 4)								
	Distillates, petroleum, hydrotreated heavy naphthenic	**White spirit**	**Xylene**	**Methyl ethyl ketone**	**Anisole (Methoxy benzene)**	**C_{13}-C_{17} sec. alkylsulphonates, Na-salt**	**Isotridecanol, ethoxylate (>5-20 EO)**	**Formic acid**
CAS Number	***64742-52-5***	***64742-82 -1***	***1330-20-7***	***78-93-3***	***100-66-3***	***85711-69-9***	***69011-36-5***	***64-18-6***
Boiling range		135/165 - 145/200 °C	137-140 °C	79 °C	154 °C			Ca. 106 °C
Flash point		25-39 C	25 C	-10 C	43 C			65 C
Product name								
Company 1- Product 1								< 2.5
Company 1- Product 2								
Company 1- Product 3								
Company 1- Product 4								
Company 1- Product 5								< 2.5
Company 1- Product 6								
Company 1- Product 7								< 2.5
Company 1- Product 8								
Company 1- Product 9								
Company 2 - Product 1		10 - 25						
Company 3 - Product 1			<12.5	60-65				
Company 3 - Product 2			<12.5	60-65				
Company 3 - Product 3			<12.5	55-60				
Company 3 - Product 4						3-<5	5-<7	

Table B9.5: Composition of Alternative Paint Strippers in Germany (Table 3 of 4)								
	Distillates, petroleum, hydrotreated heavy naphthenic	**White spirit**	**Xylene**	**Methyl ethyl ketone**	**Anisole (Methoxy benzene)**	**C_{13}-C_{17} sec. alkylsulphonates, Na-salt**	**Isotridecanol, ethoxylate (>5-20 EO)**	**Formic acid**
CAS Number	***64742-52-5***	***64742-82 -1***	***1330-20-7***	***78-93-3***	***100-66-3***	***85711-69-9***	***69011-36-5***	***64-18-6***
Company 4 - Product 1								
Company 4 - Product 2								
Company 5 - Product 1	10-30							
Company 5 - Product 2	>60							
Company 5 - Product 3								1-10
Company 5 - Product 4					1-10			
Company 5 - Product 5								
Company 5 - Product 6								
Company 5 - Product 7								
Company 6 - Product 1								
Substance is found in .....% of strippers listed in this table	8%	4%	13%	13%	4%	4%	4%	17%
Source: Consultation								

Table B9.6: Composition of Alternative Paint Strippers in Germany (Table 4 of 4)							
	Aminoethoxy ethanol	**Ethanolamine**	**Potassium hydroxide**	**Ammonia**	**Ammonium carbonate**	**Hydrogen peroxide**	**Sodium nitrate**
CAS Number	***929-06-6***	***141-43-5***	***1310-58-3***	***7664-41-7***	***506-87-6***	***7722-84-1***	***7631-99-4***
Boiling range	223 - 224 °C						
Flash point							
Product name							
Company 1- Product 1							
Company 1- Product 2							
Company 1- Product 3							
Company 1- Product 4							
Company 1- Product 5							
Company 1- Product 6							
Company 1- Product 7							
Company 1- Product 8							
Company 1- Product 9							
Company 2 - Product 1							
Company 3 - Product 1							
Company 3 - Product 2							
Company 3 - Product 3							
Company 3 - Product 4							
Company 4 - Product 1							

Table B9.6: Composition of Alternative Paint Strippers in Germany (Table 4 of 4)							
	Aminoethoxy ethanol	**Ethanolamine**	**Potassium hydroxide**	**Ammonia**	**Ammonium carbonate**	**Hydrogen peroxide**	**Sodium nitrate**
CAS Number	***929-06-6***	***141-43-5***	***1310-58-3***	***7664-41-7***	***506-87-6***	***7722-84-1***	***7631-99-4***
Company 4 - Product 2							
Company 5 - Product 1		10-30	1-10				
Company 5 - Product 2							
Company 5 - Product 3							
Company 5 - Product 4				1-10			
Company 5 - Product 5					1-10		
Company 5 - Product 6						1-10	1-10
Company 5 - Product 7						1-10	
Company 6 - Product 1	1-10						
Substance is found in .....% of strippers listed in this table	4%	4%	4%	4%	4%	8%	4%
Source: Consultation							

Table B9.7: Overview of Identities and Classification of Components of Alternative Paint Stripping Formulations – Data on Products on the German Market				
No	**Substance**	**CAS Number**	**Classification**	**Vapour pressure (hPa) at 20°C**
1	Benzyl alcohol	100-51-6	Xn, R20/22	< 0.1
2	Anisole (Methoxy benzene)	100-66-3		
3	Triethanolamine	102-71-6		0
4	2-ethylhexyl acetate	103-09-3	Xi, R36-38	17.6 (at 25°C)
5	Benzyl formate	104-57-4	Xn, R 22	0.31
6	Dimethyl succinate	106-65-0		0.3
7	Butane	106-97-8	R12-45-46	
8	1,2-ethandiol	107-21-1	Xn, R22	
9	1-methoxy-2-propanol	107-98-2		
10	Propylene carbonate	108-32-7	Xi, R36	0,09
11	1-methoxy-2-propyl acetate	108-65-6	Xi, R10-36	5
12	Dimethoxymethane	109-87-5		
13	5-methylhexan-2-one	110-12-3	Xn, R10-20	
14	Methyl decanoate	110-42-9	Xi, R36-38	0.48
15	2-butoxy-ethanol	111-76-2	Xn, Xi, R20-21-22-36-38	0.01
16	Ethyl diglycol	111-90-0		0.1
17	Dipropylene glycol dimethyl ether	111109-77-4		0.7
18	Dimethyl glutarate	1119-40-0		
19	2-(2-Butoxyethoxy) ethanol	112-34-5	Xi, R36	0.3
20	n-Butyl acetate	123-86-4	R10-66-67	9.6
21	Butyl diglycol acetate	124-17-4		
22	Potassium hydroxide	1310-58-3	Xn, C, R22-35	0
23	Sodium hydroxide	1310-73-2	C, R35	
24	Xylenes (mixed isomers)	1330-20-7	Xn,Xi;R10-20-21-38	
25	Orange terpene (dipentene)	138-86-3	Xi, N, R10-38-43-50/53	

Table B9.7: Overview of Identities and Classification of Components of Alternative Paint Stripping Formulations – Data on Products on the German Market				
No	**Substance**	**CAS Number**	**Classification**	**Vapour pressure (hPa) at 20°C**
26	2-amino-ethanol	141-43-5	Xn, R20/21/22-34	0.3
27	Propanedioic acid (malonic acid)	141-82-2		
28	2-Benzothiazolethiol	149-30-4	N, R43-50/53	
29	1-ethoxypropane-2-ol	1569-02-4	R10-67	10
30	Diethylenetriaminepenta (methylene-phosphonic acid)	15827-60-8		
31	2-methoxypropanol	1589-47-5	Xi, T, Repr. Cat. 2, R1037-38-41-61	
32	1-ethyl-2-pyrrolidine	2687-91-4		
33	(2-methoxymethyl ethoxy) propanol (isomer mixture)	34590-94-8		0.5
34	3-methoxy-n-butyl acetate	4435-53-4		
35	Ammonium carbonate	506-87-6		
36	1,2-propylene glycol	57-55-6		0.11
37	Dioctyl sodium sulphosuccinate	577-11-7		
38	D-Limonene	5989-27-5	N, Xi, R10-38-43-50/53	
39	Dimethyl adipate	627-93-0		0.06
40	Ethanol	64-17-5	F, R11	57.3
41	Formic acid	64-18-6	C, R35	43
42	1,3-dioxolane	646-06-0	F, R11	
43	Naphtha (hydrotreated heavy)	64742-48-9	Xn, Carc. Cat. 2; R45-65	< 1 - 8
44	Distillates (petroleum hydrotreated heavy naphthenic)	64742-52-5	Carc. Cat. 2, R45	
45	Mixture of waxes	64742-82 -1		
46	Solvent naphtha (petroleum), heavy aromatic	64742-94-5	Xn, R65	
47	Solvent naphtha (petroleum), light aromatic	64742-95-6	Carc. Cat. 2, Xn, R45-65	
48	Solvent naphtha light to heavy	Mixture incl: 64741-68-0, 64742-94-5, 64742-95-6, 68477-31-6, 68603-08-7, 8002-05-9, 8030-30-6	Carc. Cat. 2, Xn, R65-66-67-51-53-45	< 1 – 5
49	Acetone	67-64-1	F, Xi, R11-36-66-67	233
50	Dimethylsulphoxide	67-68-5		0.55

Table B9.7: Overview of Identities and Classification of Components of Alternative Paint Stripping Formulations – Data on Products on the German Market				
No	**Substance**	**CAS Number**	**Classification**	**Vapour pressure (hPa) at 20°C**
51	Nonylphenoxydiglycol	68412-54-4		
52	Distillates (petroleum), catalytic reformer	68477-31-6	Carc. Cat. 2, R45	
53	Degreasing agent/Cleaning Solution (only trade names)	69011-36-5		
54	1-butanol	71-36-3	Xn, Xi, R10-22-37/38-41-67	6.7
55	Propane, liquefied	74-98-6	F+, R12	
56	Isobutane	75-28-5	R12-45-46	
57	Sodium nitrate	7631-99-4		
58	Ammonium hydroxide	7664-41-7	T, C, N, R10-23-34-50	
59	Hydrogen peroxide	7722-84-1	O, C, Xn R5-8-20/22-35	6.67 (at 30°C)
60	Triethylphosphate	78-40-0	Xn, R22	
61	2-methylpropane-1-ol	78-83-1	Xi, R10-37/38-41-67	11.7
62	Methyl ethyl ketone (butanone)	78-93-3	F, Xi, R11-36-66-67	
63	Glycolic acid	79-14-1		
64	Orange terpene/citrus terpene	8028-48-6	Xn, R10-38-65	1.9
65	Alkyl sulphonate, sodium C_{14}-C_{17} alkyl sec sulphonate	85711-69-9		
66	N-Methyl-2-pyrrolidone	872-50-4	Xi, R36/38	0.32
67	2-(2-Aminoethoxy) ethanol	929-06-6	C, R21-34	< 0.1
68	Dibasic esters (mixture)	95481-62-2		
69	Gamma-butyrolactone	96-48-0	Xn, R22-36	0.4
70	Ethylene carbonate	96-49-1	Xi, R41	< 0.09
Source: BMAS, 2006 and the ClassLab Database of the European Chemicals Bureau (ecb.jrc.it/classification-labelling/search-classlab/)				

B9.5 National Regulatory Controls

B9.5.1 Overview of Current Measures

The Technische Regel für Gefahrstoffe (TRGS - Technical Rules for Hazardous Substances) provide information on the current, state of the art, occupational, medicinal and hygiene requirements as well as other established knowledge relating to work with hazardous substances, including classification and labelling. They are compiled by the Committee for Hazardous Substances (AGS) and regularly updated to take account of current developments. The TRGS are published by the Federal Ministry of Labour and Social Affairs (BMAS) in the Federal Labour Gazette (Bundesarbeitsblatt) (BMAS, 2006).

In the decade from 1980 to 1990, several lethal accidents during the use of DCM containing paint strippers led to the so called "TRGS 612: Ersatzstoffe, Ersatzverfahren und VervvendungsbeschrAnkungen fiir dichlormethanhaltige Abbeizer". The TRGS 612 is the official document describing the science and techniques that have to be followed to fulfil the substitution requirements of workplace legislation in Germany (Hazardous Substances Ordinance based on Directive 98/24/ EC). The TRGS 612 is not a restriction on the placing on the market of DCM (BauA, 2006b). Substitute substances within the meaning of this TRGS are substances, preparations or products that can replace DCM-based paint strippers and are not hazardous or are less hazardous to the health and safety of employees under application conditions (BMAS, 2006).

The TRGS 612 recommends reducing or avoiding the use of DCM-based paint strippers wherever possible and using substitutes or different technical procedures, leading to a significant reduction of exposure to DCM. Although this TRGS was adapted several times to meet prevailing conditions, and despite the fact that additional severe accidents occurred, little has changed in procedures and behaviour practices (Rühl *et al*, 2004). Today, in Germany, as Rühl *et al* (2004) suggest, in spite of the well-known high exposure levels, stripping work with DCM-based paint strippers is still performed without personal protective measures. Restrictions on, and even prohibitions of, the use of chlorinated hydrocarbons during the stripping of facades are largely ignored.

When working with DCM-based paint strippers, protective measures in accordance with §§ 8 and 9 of the German Hazardous Substance Regulations (GefStoffV) (protection level 2) should be taken as a general rule. Owing to the high volatility of the substance, such high workplace concentrations can occur that a very high risk to users may be assumed, particularly as a result of the narcotic effect. Therefore, in addition, suitable protective measures in accordance with §10 of the German Hazardous Substance Regulations (GefStoffV) (protection level 3) should be employed. The technical, organisational and personal protective measures that should be taken when using DCM-based paint strippers in the trades sector are detailed in Appendices 1 and 3 of TRGS 612 (BMAS, 2006).

B9.5.2 The Provisions of the TRGS 612

The TRGS 612 describes the following restrictions conditions on use (BMAS, 2006):

- DCM-based paint strippers should no longer be used in view of the availability in principle and comparable effectiveness of substitute substances and substitute processes. If employers depart from this advice, they must take other measures to ensure that the health and safety of employees is at least as well protected;

- alkaline strippers labelled as "corrosive" should not be sprayed because of the risk of chemical burns; and

- employers must carry out tests to determine which substitute substance will be most effective in each individual case. If such tests fail (at least three stripping trials with potentially suitable substitute substances), then the use of substitute substances may be deemed technically unsuitable. Manufacturers or dealers can be asked for information on suitable products. The result of the tests should be documented in the risk assessment. In the risk assessment documentation, employers should give their reasons for not implementing a substitution (replacement of DCM-based paint strippers by substitute substances or substitute processes) and should detail the protective measures taken instead of substitution.

For work involving the use of DCM-free paint strippers, employers should as a general rule take protective measures in accordance with the German Hazardous Substance Regulations §§ 8 and 9 (protection level 2) (see Appendices 1 and 2).

B9.5.3 Access of Consumers to DCM-based Paint Strippers

According to the "Chemikalienverbotsverordnung" (Ordinance on Bans and Restrictions on the Placing on the Market of Dangerous Substances, Preparations and Products Pursuant to the Chemicals Act) § 4, it is prohibited to sell products via self-service which are classified as Xn (harmful) and R40 (limited evidence of a carcinogenic effect) (ETVAREAD, 2004).

In Germany self-service sales of DCM containing paint removers is prohibited. It is only allowed to sell it over the sales counter or from a closed cabinet (ETVAREAD, 2004). The intention of this measure is to enable suitably trained staff to provide accurate information to the consumers on the use of DCM-based paint strippers.

However, there are doubts whether the system is working as intended. ETVAREAD (2004) indicates that DCM-based paint strippers have disappeared from the big self-service chains but they are still easily available from small regional stores and painters purchasing associations. The Technische Informationsstelle des Deutschen Maler- und Lackiererhandwerks (TIS, 2006) suggests that no special instruction is given to consumers or professional users of DCM paint strippers at the point of sale. Finally, BauA (2007b) suggests that the system has not worked properly because of the high associated cost to the retailers. Monitoring that has recently been undertaken showed

that more than 50 out of approximately 150 retailers visited in certain areas in Germany were illegally selling DCM-based paint strippers.

B10. GREECE

B10.1 Current Situation

Information on the domestic markets for DCM has been provided by the Greek General Chemical State Laboratory (2006a) and is reproduced here as Table B10.1.

Table B10.1: Markets for DCM in Greece for the Year 2005	
Tonnage of DCM manufactured in Greece	0
Application category	**Tonnage of DCM used**
Paint stripping	ca. 800 tonnes
Adhesives	ca. 200 tonnes
Pharmaceuticals	ca. 30-40 tonnes
Degreasing agent in the mechanical and electrical engineering industries	ca. 30 tonnes
Solvent or auxiliary agent in foam blowing (e.g. polyurethane)	ca. 50-100 tonnes
Source: Greek General Chemical State Laboratory, 2006a	

The overall consumption of DCM-based paint strippers in Greece in 2005 was as follows (Greek General Chemical State Laboratory, 2006a):

- industrial uses: ca. 4,000 tonnes;
- professional uses: ca. 3,200 tonnes; and
- consumer uses: ca. 800 tonnes.

These tonnages are quite large (much large than what would be expected on the basis of information collected from ECSA and the six European DCM manufacturers) and were provided as a response to a question on "Overall trend in consumption of DCM-based paint strippers over the last 5 years in your country". We suspect (but have not confirmed) that the above figures may represent the total tonnage consumed in Greece over all five years (i.e. the average yearly consumption would be 800, 640 and 160 tonnes for the three categories of use respectively).

With regard to the structure of the relevant industry sectors, it has been suggested that the following numbers of companies are active (Greek General Chemical State Laboratory, 2006a):

- number of manufacturers of DCM-based paint strippers in Greece: <15;
- number of suppliers of DCM-based paint strippers in Greece: ca. 3,000; and
- estimated number of users (workers, consumer, etc.) exposed to DCM during use of paint strippers in Greece: 4,000-5,000 users of which ca. 5% are involved in uses, ca. 90% are involved in professional uses and ca. 5% are consumers.

Table B10.2 shows the available information for the supply chains of DCM-based paint stripper manufacturers in Greece.

Table B10.2: Structure of Supply Chains for DCM-based Paint Stripper Manufacturers in Greece			
Company	**Size**	**No. of direct customers**	**No. of suppliers**
Company A	SME		3 suppliers of DCM and 1 supplier of methanol
Company B	?	Products sold by retail stores to consumers	
Source: Consultation			

B10.2 Composition of DCM-based Paint Strippers

B10.2.1 Information from Consultation with Competent Authorities

Around 95% of the tonnage of DCM-based paint strippers available on the Greek market contains vapour retardants (Greek General Chemical State Laboratory, 2006a).

B10.2.2 Information from Consultation with Manufacturers

Table B10.3 outlines the available information on the compositions of products manufactured by two companies that have responded to the RPA questionnaire.

Table B10.3: Composition of DCM-based Paint Strippers that Contain Vapour Retardants in Greece (confidential information)			
Component	**CAS Number**	**Percentage in formulation**	
		Company A	**Company B**
DCM	75-09-2	85-95	~ 80
Methanol	67-56-1	3-7	
Toluene	108-88-3	1-5	
Wax		1-2	~ 5
Isopropanol	67-63-0		~ 10
Acetone	67-64-1	~ 5 %	
Noticeable changes in last 5 years and other notes			*Replacement of methanol by isopropanol*
Source: Consultation			

B10.3 Container Issues

The market situation with regard to the available sizes of containers in the Greek market is outlined in Table B10.4.

The majority of DCM-based paint strippers in the domestic market are sold in spill-proof containers, although there is no national legislation requiring the use of such containers. Consumers are not actively advised by sales people to purchase DCM-based paint strippers. The Competent Authority suggests that there is probably no price difference

between DCM-based paint strippers which are sold in 'standard' and 'spill-proof' containers (Greek General Chemical State Laboratory, 2006a).

Table B10.4: Available Sizes for Containers of DCM-based Paint Strippers in Greece		
Use area	**Available sizes of containers**	**Predominant ('most popular') size**
Industrial use	5,000 ml	
Professional use	5,000 ml	
Consumer (DIY) use	1,000 ml, 750 ml, 500 ml, 375 ml	1,000 ml, 750 ml
Source: Greek General Chemical State Laboratory, 2006a		

B10.4 Alternatives

Consultation with the authorities suggests that there are no alternative formulations on the Greek market. There are also no manufacturers of DCM-free paint strippers in Greece. The only alternative mentioned was sanding but it is believed to account for no more than 1% of all paint stripping activities (Greek General Chemical State Laboratory, 2006a).

B11. HUNGARY

B11.1 Current Situation

Information from the Association of Hungarian Paint Manufacturers (which covers 95% of the Hungarian paint manufacturers) suggests that the production of DCM and DCM-based paint strippers in Hungary was discontinued some years ago by members of the association. The most common and most effective method for paint stripping currently used in Hungary is heat stripping (Hungarian National Institute of Chemical Safety, 2006).

There are no restrictions on the marketing and use of DCM-based paint strippers in Hungary and there are no foreseen proposals based on public health considerations (Hungarian Ministry of Health, 2006).

Concerning the Hungarian occupational exposure limits (average and maximum concentration of DCM) determined by the Decree No. 25/2000. (IX. 30.) EüM-SzCsM on chemical safety at workplace, both values had been set to 10 mg/m^3 according to the professional approach of the time of adopting the decree. These values were chosen because DCM may cause irreversible damage (Hungarian Ministry of Health, 2006).

B12. ICELAND

B12.1 Current Situation

Information on the domestic markets for DCM has been provided by the Icelandic Environment and Food Agency (2006a) and is reproduced here as Table B12.1.

Table B12.1: Markets for DCM in Iceland for the Year 2005	
Tonnage of DCM manufactured in Iceland	0
Application category	**Tonnage of DCM used**
Paint stripping	Identified but no data available
Pharmaceuticals	Identified but no data available
Source: Icelandic Environment and Food Agency, 2006a	

There is one commercial product (trade name) on the Icelandic market; a further product is also imported as a sample. The total DCM imports into Iceland are said to have decreased over recent years (Icelandic Environment and Food Agency, 2006a).

No distinction between professional and consumer products can be made (Icelandic Environment and Food Agency, 2006a).

B12.2 Composition of DCM-based Paint Strippers

The Icelandic Environment and Food Agency (2006) has provided an overview of composition of DCM-based paint strippers available on the Icelandic market. This is presented in Table B12.2.

Table B12.2: Composition of DCM-based Paint Strippers in Iceland (information submitted by the Competent Authority)		
Components	**CAS Number**	**Percentage in formulations**
DCM	75-09-2	90
Methanol	67-56-1	< 10
Thickening agents, waxes and stabilisers		not known
Source: Icelandic Environment and Food Agency, 2006a		

Originally the Icelandic Environment and Food Agency had suggested that a product that contained no vapour retardant (based on DCM and dodecylbenzeneic sulphonic acid) was imported into Iceland as a sample only. Further communication with the Agency (Icelandic Environment and Food Agency, 2006b) suggests that the product most likely contains vapour retardants (but these are not indicated on the Safety Data Sheet).

B12.3 Container Issues

The market situation with regard to the available sizes of containers in the Icelandic market is outlined in Table B12.3.

Table B12.3: Available Size for Containers of DCM-based Paint Strippers in Iceland	
Use area	**Available sizes of containers**
Professional use	5,000 ml*, 500 ml
Consumer (DIY) use	500 ml
** Only as sample* *Source: Icelandic Environment and Food Agency, 2006a*	

No national legislation requiring the use of spill-proof containers exists in Iceland (Icelandic Environment and Food Agency, 2006a).

B12.4 Alternatives

Table B12.4 outlines the information on alternatives that has been submitted by the Icelandic Environment and Food Agency (2006a).

Table B12.4: Typical Components of Alternative Formulations available on the Icelandic Market			
Composition of alternative DCM-free paint strippers	**CAS Number**	**Percentage in formulation**	**Relevant application(s)**
Solvent naphtha (petroleum), heavy aromatic 1-methoxy-2-propanol N-methyl-2-pyrrolidone Nonylphenoxydiglycol 2-methoxypropanol	64742-94-5 107-98-2 872-50-4 68412-54-4 1589-47-5	25-50% 25-50% 10-25% 2.5-10% 0-1%	All but two-component varnish/paint, linoleum, linoleum in combination with zinc white paint and vinyl
Source: Icelandic Environment and Food Agency, 2006a			

B12.5 National Regulatory Measures

B12.5.1 Marketing and Use Controls

There are certain provisions in the legislation affecting marketing of DCM-based paint strippers in particular. DCM-based paint strippers may only be put on the market if they contain a vapour retarding substance/substances as well as thorough instructions on the use and safety measures required. These measures are the same for paint strippers whatever their application and whoever uses them (consumer or professional uses) (Icelandic Environment and Food Agency, 2006a).

There is little information on the rationale behind these measures or current levels of compliance. The Icelandic Environment and Food Agency suggested that "*it is not*

unlikely that this had been a co-operative action by the Nordic countries back then" (Icelandic Environment and Food Agency, 2006a).

B12.5.2 Controls on Supply to Consumers

Chemical products, either substances or preparations, are only to be sold in stores and other facilities with a permit from local authorities and are, therefore, subject to regular surveillance. Otherwise, the national legislation on marketing, use and disposal is in accordance with EU legislation (Icelandic Environment and Food Agency, 2006a).

B13. IRELAND

B13.1 Current Situation

Information on the domestic markets for DCM-based paint strippers has been provided by the Irish Health and Safety Authority (2006a) and is reproduced here as Table B13.1.

Table B13.1: Markets for DCM-based Paint Strippers in Ireland for the Year 2005

Parameter	Industrial use	Professional use	Consumer use
Tonnage of DCM-based paint strippers manufactured	Approx. 100 t/yr (2001-2003)*		
Tonnage of DCM-based paint strippers imported	85 t (2005)*		
Tonnage of DCM-based paint strippers used			Approx 2,730 lit (2005)**

Source: Irish Health and Safety Authority, 2006a
** Based on information received from one Irish DCM-based paint stripper manufacturer. It appears that while the company manufactured the paint strippers in Ireland until 2003, it has recently started to import it from elsewhere in Europe.*
*** Based on information received from one Irish consumer supplier of DCM-based paint strippers (using a density of 1.260 g/cm^3 referred to in the Safety Data Sheets of the manufacturer, this volume is equivalent to 3.34 tonnes).*

The applications for DCM-based paint strippers in 2005 and the breakdown between industrial/professional/consumer uses and the recent trends in Ireland are given in Table B13.2.

Table B13.2: Applications of DCM-based Paint Strippers in Ireland and Recent Trends

Use area	Detailed description of applications	Percentage of total tonnage used	Trends in the last 5 years
Industrial use	▪ Cleaning of mixing tanks	5%	Stable
Professional use	▪ Components in dipping process, stripping paint on timber doors, frames, internal walls floors, structured steel ▪ Furniture and antique restoration ▪ Exterior façade, masonry and metal work	15%	Stable
Consumer (DIY) use	▪ Stripping of wooden floors and furniture ▪ Removing paint/varnish from timber units	80%	Declined slightly (possible due to a move from wooden to uPVC windows)

Source: Irish Health and Safety Authority, 2006a
Note: Figures above were provided by one Irish manufacturer of DCM-based paint strippers.

With regard to supply chains, there is a single manufacturer of DCM-based paint strippers who supplies his products to a total of 400 outlets in Ireland.

B13.2 Composition of DCM-based Paint Strippers

B13.2.1 Information from Consultation with Manufacturers

Table B13.3 outlines the available information on the compositions of products manufactured by companies that have responded to the RPA questionnaire. Only one company has submitted a completed questionnaire (it is understood that there are no other manufacturers of DCM-based paint strippers in Ireland).

Table B13.3: Composition of DCM-based Paint Strippers that Contain Vapour Retardants in Ireland

Component	CAS Number	Percentage in formulation
		Company A
DCM	75-09-2	Ireland's main manufacturer of DCM-based paint strippers has informed the Irish Competent Authority that this information is confidential but confirmed that all formulations contain DCM, methanol and vapour retardant (Irish Health and Safety Authority, 2006a).
Methanol	67-56-1	
Wax		
Noticeable changes in lat 5 years and other notes		*No fundamental change in the formulations or percentages for many years*
Source: Consultation		

Following consultation with the main Irish manufacturer of DCM-based paint strippers, it has been confirmed that all DCM-based paint stripping products manufactured in Ireland have contained vapour retardants for the past 20 years.

B13.3 Container Issues

The market situation with regard to the available sizes of containers in the Irish market is outlined in Table B13.4.

Table B13.4: Available Size for Containers of DCM-based Paint Strippers in Ireland

Use area	Available sizes of containers	Predominant ('most popular') size
Industrial use	200L, 5L, 2.5L, 1L	5L
Professional use	5L, 2.5L, 1L, 0.5L	1L
Consumer (DIY) use	5L, 2.5L, 1L, 0.5L, 0.3L, 0.25L	0.5L
Source: Irish Health and Safety Authority, 2006a		

One Irish consumer supplier of DCM-based paint strippers has indicated that out of the three different sizes 250 ml, 500 ml and 1,000 ml for sale to consumers, the middle size (500 ml) is merchandised more intensively than the smaller and larger sizes i.e. the 500 ml size is given more 'facing'. . This is because the majority of consumers buying paint strippers are doing small jobs in the home and often buy the medium size, so as not to have too little (250 ml) or too much (1,000 ml) paint stripping product. The Irish consumer supplier has also indicated that staff would tend to encourage the consumer to

purchase the 500 ml container as opposed to the 1,000 ml container due to their basic knowledge that such products have hazardous properties (Irish Health and Safety Authority, 2006a).

The size of the market for spill-proof containers is an ambiguous issue, depending on how consultees interpret the term 'spill-proof'. The conclusion that can be reached from the information in Table B13.5 is that 100% of containers on the Irish market are 'narrow-neck' ones without any special mechanism that would reduce the spillage in the case of an accident (e.g. the container being knocked over).

Table B13.5: Market Share of Spill-proof Containers on the Irish Market for DCM-based Paint Strippers

What percentage of DCM-based paint strippers in the domestic market is sold in spill-proof containers?	Opinion 1: 100%* Opinion 2: 0%**
Is there any national legislation requiring the use of such containers?	No*
Are consumers actively advised by sales people to purchase DCM-based paint strippers in spill-proof containers?	No
Is there a price difference between DCM-based paint strippers which are sold in 'standard' and spill-proof containers?	Opinion 1: The main Irish manufacturer of DCM -based paint strippers do not sell such products without spill proof containers, but imagine that products in 'standard' containers would be slightly cheaper* Opinion 2: One Irish consumer supplier of DCM-based paint strippers stated that such products are only sold in standard containers**

Source: Irish Health and Safety Authority, 2006a
**Opinion 1: Based on information received from one Irish DCM-based paint stripper manufacturer. The Irish manufacturer described spill-proof containers as having a narrow neck, stating that if a tin possessing such a narrow neck was to be knocked over, the spillage would be less that if the paint stripper was contained in a container with a neck of wider diameter. The manufacturer used a paint tin as a comparison of a vessel with a neck of wider diameter, i.e. not 'spill-proof'.*
***Opinion 2: One Irish consumer supplier of DCM-based paint strippers stated that such products are not contained in spill-proof vessels as such vessels do not possess a valve on the inner side of the neck of the vessels, which impedes the contents of the vessel from flowing out if turned upside down*

B13.4 Alternatives

Table B13.6 outlines the information on alternatives that has been submitted by the Irish Health and Safety Authority (2006a).

Table B13.6: Typical Alternative Paint Strippers available on the Irish Market

NMP based systems D-limonene based systems Benzyl alcohol based systems Caustic soda based systems Dibasic ester based systems DMSO based systems
Source: Irish Health and Safety Authority, 2006a

Information from an Irish manufacturer of DCM-based paint strippers suggests that "*there are few if any non DCM-based strippers in the Irish market*". The Irish Health and Safety Authority (2006a) indicates that out of four brands (17 products) of paint strippers being sold to Irish consumers, 3 brands (15 products) are DCM-based. The Irish Competent Authority believes that this illustrates the considerable preference Irish consumers hold for DCM-based paint strippers.

B14. ITALY

B14.1 Current Situation

According to the Italian Ministry of Health, 800 tonnes of DCM are used annually in the manufacture of paint strippers and a further 100 tonnes are used in the manufacture of adhesives (Italian Ministry of Health, 2007). It is not clear which year these figures relate to, nor have we received an indication from the Italian authorities of the tonnage of DCM manufactured in the country.

B14.2 Composition of DCM-based Paint Strippers

The Italian Ministry of Health (2007) has confirmed the presence of one manufacturer of DCM and of 10-15 manufacturers of DCM-based paint strippers. Table B14.1 outlines the composition of DCM-based paint strippers with and without vapour retardants.

Table B14.1: Composition of DCM-based Paint Strippers in Italy

Components in non-vapour retarded products	**CAS Number**	**Percentage in formulations**	**Noticeable changes over the last 5 years**
DCM	75-09-2	90	No
Other		10	No
Components in vapour retarded products	**CAS Number**	**Percentage in formulations**	**Noticeable changes over the last 5 years**
DCM	75-09-2	75-90	No
Toluene	108-88-3	2-6	
Other		10-23	

Source: Italian Ministry of Health, 2007

The Italian Ministry of Health (2007) reported the uses of DCM-based paint strippers as follows:

- ***industrial uses***: stripping of dried paint in the electrical market (declining);
- ***professional uses***: removing and cleaning adhesives; stripping of wood/iron articles (declining); and
- ***consumer uses***: cleaning of wood/iron articles (increasing).

B14.3 Use of Vapour Retardants

The Italian Ministry of Health notes that over 95% of the DCM-based paint strippers manufactured and used in Italy contain vapour retardants (Italian Ministry of Health, 2007).

B14.4 Container Issues

Table B14.2 outlines the available container sizes and the most widely used for each category in the Italian markets.

Table B14.2: Available Size for Containers of DCM-based Paint Strippers in Italy		
Use area	**Available sizes of containers**	**Predominant ('most popular') size**
Industrial use	Drum to 25 kg	Drum of 70kg
Professional use	750 ml-20 L	3-4 L
Consumer (DIY) use	750 ml -2L	750 ml
Source: Italian Ministry of Health, 2007. *Note: All containers are spill-proof in accordance with national legislation.*		

B14.5 Alternatives

Reportedly, there is only one manufacturer of alternative paint strippers in Italy manufacturing less than a tonne of formulations (Italian Ministry of Health, 2007). Table B14.3 outlines the types of alternative paint strippers that have been identified by the Italian Ministry of Health (2007) as being available on the domestic market

Table B14.3: Typical Alternative Paint Strippers available on the Italian Market			
Paint stripper type ('active' ingredient)	**CAS Number (where relevant)**	**Percentage in formulation**	**Relevant application(s)**
Alternative 1. *N-methyl-2-pyrolidone*	872-50-4	10-80%	Removing products with low thickness (coatings) but not with high thickness (adhesives)
Alternative 2. *2-phenoxyethanol*	122-99-6	50%	Industrial
Source: Italian Ministry of Health, 2007. *Note: In case of use for dipping, it is necessary to cover the tank with a lid and the tank material must be resistant to acids.*			

Alternative paint stripping methods used in Italy include: cryogenic stripping, pyrolytic stripping and mechanical stripping (Italian Ministry of Health, 2007).

B15. LATVIA

B15.1 Current Situation

Information on the domestic markets for DCM has been provided by the Latvian Environment, Geology and Meteorology Agency (2006) and is reproduced here as Table B15.1.

Table B15.1: Markets for DCM in Latvia for the Years 2004-2006	
Tonnage of DCM manufactured in Latvia	0
Year	**Tonnage of DCM used**
2004	23.43
2005	25.09
2006 (first 9 months)	21.52
Source: Latvian Environment, Geology and Meteorology Agency, 2006	

B15.2 Composition of DCM-based Paint Strippers

Table B15.2 reproduces information provided on the composition of vapour-retarded DCM-based paint strippers. It appears that non-vapour-retarded DCM-based paint strippers are not available on the Latvian market.

Table B15.2: Composition of DCM-based Paint Strippers that Contain Vapour Retardants on the Latvian Market		
Components	**CAS Number**	**Percentage in formulations**
DCM	75-09-2	70-80
Toluene	108-88-3	5-10
Ethanol	64-17-5	10-20
n-Butyl alcohol	71-36-3	1-3
Paraffin T1 (vapour retardant)	-	0.5
Source: Latvian Environment, Geology and Meteorology Agency, 2006		

The Agency has advised that there are no differences in composition between products used in different use categories (industrial, professional, consumer uses). The split between uses is:

- industrial and professional use: 10%; and
- consumer use: 90%.

B15.3 Container Issues

The market situation with regard to the available sizes of containers in the Latvian market is outlined in Table B15.3.

Table B15.3: Available Size for Containers of DCM-based Paint Strippers in Latvia		
Use area	**Available sizes of containers**	**Predominant ('most popular') size**
Industrial use	1 L, 20 L	20 L
Professional use	1 L, 20 L	20 L
Consumer (DIY) use	1 L	1 L
Source: Latvian Environment, Geology and Meteorology Agency, 2006		

In Latvia, 100% of DCM-based paint strippers are sold in spill-proof containers. There is national legislation requiring the use of such containers (Latvian Environment, Geology and Meteorology Agency, 2006).

B15.4 Alternatives

Table B15.4 outlines the information on alternatives that has been submitted by the Latvian Environment, Geology and Meteorology Agency (2006).

Table B15.4: Typical Components of Alternative Formulations available on the Latvian Market			
Composition of alternative DCM-free paint strippers	**CAS Number**	**Percentage in formulation**	**Relevant application(s)**
Methyl sulphoxide (Dimethyl sulphoxide)	67-68-5	30-40%	Paint stripping
Source: Latvian Environment, Geology and Meteorology Agency, 2006			

B16. LITHUANIA

B16.1 Current Situation

Information on the domestic markets for DCM has been provided by the Lithuanian Environmental Protection Agency (2006a) and is reproduced here as Table B16.1.

Table B16.1: Markets for DCM in Lithuania for the Year 2004	
Tonnage of DCM manufactured in Lithuania	0
Application category	**Tonnage of DCM used**
Paint stripping	0.9
Solvent or auxiliary agent in foam blowing (e.g. polyurethane)	57
Source: Lithuanian Environmental Protection Agency, 2006a	

Further to the information above, the markets for DCM-based paint strippers in Lithuania are presented in Table B16.2.

Table B16.2: Markets for DCM-based Paint Strippers in Lithuania for the Year 2004			
Parameter	**Industrial use**	**Professional use**	**Consumer use**
Tonnage of DCM-based strippers manufactured in Lithuania	1.1		
Tonnage of DCM-based strippers imported into Lithuania	12.8		
Tonnage of DCM-based strippers exported from Lithuania	0		
Tonnage of DCM-based paint strippers used	~14		
Number of commercial products (trade names) available in the domestic market	4		
Overall trend in consumption of DCM-based paint strippers over the last 5 years in Lithuania	Marginally increasing		
Source: Lithuanian Environmental Protection Agency, 2006a *Note: It is difficult to separate industrial, professional and consumer use areas for DCM-based strippers in Lithuania because of the small quantities of these strippers used in paint removal*			

Table B16.3 presents an overview of applications and a split of the consumption between industrial/professional/consumer uses, while Table B16.4 shows the number of companies involved in the national supply chains.

Table B16.3: Applications of DCM-based Paint Strippers in Lithuania and Recent Trends			
Use area	**Detailed description of applications**	**Percentage of total tonnage used**	**Trends in the last 5 years**
Industrial use	Manual use - apply paint stripper on wooden or metal surfaces by brush and remove old paint by scrapper. **Note:** According to information received from producers and retailers it is hard to separate these two use areas	Approx. 15 %	No change
Professional use			
Consumer (DIY) use	Manual use	85 %	Marginally increasing
Source: Lithuanian Environmental Protection Agency, 2006a			

Table B16.4: Overview of Domestic Supply Chain for DCM-based Paint Strippers in Lithuania	
Number of manufacturers of DCM	0
Number of manufacturers of DCM-based paint strippers	1 (100% SMEs)
Numbers of suppliers of DCM-based paint strippers	3 (66% SMEs)
Number of downstream users per use area	No data
Estimated number of users (workers, consumer, etc.) exposed to DCM during use of paint strippers	No data
Source: Lithuanian Environmental Protection Agency, 2006a	

B16.2 Composition of DCM-based Paint Strippers

B16.2.1 Information from Consultation with Competent Authorities

Information has been provided by the Lithuanian Environmental Protection Agency (2006a) on the composition of DCM-based paint strippers that do not contain vapour retardants (Table B16.5). The use of these paint strippers is said to be marginally increasing.

The Agency has claimed that approximately 50% of DCM-based paint strippers manufactured in Lithuania contains vapour retardants and suggested that it holds no information on the difference in uses for DCM-based paint strippers that contain vapour retardants and those that do not contain vapour retardants. However, this percentage may be misleading. Additional information received in January 2007 (Lithuanian Environmental Protection Agency, 2007) suggests while one Lithuanian manufacturer has been confirmed to use vapour retardants, for three other products available on the Lithuanian market only Safety Data Sheets are available and these do not mention any vapour retardant. Interestingly, one of the products available on the market is manufactured by a UK formulator who is known to use vapour retardants for his UK products. Overall, the 50% percentage identified by the Agency last year is very likely to be an underestimate.

According to producers and retailers of these paint strippers in Lithuania there is no noticeable difference between products used in different use areas (Lithuanian Environmental Protection Agency, 2006a).

Table B16.5: Composition of DCM-based Paint Strippers that do not Contain Vapour Retardants on the Lithuanian Market

Components	CAS Number	Percentage in formulations			
		Product 1	Product 2	Product 3	Product 4
DCM	75-09-2	<81	50-100	>50-100	>50-100
Toluene	108-88-3	<14			
Methanol	67-56-1		5-10		
Phosphoric acid	7664-38-2			<5	
Formic acid	64-18-6			<5	
Isopropanol	67-63-0				>10-25
Butyl alcohol	78-83-1				>0.1-2.5
Methoxy-isopropanol	107-98-2				>0.1-2.5

Source: Lithuanian Environmental Protection Agency, 2006a
Note: as said further above, there are doubts whether these products are indeed vapour retardant-free.

B16.3 Container Issues

The market situation with regard to the available sizes of containers in the Lithuanian market is outlined in Table B16.6.

Table B16.6: Available Size for Containers of DCM-based Paint Strippers in Lithuania

Use area	Available sizes of containers	Predominant ('most popular') size
Industrial use	0.5L, 0.75L, 1.1L, 4L, 5L, 10L	0.75L
Professional use		
Consumer (DIY) use	0.5L, 0.75L, 1.1L, 4L, 5L	1L

Source: Lithuanian Environmental Protection Agency, 2006a

It is interesting that the most 'popular' size for consumer use appears to be larger than the most 'popular' size for professional/industrial use.

The Lithuanian Environmental Protection Agency (2006a) assumes that it might be that the indicated sizes appear are the "most popular" because of small surfaces on which these paint strippers are used.

The market share of spill-proof containers is described in Table B16.7.

Table B16.7: Market Share of Spill-proof Containers on the Lithuanian Market for DCM-based Paint Strippers	
What percentage of DCM-based paint strippers in the domestic market is sold in spill-proof containers?	93 %
Is there any national legislation requiring the use of such containers or it is simply your choice to use these?	There is no national legislation requiring the use of such containers.
Are consumers actively advised by sales people to purchase DCM-based paint strippers in spill-proof containers?	Yes
Is there a price difference between DCM-based paint strippers which are sold in 'standard' and spill-proof containers?	Yes Products with standard package are about 5% cheaper than products with spill-proof package. Spill-proof mechanism means that these packages have child-resistant fastening) and tangible risk marks. These packages are hard and durable, standing strain under the usual conditions
Source: Lithuanian Environmental Protection Agency, 2006a & 2006b	

B16.4 Alternatives

The Lithuanian Environmental Protection Agency (2006a) has advised that, according to the information received from producers and retailers of paint strippers, there are no widely used alternative, DCM-free paint strippers in Lithuania.

B17. LUXEMBOURG

B17.1 Composition of DCM-based Paint Strippers in Luxembourg

Table B17.1 presents the findings of a survey organised in the main Luxembourgian DIY stores in late August/early September 2006. While not completely representative of the situation on DCM-based paint strippers in Luxembourg, it does provide some indications (Luxembourgian Inspection du Travail et des Mines, 2006a).

Table B17.1: Composition of DCM-based Paint Strippers available on the Luxembourgian Market (Consultation with Competent Authority)

Component	CAS Number	Percentage in formulations						
		1	2	3	4	5	6	7
DCM	75-09-2	50-100%	<90%	<90%	50-100%	>1%	60-80%	>60%
Methanol	67-56-1	2.5 – 10%	<10%	<10%		>3-20%	3-10%	
Sodium N-alkyl benzo sulphonate	68411-30-3	0-2.5%						
Naphtha, heavy, desulphurised	64742-82-1		<2%	<2%				
Fatty alcohol ethoxylate					<2.5%			
Isopropanol	67-63-0				<2.5%			
Ethyl alcohol	64-17-5							<30%
Solvent naphtha, light aromatic	64742-95-6							<10%
Ammonia	1336-21-6							<5%
Additives								to 100%

Source: Luxembourgian Inspection du Travail et des Mines, 2006a

B17.2 Alternatives

Table B17.2 outlines the information on alternatives submitted by the Luxembourgian Inspection du Travail et des Mines (2006a).

Table B17.2: Typical Components of Alternative Formulations available on the Luxembourgian Market			
Product	**Component**	**CAS Number**	**Percentage in formulations**
A	Xylene	1330-20-7	50-75%
	Butanone	78-93-3	30-40%
	N-methyl-2-pyrrolidone	872-50-4	5-10%
B	Xylene	1330-20-7	50-75%
	Butanone	78-93-3	30-40%
	N-methyl-2-pyrrolidone	872-50-4	5-10%
C	1,3-dioxolane	646-06-0	<40%
	Dimethoxymethane	109-87-5	< 20 %
	Naphtha heavy, desulphurised	64742-82-1	> 10 - < 25 %
	N-methyl-2-pyrrolidone	872-50-4	< 20 %
	Butane	106-97-8	< 10 %
	Isobutane	75-28-5	< 5 %
	Propane, liquefied	74-98-6	< 5 %
	Sodium dioctyl sulphosuccinate	577-11-7	< 5 %
D	1,3-dioxolane	646-06-0	<40%
	Dimethoxymethane	109-87-5	<20%
	Naphtha, heavy	64742-82-1	10-25%
E	1,3-dioxolane	646-06-0	<40%
	Dimethoxymethane	109-87-5	<20%
	Naphtha, heavy	64742-82-1	10-25%
F	1-ethyl-2-pyrrolidone	2687-91-4	10-25%
G	N,N-dimethylformamide	68-12-2	
	Xylene	1330-20-7	
Source: Luxembourgian Inspection du Travail et des Mines, 2006a			

B18. MALTA

B18.1 Current Situation

Information on the domestic markets for DCM has been provided by the Malta Standards Authority (2006) and is reproduced here as Table B18.1.

Table B18.1: Markets for DCM in Malta for the Year 2005	
Tonnage of DCM manufactured in Malta	0
Application category	**Tonnage of DCM used**
Paint stripping	<100
Adhesives	<10
Pharmaceuticals	Unknown
Aerosols	Unknown
Degreasing agent in the mechanical and electrical engineering industries	Unknown
Coatings	Unknown
Textiles	Negligible
Detergents/dry cleaning	Unknown
Extraction processes in the food industry	0
Source: Malta Standards Authority, 2006	

Further to the information above, the markets for DCM-based paint strippers in Malta are presented in Table B18.2.

Table B18.2: Markets for DCM-based Paint Strippers in Malta for the Year 2005			
Parameter	**Industrial use**	**Professional use**	**Consumer use**
Tonnage of DCM-based strippers manufactured in Malta	< 10 t per annum		
Tonnage of DCM-based strippers imported into Malta	< 100 t per annum		
Tonnage of DCM-based strippers exported from Malta	Nil		
Overall trend in consumption of DCM-based paint strippers over the last 5 years in Malta	Stable	Stable	Stable
Source: Malta Standards Authority, 2006			

The applications of DCM-based paint strippers in Malta are described in Table B18.3, while Table B18.4 shows the number and sizes of players in the domestic supply chain.

Table B18.3: Applications of DCM-based Paint Strippers in Malta and Recent Trends			
Use area	**Detailed description of applications**	**Percentage of total tonnage used**	**Trends in the last 5 years**
Industrial use	No data on individual applications. Only general usage information from Health & Safety Authority is available.	Extensively used	Stable
Professional use	Removal of graffiti on surfaces, including historical buildings. Removal of paint, varnish and lacquer on metal, wood and masonry.	Small scale specialised use Relatively common use	Increase Stable
Consumer (DIY) use	Stripper for use on wood, metal and masonry.	Relatively common use	Stable
Source: Malta Standards Authority, 2006			

Table B18.4: Overview of Domestic Supply Chain for DCM-based Paint Strippers in Malta						
Parameter	**Industrial use**		**Professional use**		**Consumer use**	
	Number	**% SMEs**	**Number**	**% SMEs**	**Number**	**% SMEs**
Number of manufacturers of DCM	0					
Number of manufacturers of DCM-based paint strippers			3	100	3	100
Numbers of suppliers of DCM-based paint strippers			6	100	6	100
Estimated number of users (workers, consumer, etc.) exposed to DCM during use of paint strippers	500	100	1,500	100	10,000 ?	
Source: Malta Standards Authority, 2006						

B18.2 Use of Vapour Retardants

Details of composition were not available. However, the Malta Standards Authority it appears that the vast majority of products available on the Maltese market do not contain vapour retardants (Malta Standards Authority, 2006). However, in subsequent communication, the Authority advised that, as regards the absence of vapour retardants, the Authority relied on information provided by suppliers/manufacturers and Safety Data Sheets. The Authority cannot exclude that these may be present but undeclared. Finally, the Authority did not come across any use of vapour retardants on site (Malta Standards Authority, 2007).

B18.3 Container Issues

Information on the available sizes of containers of DCM-based paint strippers was provided for consumer uses only. The sizes range from 250 ml to 1,000 ml and the most 'popular' size seems to be 500 ml. The Malta Standards Authority (2006) argues that 500 ml seem to be sufficient for most individual consumer applications.

The market share of spill-proof containers is described in Table B18.5.

Table B18.5: Market Share of Spill-proof Containers on the Maltese Market for DCM-based Paint Strippers	
What percentage of DCM-based paint strippers in the domestic market is sold in spill-proof containers?	None
Is there any national legislation requiring the use of such containers or it is simply your choice to use these?	No
Are consumers actively advised by sales people to purchase DCM-based paint strippers in spill-proof containers?	No
Is there a price difference between DCM-based paint strippers which are sold in 'standard' and spill-proof containers?	N/A
Source: Malta Standards Authority, 2006	

B18.4 Alternatives

Table B18.6 outlines the information on alternatives that has been submitted by the Malta Standards Authority (2006).

Table B18.6: Typical Components of Alternative Formulations available on the Maltese Market			
Composition of alternative DCM-free paint strippers	**CAS Number**	**Percentage in formulation**	**Relevant application(s)**
Toluene & xylene		Mixture	Removal of paint, varnish, lacquer, epoxy, urethane & graffiti
Sodium hydroxide			Removal of paint and varnish from solid wood.
Toluene, xylene and methanol		< 5 % methanol	For use on metals.
Source: Malta Standards Authority, 2006			

The Malta Standards Authority (2006) has advised that there are two alternative products on the market for professional uses and a further three for consumer uses.

Sanding and similar techniques such as sand or grit-blasting are discouraged in Malta in view of the large amounts of particulate matter generated. In view of Malta's high population density (1,300 per sq km) and limited area (315 sq km), most industrial and professional activities take place in densely populated areas (the Inner Harbour Area). Techniques involving generation of dust lead to environmental concerns. The Malta Standards Authority (2006) advised us that public opinion has forced some companies formerly using sand and grit-blasting to adopt new techniques such as use of high pressure water jets, for example, for use on metals in the ship repair industry. These techniques require extensive training and investment but have proven effective in some cases.

The Malta Standards Authority (2006) believes that sanding and blasting techniques are not suitable for delicate work such as restoration of old/historical buildings, renovation of old houses and antiques, or removal of graffiti from historical buildings and monuments. These activities are particularly significant in Malta.

Moreover, it appears that some local companies have experimented (reportedly, with limited success so far) with strippers containing N-methyl-2-pyrrolidone. These products are effective but take much longer to work. NMP cannot be used for polyester or baked-on coatings. However, its lower volatility is an advantage for Malta's relatively warm climate as frequent reapplications are less necessary (Malta Standards Authority, 2006).

B19. THE NETHERLANDS

B19.1 Current Situation

The Dutch Competent Authority (RIVM) reportedly contacted a number of companies which are said to supply around 80% of the Dutch market, but did not obtain detailed information on the current situation. RIVM (2006a) has provided emission figures for 1995 & 2003 although it is unclear whether figures relate to DCM as paint-strippers or other uses. As a result the figures are not presented in this report.

B19.2 Composition of DCM-based Paint Strippers

B19.2.1 Information from Consultation with Manufacturers

Table B19.1 outlines the available information on the compositions of products manufactured by companies that have responded to the RPA questionnaire. Only one company has submitted information on vapour-retarded DCM-based paint strippers. Another one does not use vapour retardants and the composition of its products is provided in Table B19.4.

Table B19.3: Composition of Vapour Retarded DCM-based Paint Strippers that Contain Vapour Retardants in the Netherlands (confidential information)

Component	CAS Number	Percentage in formulation
		Company A
DCM	75-09-2	80
Methanol	67-56-1	15
Lye Caustic 50%		3
Wax		2
Source: Consultation		

Table B19.4: Composition of Vapour Retarded DCM-based Paint Strippers that do not Contain Vapour Retardants in the Netherlands (confidential information)

Component	CAS Number	Percentage in formulation
		Company B
DCM	75-09-2	60-80
Phenol	108-95-2	10-20
Non-ionic surfactant	9016-45-9	1-5
Ammonia solution 25%	1336-21-6	1-5
Sodium chromate	7775-11-3	0.3%
Source: Consultation		

B19.3 National Regulatory Measures

B19.3.1 Legislation on the Use of Solvents

According to the Dutch occupational legislation, the use of paints and paint pre-treatment products containing more then 100 g/l of solvents[3] is forbidden. As DCM is a solvent and can be considered as a pre-treatment agent, similar use conditions apply here. The rationale is to limit the exposure of workers to organic solvents, in order to prevent damage to their central nervous system. This legislation was introduced in 2000 (RIVM, 2006a).

B19.3.2 Emission Reduction Policy and Agreements with Industry

DCM is subject to general legislation for volatile organic compounds (VOCs). Until 2010, the VOC policy aims to achieve the national emission limit for VOC, which was recommended by the European National Emission Ceilings Directive (2001/81/EC). The Netherlands has committed itself to a maximum VOC emission of 185,000 tonnes in 2010 (including traffic). The National Reduction Plan for VOC describes the contributions of various activity branches (industry, HOD[4] and construction) to the realisation of this goal, and measures planned to achieve it (RIVM, 2006a).

The implementation of these measures is realised partly through general regulations, e.g. the Dutch Solvent Act (Oplosmiddelenbesluit) which implements EU Directive 1999/13/EG, the Organic Solvents in Paints and Varnishes Act (Besluit organische oplosmiddelen in verven en vernissen) and implementing ordinances according to article 8.40 of the Dutch Law on environmental management ("8.40-AMvB's"). An important part of the implementation will be achieved covenants/agreements, and through the Dutch Emission Guidelines for Air (NeR), where measures need to be laid down in permits. VOC measures in the NeR were updated in 2005 (RIVM, 2006a).

In the framework of a covenant for the cleaning sector (9 April 2003), it was agreed that after 1 April 2005, **paint strippers based on DCM should no longer be used**. After 1 April 2005, the use of DCM is no longer considered to comply with technical/scientific standards, and therefore could be sanctioned (RIVM, 2006a).

This agreement has been converted into the following measures (RIVM, 2006a):

- ***cleaning of vehicles (graffiti removal)***: the intention is to stop using DCM-based paint stripping agents for cleaning of vehicles, under the following conditions:
  - branches performing similar services (i.e. companies that carry out the same kind of work but that are not committed to the covenant) are not allowed to continue using DCM-based strippers (for fairness in competition);

[3] Solvent is defined as substance having a vapour pressure of 0.01 kPa or more at 298 K.

[4] HOD is actually more commonly referred to as HDO, which stands for "handel, diensten en overhead", which could be translated as "trade, services and authorities" (RIVM, 2006b).

  - there is no shift towards products or services by companies in countries where DCM may still be used; and
  - replacement of DCM does not conflict with (current or future) European legislation;

- ***cleaning of buildings***: considering the expected impact on competitiveness, it is not agreed to substitute DCM for cleaning of buildings. Replacement of DCM should be implemented on a higher level. It has recommended to consider alternatives in consultation with clients and to guarantee education and safety measures for workers. Therefore, until today, DCM-based graffiti removal products are being used in the Netherlands (Bunnik-Advies, 2007a).

For the purposes of this agreement, several organisations including professional cleaners, part of the building industry and professional painters prepared, in 2002, under the initiative of the Dutch Ministry of Environment, a paper that give technical and legal information how to undertake the removal of graffiti (InfoMil, 2002). In Part 7 of this paper, there is a recommendation for producers to develop alternative, non-solvent based, materials for graffiti removal (Bunnik-Advies, 2007a)

B20. NORWAY

B20.1 Current Situation

Information on the domestic markets for DCM has been provided by the Norwegian Pollution Control Authority (2006) and is reproduced here as Table B20.1.

Table B20.1: Markets for DCM in Norway for the Year 2005	
Tonnage of DCM manufactured in Norway	0
Application category	**Tonnage of DCM used**
Paint stripping	94
Adhesives	2
Detergents/dry cleaning	9
Solvent or auxiliary agent in:	34
- foam blowing (e.g. polyurethane)	
- polycarbonate production	
- triacetate production	
- aerosols	
- degreasing	
Chemicals used in labs	10
Source: Norwegian Pollution Control Authority, 2006	

Table B20.2 shows that although the majority of products on the Norwegian market have a concentration of DCM between 60% and 80%, products with a DCM concentration above 80% have a tonnage twelve times larger.

Table B20.2: Number of DCM-based Paint Strippers and Associated Tonnages in the Norwegian Market by the Concentration of DCM			
Product	**Concentration of DCM**	**Number of products**	**Tonnages**
Paint strippers	60-80	10	7
Paint strippers	80-100	7	87
Source: Norwegian Pollution Control Authority, 2006			

Further to the information above, the markets for DCM-based paint strippers in Norway are presented in Table B20.3.

Table B20.3: Markets for DCM-based Paint Strippers in Norway for the Year 2005		
Parameter	**Industrial use/ professional use**	**Consumer use**
Tonnage of DCM-based paint strippers used in Norway	67	26
Number of commercial products (trade names) available in the domestic market	17 (total number of products)	
Overall trend in consumption of DCM-based paint strippers over the last 5 years	*For the years 2002 to 2005:* Number of products: 17 down from 27 Tonnage used: 94 down from 249	
Source: Norwegian Pollution Control Authority, 2006		

Some information on consumer uses has been provided by an industry consultee; according to this source, on the Norwegian DIY market, there is only one DCM-based product available and it is sold in small metal pails.

According to the Norwegian Pollution Control Authority (2006), the use of DCM in Norway has decreased very much in recent years and alternatives can be found for most uses. One of the remaining uses is for removing epoxy coatings from swimming pools etc. The remaining products are also sold in small amounts for private (DIY) use, in some warehouses.

B20.2 Use of Vapour Retardants

The information available to the Norwegian Pollution Control Authority (2006) suggests that the DCM-based paint strippers available on the domestic market contain vapour retardants.

B21. PORTUGAL

B21.1 Current Situation

A total of six responses to the RPA questionnaire were submitted to the Portuguese Direcção-Geral da Empresa and were made available to RPA through the Associação Portuguesa dos Fabricantes de Tintas e Vernizes (APFTV – the Portuguese trade association of paints and varnishes manufacturers).

The six companies are said to represent more than 55% of the total turnover in the Portuguese paint sector (Direcção-Geral da Empresa, 2006).

Of the six companies, two are large companies and four are SMEs. The combined tonnage of four companies reporting the production levels for the year 2005 was 65.3 tonnes. Generally, the Portuguese companies tend to supply only Portuguese clients, with a few exceptions (clients in Spain and the United Kingdom have also been mentioned).

Information on the characteristics of the supply chain has been provided by some of the companies and this is summarised in Table B21.1.

Table B21.1: Description of Supply Chain for Portuguese DCM-based Paint Stripper Manufacturers

Company	**No. of direct customers**
Company A	Own net sales; 1 distributor in Portugal and 2 distributors in another European country
Company B	Supply directly to companies involved in industrial uses (less than 4 customers) Supply directly to companies involved in professional uses (less than 8 customers)
Company C	Distributors in Portugal and another European country supply companies involved in industrial and professional users

Source: Consultation

Table B21.2 outlines the applications for the different products marketed by the six Portuguese companies.

Table B21.2: Applications of DCM-based Paint Strippers in Portugal		
Application type	**DCM-based paint strippers that contain vapour retardants**	**DCM-based paint strippers that do not contain vapour retardants**
Industrial applications	Company A: Paint stripper Company B: We don't have separated data concerning to this subject Company C: to remove air drying paints in wood and metal	Company Z: Machines, metal industry
Professional applications	Company A: Paint stripper Company B: We don't have separated data concerning to this subject Company C: Product applied by brush Company D: To remove air drying paints in wood and metal	Company Z: Car repair Company Y: Paint removal on metallic surfaces before repainting (not entirely certain whether the relevant products does not contain vapour retardants)
Consumer applications	Company A: Paint stripper Company B: We don't have separated data concerning to this subject Company C: Product applied by brush Company D: To remove air drying paints in wood and metal	
Source: Consultation		

B21.2 Composition of DCM-based Paint Strippers

Tables B21.3 and B21.4 present confidential information on the composition of non-vapour retarded and vapour-retarded DCM-based paint strippers that are manufactured and/or supplied by Portuguese enterprises to the Portuguese (predominantly) and other European markets.

Table B21.3: Composition of Non-vapour Retarded DCM Paint Strippers in Portugal (data from two companies) (confidential information)			
Component	**CAS Number**	**Percentage in formulations**	
		Company Z	**Company Y**
DCM	75-09-2	65	80-90
Methanol	67-56-1		5-10
Toluene	108-88-3	3	
n-butyl acetate	123-86-4	1	
Naphtha (petroleum), hydrodesulphurised heavy	64742-82-1		1-5
Source: Consultation			

Table B21.4: Composition of Vapour Retarded DCM Paint Strippers in Portugal (data from four companies) (confidential information)					
Component	**CAS Number**	**Percentage in formulations**			
		Company A	**Company B**	**Company C**	**Company D**
DCM	75-09-2	>75	76	84.07	77
Methanol	67-56-1	<10			4
Paraffin waxes (petroleum), hydrotreated (vapour retardant)	64742-51-4	ca. 1			
Isobutanol	78-83-1	<5			
Methylhydroxyethylcellulose		ca. 2			
Ethanol			10		
Cellulose ether			2.2		
Additives			21.8		
Isopropanol	67-63-0			9.07	
Tylose MHB 3000 P2				2.16	
Refined Paraffin 135/140 F (vapour retardant)	8002-74-2			0.51	
Toluene	108-88-3			1.59	
Teepol N	2564-83-2			2.57	
Ammonia	1336-21-6			0.03	
Benzyl alcohol	100-51-6				9
Additol XL 102 (vapour retardant)					2.5
Source: Consultation					

The companies that use vapour retardants could not provide any information on measurements undertaken on the evaporation reductions achieved by using vapour retardants.

B21.3 Container Issues

The market situation with regard to the available sizes of containers in the Portuguese market is outlined in Table B21.5.

Table B21.5: Available Size for Containers of DCM-based Paint Strippers in Portugal			
Use area	**Available sizes of containers**	**Predominant ('most popular') size**	**Overall 'popularity'**
Industrial use	Company A: 1L, 5L Company B: 1L, 5L Company C: 1L, 5L Company D: 0.25L, 1L, 5L	Company A: 1L Company B: 1L Company C: 5L Company D: 5L	1L & 5L
Professional use	Company A: 1L, 5L Company B: 1L, 5L Company C: 0.25L, 1L, 5L Company D: 0.25L, 1L, 5L Company E: 0.25L, 1L, 5L Company F: 0.5L, 1L, 5L	Company A: 1L Company B: 1L Company C: 1L Company D: 1L Company E: 1L Company F¨1L	1L
Consumer (DIY) use	Company A: 0.25L, 1L Company C: 0.25L, 1L Company D: 0.25L, 1L, 5L Company E: 0.25L, 1L, 5L	Company A: 0.25L Company C: 0.25L Company D: 0.25L Company E: 1L	0.25L
Source: Consultation			

The market share of spill-proof containers per respondent is described in Table B21.6.

Table B21.6: Market Share of Spill-proof Containers on the Portuguese Market for DCM-based Paint Strippers					
Question	**Company A**	**Company B**	**Company C**	**Company D**	**Company E**
What percentage of your portfolio of DCM-based paint strippers is represented by products sold in spill-proof containers?	100	100	Our packaging has a child-resistant fastening	100	None
Are consumers actively advised by sales people to purchase DCM-based paint strippers in spill-proof containers?	No	We only have it in spill-proof containers	-	Unknown	N/A
Is there a price difference between DCM-based paint strippers which are sold in 'standard' and spill-proof containers?	Information not available	We only have it in spill-proof containers	Packaging with child-resistant fastenings are more expensive	The spill-proof container is about 20% more expensive than standard	N/A
Source: Consultation					

B22. THE SLOVAK REPUBLIC

B22.1 Current Situation

Information on the domestic markets for DCM has been provided by the Centre for Chemical Substances and Preparations of the Slovak Republic (2006) and is reproduced here as Table B22.1.

Table B22.1: Markets for DCM in the Slovak Republic for the Year s 1999 to 2005

Year	Application area and tonnages			
	Paint stripping	**Pharma-ceuticals**	**Solvent or auxiliary agent***	**Other**
1999	0.5	64		Various: 34 Common industry use: 32 Chemical industry – various: 16 Furniture industry: 5 Car-repairing sector: 0.4 Laboratory practice: 0.04 Building industry: 0.2
2000	0.4	84		Various: 39 Common industry use: 86 Chemical industry – various: 15 Furniture industry: 6 Car-repairing sector: 0.4 Laboratory practice: 0.14 Building industry: 0.2
2001	0.6	126		Various: 76 Common industry use: 14 Chemical industry – various: 26 Furniture industry 1: refrigeration industry: 5 Car-repairing sector: 0.5 Laboratory practice: 0.08 Building industry: 0.2
2002			50 – 100	Shoe industry: 10-50 Unspecified category: 10-50 Unspecified category: 50-100
2005				10 – 50 unspecified category: 10-50

Source: Centre for Chemical Substances and Preparations of the Slovak Republic, 2006
**Solvent or auxiliary agent: (foam blowing, polycarbonate production, triacetate production, aerosols, degreasing)*

Notably, some of the uses under the "Other" category, such as the automotive repair sector and the building industry may well be relevant to the use of DCM in paint strippers.

The aforementioned quantities of DCM (not exceeding 1 tonne in recent years and apparently diminishing in the 2000's) have been imported into the Slovak Republic rather than being produced there. All of this DCM is believed to have been used in industrial applications. The Slovakian authorities suggest that there is a sole supplier of

paint strippers to the domestic market, but no indication is given whether this is an SME or a larger company (Centre for Chemical Substances and Preparations of the Slovak Republic, 2006).

B23. SLOVENIA

B23.1 Current Situation

Table B23.1 outlines the current situation with regard to manufacture and use of DCM in Slovenia.

Table B23.1: Markets for DCM in Slovenia (unspecified year)	
Tonnage of DCM manufactured in Slovenia	184.76
Application category	**Tonnage of DCM used**
Paint stripping	124.2
Adhesive in shoemaking industry, pneumatics, upholstery, timber industry	102.7
Degreasing agent in the mechanical and electrical engineering industries	40.4
Coatings	20.3
Thinners	5.24
Pharmaceuticals	1.78
Aerosols	0.26
Seals	0.79
Textiles	0.06
Solvent or auxiliary agent in:	96.23 (not specified)
- foam blowing (e.g. polyurethane)	0
- polycarbonate production	0
- triacetate production	0
- aerosols	5.52
- degreasing	39.9
Other	1.86
Source: Slovenian National Chemicals Bureau, 2007a	

The number of key players in the Slovenian DCM market are:

- number of manufacturers of DCM: 2 (both SMEs);
- number of manufacturers of DCM-based paint strippers: 8 (7 are SMEs); and
- number of suppliers of DCM-based paint strippers: 11 (10 are SMEs).

The above data contradict somewhat the information we have received in the course of this study from ECSA and the six main DCM manufacturers as it shows that DCM production takes place in Slovenia. The Slovenian National Chemicals Bureau has obtained this information from the register of companies that trade and manufacture dangerous chemicals but it was not in position to provide more detail.

Table B23.2 summarises the information on the manufacture of DCM-based paint strippers in Slovenia. It appears that industrial uses account for the vast majority of use of DCM-based paint strippers in the country.

Table B23.2: Manufacture, Imports, Exports and Consumption of DCM-based Paint Strippers in Slovenia

Parameter	Industrial use	Professional use	Consumer use
Tonnage of DCM-based strippers manufactured in Slovenia	21.61		
Tonnage of DCM-based strippers imported into Slovenia	9.62		
Tonnage of DCM-based strippers exported from Slovenia	7.05		
Tonnage of DCM-based paint strippers used in Slovenia	17.99	0.011	6.19
Number of commercial products (trade names) available in the domestic market	16	1	5

Source: Slovenian National Chemicals Bureau, 2007a

B23.2 Composition of DCM-based Paint Strippers

There are 17 DCM-based paint stripper products on the Slovenian market, 5 of which contain vapour retardants. Current trends show that the quantity of DCM-based paint strippers containing vapour retardants used in Slovenia was constant in the years between 2002 and 2005. There appears to be a trend towards a slight increase in the use of DCM-based paint strippers that do not contain vapour retardants (Slovenian National Chemicals Bureau, 2007a).

Table B23.3: Composition of DCM-based Paint Strippers available on the Slovenian Market

	Components	CAS Number	Percentage in formulations
Without vapour retardants	DCM	75-09-2	70-100
	Ethanol	64-17-5	2.5-10
	Toluene	108-88-3	2.5-10
	2-ethylhexanoic acid	149-57-5	<2.5
With vapour retardants	**Components**	**CAS Number**	**Percentage in formulations**
	Naphtha (petroleum), hydrotreated light	64742-49-0	25-50
	Methyl ethyl ketone	78-93-3	10-25
	DCM	75-09-2	10-25
	Ethanol	64-17-5	10-25

Source: Slovenian National Chemicals Bureau, 2007a

There are no differences in composition between DCM based paint strippers used in industrial, professional and consumer applications (Slovenian National Chemicals Bureau, 2007a). The types of uses and prevailing trends in consumption over the last

five years are presented in Table B23.4. It appears that some of the applications indicated by the Slovenian authorities fall outside the scope of this study (as they relate to cleaning rather than paint stripping).

Table B23.4: Applications of DCM-based Paint Strippers for each Use Category in Slovenia

Use category	Description of applications	% of total tonnage used	Trends in the last 5 years
Industrial use	- Paint strippers, paint removers in car services and car industry, used with small spade or brush; - leather, gum and plastic cleaner, used with spraying; - cleaning of polyurethane in car industry	95%	The quantity of used DCM paint strippers is slowly decreasing
Professional use	- Paint stripper; - coating for granites	0.01%	No data
Consumer use	- Paint strippers, paint removers; - leather, gum and plastic cleaner	4.99 %	No data

Source: Slovenian National Chemicals Bureau, 2007a

B23.3 Container Issues

For consumers, the only available sizes of containers are 1,000 ml and 750 ml. For professional users only 1,000 ml are available while for industrial use sizes are 1,000 ml, 20 kg and 25 kg. The common container size for all use categories is 1,000 ml. For consumers, both sizes (1,000 ml and 750 ml) appear to be equally popular (Slovenian National Chemicals Bureau, 2007a).

Paint strippers that contain more than 1% of DCM are sold to the general public with child-resistant fastening according to Directive 67/548/EC and 1999/45/EC (Slovenian National Chemicals Bureau, 2007a).

B23.4 Alternatives

According to the Slovenian authorities (Slovenian National Chemicals Bureau, 2007a), there are two manufacturers of DCM-free paint strippers in the country manufacturing three different commercial products intended for industrial use. The composition of these alternatives is given in Table B23.5. Alternative products are reported as being more expensive and not as efficient as DCM-based paint strippers.

Table B23.5: Composition of DCM-free Paint Strippers on the Slovenian Market

Components	CAS Number	Percentage	Relevant application(s)
1-methyl-2-pyrrolidone Dimethyl glutarate Dimethyl succinate	872-50-4 1119-40-0 106-65-0	No data	No data
1-methyl-2-pyrrolidone 2-butoxy ethanol	872-50-4	No data	Industrial use only

Source: Slovenian National Chemicals Bureau, 2007a

B24. SPAIN

We have only received information from one Spanish manufacturer of DCM-based paint strippers, whose sales are equally split between industrial and professional uses. The composition of the relevant product is given in Table B24.1

Table B24.1: Example Composition of a DCM-based Paint Stripper on the Spanish Market

Component	CAS Number	Percentage in formulations	Noticeable changes over the last 5 years
DCM	75-09-2	70	No
Ethyl alcohol	64-17-5	12	No
Alkyl benzene	64742-95-6	14	No
Cellulose		2	No
Wax		2	

Source: Consultation

B25. SWEDEN

B25.1 Past Statistics and Current Situation

Information on the domestic markets for DCM is available from the Swedish Chemicals Inspectorate Internet site and is reproduced here as Table B25.1. It is evident that over the last 12 years the presence of DCM available in the Swedish market has been reduced by around 90%.

Table B25.1: Markets for DCM in Sweden for the Years 1993 to 2004

Year	Tonnage	Year	Tonnage
1993	1,172	1999	629
1994	1,297	2000	546
1995	1,068	2001	451
1996	439	2002	230
1997	579	2003	317
1998	644	2004*	140

* Note that the figures for 2004 are preliminary.
Source: Swedish Chemicals Inspectorate Internet site (www.kemi.se/templates/Page.aspx?id-4021.)

There is no manufacturing of DCM in Sweden. The DCM-based products used in Sweden, according to the exemptions, are imported from other EU Member States. More recent data for 2006 have been provided by the Swedish Chemicals Inspectorate during consultation and are reproduced here as Table B25.2.

Table B25.2: Quantities of DCM used in Sweden in 2006

Areas of use	Number of companies		Tonnage	
	2002	2006	2002	2006
Pharmaceutical industry	6	4	1,474	64-79
Degreasing/cleaning	12	8	17	6.7
Paint stripping (industrial use)	5	3	0.8	0.5
Adhesives	10	12	3.3	2.6
Vulcanising of conveyor belts	5	6	5.1	0.5
Totals			1,500	74.3-89.3

Source: Swedish Chemicals Inspectorate, 2006

Although the aggregate for 2002 appears to be considerably higher in comparison to the data from the Swedish Chemicals Inspectorate Internet site (see Table B25.1 above), it is again evident that in the last five years there has been a distinct decline in the use of DCM-based products (around 40% decrease in the generally small tonnage associated with paint strippers). According to the Swedish Chemicals Inspectorate (2006), there are no longer any exemptions granted for professional use of DCM-based paint strippers.

B25.2 National Regulatory Measures

DCM has been prohibited for marketing and use in Sweden since 1 January 1996[5] as per the Chemical Products (Handling, Import, and Export Prohibitions) Ordinance (1998:944). The rationale for introducing a national ban on DCM was based on concerns about the carcinogenic properties of the substance and its effect on workers' health (Swedish Chemicals Inspectorate, 2006). According to Sections 5 to 7 of the Ordinance:

- ***Section 5***: chemical products which, in whole or in part, consist of methylene chloride (DCM), trichloroethylene, or tetrachloroethylene may not be offered for sale or transferred to consumers for private use. The Swedish Chemicals Inspectorate may prescribe that goods containing DCM, trichloroethylene, or tetrachloroethylene may not be offered for sale or transferred to consumers for private use;

- ***Section 6***: chemical products which, in whole or in part, consist of DCM, or trichloroethylene may not be offered for sale, transferred, or used professionally; and

- ***Section 7***: the Swedish Chemicals Inspectorate may issue regulations regarding exceptions from the prohibitions set forth in Sections 5 and 6 where particular reasons exist. The Swedish Chemicals Inspectorate may, in individual cases, grant exemptions from the prohibitions set forth in Sections 5 or 6 where exceptional reasons exist therefore.

The Swedish Chemicals Agency has issued a general exception for use in Research and Development or analysis purposes and more than 30 exemptions have been granted in individual cases. The conditions for being granted an exemption are that:

- the company can confirm that it is continuously searching for feasible alternatives;
- no feasible alternative is available for that particular use; and
- that the use does not cause unacceptable exposure.

The Swedish Chemicals Inspectorate holds no information regarding the extent to which DCM is used for analytical purposes. In general, the companies that have been granted an exemption are small to medium sized companies, i.e. the company has less than 250 employees. In those few cases where the number of employees is more than 250, the activity including the use of DCM-based products only represents a minor part of the company's field of work (Swedish Chemicals Inspectorate, 2006).

The information on quantities and areas of use that has been provided for the purposes of this study is thus based on information gathered in connection with the granting of exemptions (Swedish Chemicals Inspectorate, 2006).

[5] CEFIC (2005) notes that a Swedish ban on DCM in consumer uses (including paint stripping) was originally introduced in 1994, followed by the ban (with derogations) for professional uses in 1995.

There are no exemptions granted for consumer use of DCM-based products (Swedish Chemicals Inspectorate, 2006).

B26. SWITZERLAND

B26.1 Current Situation

Information on the domestic markets for DCM has been provided by the Swiss Federal Office of Public Health (2006a) and is reproduced here as Table B26.1. Note that the figures reflect the number of products rather than tonnages (tonnage data are not available).

Table B26.1: Markets for DCM in Switzerland for the Year 2005

Application category	Number of DCM-based products
Paint stripping (not categorised, number of products is based on a trade name-search)	100
Adhesives	42
Pharmaceuticals	No information
Aerosol propellants	2
Degreasing agent in the mechanical and electrical engineering industries and solvents or auxiliary agents	220
Coatings	73
Textiles	No information
Detergents/dry cleaning	73
Extraction processes in the food industry	No information
Other: - Lubricants - Care agents (car, furniture, metal treatment) - Not specified	 30 32 145

Source: Swiss Federal Office of Public Health, 2006a

The Swiss Federal Office of Public Health, (2006a) state that the number of commercial products (trade names) available in the domestic market are:

- ***industrial and professional uses***: 93 (not categorised separately); and
- ***consumer uses***: 7 (of which 2 are doubtful whether still available on the market).

Those 93 DCM-based paint-stripping products found on the register can be attributed to approximately 50 suppliers. The number of these suppliers that are still producing such products is unknown (Swiss Federal Office of Public Health, 2006b).

B26.2 Composition of DCM-based Paint Strippers

Table B26.2 shows the composition of DCM-based paint strippers with and without vapour retardants available on the Swiss market.

Table B26.2: Composition of DCM-based Paint Strippers in Switzerland		
Components for products without vapour retardants	**CAS Number**	**Percentage in formulations**
DCM	75-09-2	70-90
Methanol	67-56-1	5-20
Formic acid	64-18-6	10-15
Xylene	1330-20-7	1-15
Water	7732-18-5	1-5
Components for products without vapour retardants	**CAS Number**	**Percentage in formulations**
DCM	75-09-2	70-90
Paraffin waxes	8002-74-2	0-2
Cellulose methyl ether	9004-67-5	0-5
Methanol	67-56-1	2-15
1-methoxypropan-2-ol	107-98-2	3-5
Benzyl alcohol	100-51-6	2-5
Water	7732-18-5	0-2
Source: Swiss Federal Office of Public Health, 2006a		

The Swiss Federal Office of Public Health has advised that for the creation of the above table the components of the formulations as they appear in the product register were considered. Paraffins and waxes were identified as vapour-retardants and paint-strippers with and without paraffin and waxes were identified (this of course, assumes that vapour retardants are only described as "paraffins" or "waxes"). It is, in theory, possible that substances which are used as vapour-retardants may not have been registered as such by companies but rather under the heading "auxiliary agents" (Swiss Federal Office of Public Health, 2006c). With regard to the few products registered for consumer uses, they all contain vapour retardants (paraffins/waxes) (Swiss Federal Office of Public Health, 2006d).

B26.3 Alternatives

Table B26.3 outlines the information on alternatives that has been submitted by the Swiss Federal Office of Public Health (2006a).

Table B26.3: Typical Components of Alternative Formulations available on the Swiss Market		
Composition of alternative DCM-free paint strippers	**CAS Number**	**Percentage in formulation**
2-aminoethanol	141-43-5	0-15%
Benzyl alcohol	100-51-6	5-10%
2-butoxy-ethanol	111-76-2	5-15%
2-(2-butoxyethoxy)ethanol	112-34-5	5-15%
Potassium hydroxide	1310-58-3	0-5%

Table B26.3: Typical Components of Alternative Formulations available on the Swiss Market		
Composition of alternative DCM-free paint strippers	**CAS Number**	**Percentage in formulation**
1-methyl-2-pyrrolidone	872-50-4	0-60%
Sodium hydroxide	1310-73-2	0-5%
Water	7732-18-5	0-95%
Source: Swiss Federal Office of Public Health, 2006a *Note: These are the most commonly used components of DCM-free products; they are, not ranked.*		

The number of DCM-free commercial products (trade) available in the domestic market is (Swiss Federal Office of Public Health, 2006a):

- ***industrial and professional uses***: 270 (not categorised separately); and
- ***consumer uses***: 20.

B26.4 National Regulatory Measures

B26.4.1 Deviations from the EC Chemical Risk Management Legislation

The Swiss chemicals legislation is largely EC-harmonised, with notable exceptions to the Swiss Ordinance on Protection against Dangerous Substances and Preparations (Chemicals Ordinance, ChemO, SR 813.11):

- ***Article 61***: obligation to register dangerous existing substances and dangerous preparations; and

- ***Articles 76-83***: use and supply restrictions for particularly dangerous substances and preparations

In particular, Article 37 of ChemO describes specific provisions like child-resistant safety measures for DCM-containing preparations (≥1%) and tactile warning symbols for substances or preparations labelled as "harmful" (Swiss Federal Office of Public Health, 2006).

B26.4.2 Effects of the National Legislation to the Marketing and Use of DCM

The Ordinance on Risk Reduction related to Chemical Products (ORRChem, SR 814.81) (this implements restrictions according to Directive 76/769/EEC) prescribes the following (Swiss Federal Office of Public Health, 2006):

- ***Annex 2.3 (Art. 3)***: "*The labelling of containers containing more than 2.5 litres of halogenated solvents must include indications as to the following points:(a) that the container contains halogenated solvents; (b) the chemical name, the boiling point and the content by mass of all the substances in the container that are mentioned in section 1 paragraph 2 with a content of more than 10% by mass….This information*

must appear in at least two official languages, be clearly legible and indelible…Any person who supplies a user with halogenated solvents in containers of more than 20 litres is responsible, if the user so requires, for taking back these solvents with the impurities and other additives arising from their use, or for arranging for them to be accepted by a third party".

Further requirements are in place with regard to the mixing of halogenated solvent waste and the recycling of halogenated solvents.

B27. THE UNITED KINGDOM

B27.1 Current Situation

Very limited information has been submitted by the UK authorities; this information does not include any information on the UK market.

A past study by RPA (2002), suggests industrial applications of DCM-based paint strippers in the UK include the automotive, furniture/wood, plastic, electronic and rubber product industries. Industrial stripping takes place either by immersion in a DCM-bath, or by spraying the surface with paint stripper.

It is reported that 50% of paint strippers in the UK are used for hand-stripping (DIY and professional applications), with the other 50% being used for industrial applications. A total of between 7,000 to 8,000 tonnes of DCM were used in the UK in the late 1990s, corresponding to 11,250 tonnes of paint stripper. About half of the volume was reported in the past to be sold in pack sizes of 1 litre or less, generally considered for consumer use (TNO, 1999).

Some up to date information has been collected from two major UK DIY retail chains. This is summarised in Table B27.1 below.

Table B27.1: Information on the Use of DCM-based Paint Strippers in the DIY Sector (responses from two DIY retailers)

Applications for DCM-based paint strippers	▪ Company A: amateur and trade paint removal ▪ Company B: removal of surface coatings (paints & varnishes) from walls, doors, timberwork, furniture, painted steel & iron
Estimated number of users (consumers) of DCM-based paint strippers	▪ Company A: 300,000 – 400,000
Annual tonnage of DCM-based paint strippers used by consumers in the UK	▪ Company A: up to 500,000 litres of stripper, containing up to 400,000 litres of DCM
Trends in consumption of DCM-based paint strippers over the last 5 years	▪ Company A: 2002 and 2003 were years with high usage, with a decline during 2004-2006. ▪ Company B: slight increase in DIY sector
Number of DCM-based products (trade names) in the market	▪ Company A: 5 products ▪ Company B: 6 products
Source: Consultation	

Table B27.2 shows the available information for the supply chains of DCM-based paint stripper manufacturers in the UK.

Table B27.2: Structure of Supply Chains for DCM-based Paint Stripper Manufacturers in the UK				
Company	**Size**	**No. of direct customers**	**No. of suppliers**	**Type of customers**
Company A	SME	100 aerospace, automotive & general industrial companies	20 suppliers of ingredients	"*We sell mainly directly to our customers, with only a small volume being sold via distributors (< 10%)*"
Company B		180 companies involved in professional uses, and irregularly to several hundred other companies involved in professional uses and hundreds of private users with single requirements	22 suppliers	
Company C	SME	3 major retail chains, more than 100 stores each		"*We supply companies predominantly in the professional & DIY sector, though a small number of industrial clients also use this product. Industrial users include metal re-finishing workshops. Professional users are involved in building contracts work, removing old paint & graffiti from buildings and structures. These are often small companies employing fewer than 5 people and are capable of using all types of paint removal formulations, methods & technologies. Consumer users are supplied via retail outlets and we supply at least 3 major chains with nationwide distribution across over 100 stores. DCM-based paint remover is also exported to countries in the Middle-East, for car paint work re-finishing. Several countries in Europe, particularly those around the eastern Mediterranean also take small volumes of these products*."
Company D		Products sold to distributors and DIY retailers		
Company E	SME	Direct sales to maintenance companies, airlines and the military		
Source: Consultation				

B27.2 Composition of DCM-based Paint Strippers

Table B27.3 outlines the available information on the compositions of products manufactured by companies that have responded to the RPA questionnaire plus the composition from the Safety Data Sheets of which we obtained (mainly from companies and only one from the manufacturers Internet site). A total of seven products are presented in the table.

Table B27.3: Composition of DCM-based Paint Strippers that Contain Vapour Retardants in the United Kingdom (confidential information)

Component	CAS Number	Percentage in formulation						
		A	B	C	D	E	F	G
DCM	75-09-2	✓	40-80	80-90	90	✓	70-90	60-100
Thickener	Various	<5						
Paraffin wax	8002-74-2	<5	✓	<2	Kerawax 2387			
Water		Up to 20	✓					
Oil	8042-47-5	Up to 30						
Industrial methylated spirits			✓	<3				
Hydroxy propyl methyl cellulose				<2	✓			
Pure Turpentine Oil				<2				
White Spirit	64742-82-1			<3				1-5
Methanol	67-56-1			<7	✓		1-10	5-10
Corrosion inhibitor				<0.5				
Surfactant					✓		1-10 (non-ionic)	
Ammonia						<10		
Sodium nitrite	7632-00-0						<1%	
1,2,4-trimethylbenzene	95-63-6						1-10%	
Low boiling point naphtha - unspecified - solvent naphtha (petroleum), Light aromatic	64742-95-6						1-10%	
Mesitylene	108-67-8						<1%	

Source: Consultation
*For Company B: **In the last 5 years,** industrial methylated spirits have replaced methanol as it is considered a less flammable and less hazardous substance*

A single UK company indicated that it manufactures non-vapour retarded formulations for industrial use. Information provided on the composition is unclear (as it appears to include a small percentage of paraffin wax).

B27.3 Container Issues

Six manufacturers of DCM-based paint strippers have provided information on the size of the containers they use for their products. The results are provided in Table B27.4.

Table B27.4: Available Size and Popularity of Container Size in the UK (Data from Manufacturers of DCM-based Paint Strippers – all sizes in litres)

		Company					
		1	**2**	**3**	**4**	**5**	**6**
Available sizes	**Industrial uses**	4x5, 25, 200 & 1,000		5, 25, 200			25, 200
	Professional uses		5, 25	5, 25	0.5, 1, 2.5, 5	0.5, 1, 2.5, 5	
	Consumer uses		5, 25	0.5, 1	0.5, 1, 2.5, 5	0.25, 0.5, 1, 2.5, 5	
Most 'popular' size	**Industrial uses**	25		25			25
	Professional uses		5, 25	5	0.5	5	
	Consumer uses		5, 25	1	0.5	1, 2.5	

Source: Consultation

It appears that for industrial uses, the most 'popular' size is 25 litres. For professional uses, 5 litres is the most popular size, while for consumer uses, there is a mixed picture. Two key DIY retailers suggest that the most widely used size is either 1L or 0.5L. This is in agreement with the ETVAREAD report which shows that 0.5L containers accounted for 45% of the paint stripper units sold in the UK in 2003 while 1L containers accounted for 32% (the total number of units sold at the time were 1.65 million).

Finally, child-resistant closures to containers are mandatory and can be found in all products available in retail stores as suggested by two key DIY store chains in accordance with existing EU and national regulations.

B27.4 Market Research by the UK-Irish Formulators

A group of UK and Irish producers devised a questionnaire to consult with paint removal companies in the UK and Ireland with the objectives of ascertaining:

1. what drivers were important in selecting a stripping product; and
2. user views on the various formulations on the market.

Over 200 companies were selected from the 'Yellow Pages' & Trade Directories throughout the UK and Ireland. These were contacted by letter. Over 50 responses were analysed before the November 2005 Forum in Brussels and a summary of the results were presented there. During consultation for this study, we have received additional completed questionnaires from representatives of the formulators' group, in total 106 of

them (more than double the number summarised and presented at the Forum). A summary of the results by question is presented below.

It should be noted that while the respondents are regarded as "professional users", some of the work they undertake (for instance, tank dipping and removal of paint in workshops) falls under the industrial use category for the purposes of this report.

Question 1. *Which paint stripping products do you use for different types of work? Indicate the types of products that have successfully been used to remove the coatings typically found on the following surfaces*.

Table B27.5: Types of Paint Removal Products used by a Sample of UK and Irish Users

Type of substrate	Number of respondents per paint removal product category				Percentage of all respondents (n = 106) per paint removal product category			
	DCM	Caustic	'Safer'	Mecha-nical	DCM	Caustic	'Safer'	Mecha-nical
Int. wood	35	24	19	37	33%	23%	18%	**35%**
Ext.wood	28	21	13	44	26%	20%	12%	**42%**
Int. walls	6	7	10	16	6%	7%	9%	**15%**
Ext. walls	17	9	6	29	16%	8%	6%	**27%**
Brickwork	27	16	11	27	**25%**	15%	10%	**25%**
Stonework	24	17	8	21	**23%**	16%	8%	20%
Furniture (wood)	21	14	12	8	**20%**	13%	11%	8%
Steelwork	15	7	4	21	14%	7%	4%	**20%**
Alum	8	1	2	11	8%	1%	2%	**10%**
Vehicle	11	1	0	3	**10%**	1%	0%	3%
Wood flooring	9	2	5	21	8%	2%	5%	**20%**
Concrete	9	2	5	15	8%	2%	5%	**14%**
Gasso/plaster	6	4	4	11	6%	4%	4%	**10%**
Vinyl/synth	3	1	2	4	3%	1%	2%	**4%**
Marine	6	2	1	8	6%	2%	1%	**8%**

Source: Consultation with UK/Irish formulators

The figures in bold in the table above show the greatest percentages for each type of substrate/work piece. The table shows that for the majority of substrates, more companies (out of the 106 respondents) use mechanical stripping than use solvent-based paint strippers. Exceptions to this include, stripping operations for brickwork (DCM-based paint strippers are used by as many as mechanical stripping), stonework, furniture (wood) and vehicle refinishing. It should be noted, however, that because one company uses a particular method of stripping, this may not necessarily mean that this is the main method used overall in the company's operations. The term 'safer' was used by the UK/Irish formulators to describe the following: *"SAFER" lower hazard, solvent strippers (non-methylene chloride) products*".

Question 2. *Give your best estimate as to the percentage of your total paint stripper usage for each of the paint removal product categories*.

Table B27.6: Percentage of Different Paint Removal Types used by a Sample of UK and Irish Users				
	Type of product			
	DCM	Caustic	'Safer'	Mechanical
Number of respondents (out of 106)	60	45	34	64
Average percentage of total paint stripper usage among respondents	57%	36%	26%	48%
Source: Consultation with UK/Irish formulators				

The table above confirms that mechanical stripping seems to be marginally more widely used by UK and Irish users. However, among those responding on the affirmative for each type of product, DCM-based paint strippers are more extensively used, i.e. if a company uses DCM-based paint strippers, it is more likely that these products will be the only ones or the most prominent in their portfolio. The numbers of companies that use only one type of paint stripper are:

- **ten** companies use only DCM-based paint strippers;
- **three** companies use only caustic paint strippers;
- **one** company uses only DCM-free solvent-based paint strippers; and
- **four** companies use only mechanical paint stripping.

If each company is assigned to only one type of paint stripper (the one that the company mainly uses), then the following apply:

- **thirty-nine** companies mainly use DCM-base paint strippers;
- **thirteen** companies mainly use caustic paint strippers;
- **nine** companies mainly use DCM-free solvent-based paint strippers; and
- **thirty-two** companies mainly use mechanical paint stripping.

Note that a small number of companies may have two equally preferred paint stripping systems.

Question 3. *Please give your best estimate of the % of each of the following categories of work your company carries out*.

Table B27.7: Percentage of Types of Paint Removal Work undertaken by a Sample of UK and Irish Users					
Type of product	**Transportable components in dipping process**	**Exterior facades, masonry & metalwork**	**Internal walls, floors, structural steel**	**In-situ timber doors, frames and other woodwork**	**Furniture and antique restoration**
Number of respondents (out of 106)	15	63	54	72	24
Percentage of respondents among all companies (n = 106)	14%	59%	51%	68%	23%
Source: Consultation with UK/Irish formulators					

If each company is assigned to only one type of removal work (the one that the company mainly focuses on), then the following apply:

- **nine** companies focus on stripping by dipping;
- **thirty-six** companies focus on stripping of exterior facades, masonry and metalwork;
- **eleven** companies focus on stripping of internal walls, floors and structural steel;
- **forty-seven** companies focus on in-situ stripping timber doors, frames and other woodwork; and
- **thirteen** companies focus on furniture and antique restoration.

Note that a small number of companies are equally focused on more than one type of paint stripping work.

Question 4. *When selecting a paint stripping product, please indicate using the following "1 (not relevant) – 2 (preferred) – 3 (essential)" scale the degree of importance each of the following properties merits when making your choice*.

Table B27.8: Most Important Properties of a Paint Stripping System for a Sample of UK and Irish Users					
Property	**Number of respondents**	**Number of companies per response**			**Average score (1 to 3)**
		'1'	**'2'**	**'3'**	
Achieves a clean base substrate within a single working session	95	3	50	41	**2.40**
Avoids high volume use by lifting multiple layers (>10) in less than 3 coats	93	7	42	43	2.39
Allows work without using respiratory protective equipment or forced ventilation	95	8	50	36	2.30
Is effective on ALL types of coating within a single property	94	16	57	21	2.05
Does not cause any damage to, or leave any residues in the substrate	95	5	30	60	**2.58**
Presents no risk of inhalation hazard to the applicator or the occupants of the property	94	7	37	50	**2.46**
Has no risk of a skin contact hazard to the applicator or the occupants of the property	96	8	55	32	2.25
Achieves the task without the treated area being sealed off whilst unattended	95	12	52	31	2.20
The paint stripper must be the lowest priced regardless of properties	94	63	25	6	***1.39***
Source: Consultation with UK/Irish formulators					

It appears that, according to this sample of users, the most important properties of a paint stripping system are:

1. the lack of adverse effects on the integrity and appearance of the substrate;
2. the 'lack of risk' to the occupants of the property in question; and
3. the ability to give a clean substrate within a single working session.

Of interest is the fact that the one property that clearly stands out as the least relevant is the cost of the paint stripping system.

Questions 5 & 6. *Which type of paint remover do you prefer due to its success in the broadest range of applications? Which 'safer' solvent-based alternatives have you used as part of a paint removal project?*

Out of 92 respondents, the vast majority prefer DCM-based paint strippers to any other paint stripping method. The numbers of companies that have actually used alternative solvent-based paint strippers are:

- water-based DBE products: 5 companies;
- DMSO-based products (plus formic acid): 37 companies:
- NMP-based products: 14 companies;
- benzyl alcohol-based products: 5 companies;
- other products: 9 companies.

Also, 27 companies appear to have tried using sodium hydroxide-based products.

The results show that users tend to trust the products they know well and do not generally try using alternatives. Only two respondents have tried three or more alternative products. Interestingly, the most widely trialled product is based on DMSO, rather than NMP, which has been suggested as being the leading alternative.

Question 7. *If dichloromethane paint removers were no longer available to use, would the alternatives be effective enough to meet all challenges faced in coatings removal?*

When asked whether alternatives to DCM-based products would be effective enough to remove coatings, 48% of respondents suggested that the alternatives would not effectively replace DCM-based products. 16% of respondents provided no answer and 6% could not provide a 'Yes or No' answer. 30% believed that the alternatives would effectively replace DCM-based products. Notably, the summary presented at the November 2005 Forum in Brussels was markedly different; in the information presented at the Forum at the time, only 10% of respondents agreed that the currently available alternatives would effectively replace DCM-based products. In summary, there is limited (but not insignificant) confidence in the coatings removal trade that the available alternatives are able to perform to the standard provided by dichloromethane..

ANNEX C:

SUMMARY OF THE AVAILABLE STUDIES ON DICHLOROMETHANE CONDUCTED FOR THE EUROPEAN COMMISSION

C1. THE TNO REPORT "METHYLENE CHLORIDE: ADVANTAGES AND DRAWBACKS OF POSSIBLE MARKET RESTRICTIONS IN THE EU"

C1.1 Results of the Risk Characterisation of DCM

The TNO report (1999) analysed the risks of exposure to DCM and discussed the selection of several priority applications for reducing the risks associated with DCM through enabling restrictions on marketing and use. An analysis of the socio-economic consequences of such restrictions on the marketing and use was also included.

Table C1.1 summarises the basis for the toxicological evaluation of the exposure to DCM that was used in the TNO report.

Table C1.1: Criteria for Toxicological Evaluation of Exposure to DCM in the TNO Report (1999)

Population	Short-term	Long-term
General public		
• Inhalation	700 mg/m^3 (LOAEL, humans; 1-few hours)*	125-700 mg/m^3 ** (NOAEL, liver toxicity, rat)
• Ingestion	N/A	6 mg/kg bw/day (NOAEL, liver toxicity, rat)
Workers (occupational exposure)	250-2,500 mg/m^3 (15-min STEL)[c]	120-350 mg/m^3 (8-hr TWA in EU countries)***

Source: TNO, 1999

Notes from the TNO report:

** Based on protection against mild, reversible CNS-effects. The traditional safety factor approach would require a margin of safety of 100 for correction for the use of a LOAEL rather than a NOAEL and to include intraspecies variation. This would result in a standard of 7 mg/m^3. For shorter time frames (e.g. 15 minutes), a factor 4 to 10 higher might be justified.*

*** The traditional safety factor approach would require a margin of safety of 100 for interspecies and intraspecies extrapolation, resulting in standards of 60 µg/kg bw/day for oral intake and 1.25-7.0 mg/m^3 for inhalation. The last-mentioned value is well in line with the Air Quality Guideline of 3 mg/m^3 derived by the WHO based on a maximum increase in COHb levels of 0.1 % in the general population by indirect exposure to DCM.*

**** Range of occupational health standards in different countries. In most cases based on a maximum increase of 5 % in COHb levels.*

The criteria used for the risk characterisation were as follows (TNO, 1999):

- short-term exposure of workers (industrial and professional uses):
  - Conclusion (i)[1]: between 250 mg/m^3 (lowest STEL in EU member states) and 700 mg/m^3 (LOAEL for short-term exposure);

[1] In accordance with the relevant Technical Guidance Document, the three different conclusions of a risk assessment may be: **Conclusion (i)**: "*There is a need for further information and/or testing*"; **Conclusion (ii)**: "*There is at present no need for further information and/or testing and for risk reduction measures beyond those which are being applied already*"; or **Conclusion (iii)**: "*There is a need for limiting the risks; risk reduction measures which are already being applied shall be taken into account*".

  - Conclusion (ii): below 250 mg/m^3 (lowest STEL in EU member states);
  - Conclusion (iii): above 700 mg/m^3 (LOAEL for short-term exposure).

- long-term exposure of workers (industrial and professional):
  - Conclusion (i): between 120 mg/m^3 (lowest Occupational Exposure Limit (OEL) in EU member states (at the time); Margin of Safety (MOS) of a factor 4-5 with the NOAEL) and 350 mg/m^3 (highest OEL in EU member states, MOS of a factor of 2 with the NOAEL);
  - Conclusion (ii): below 120 mg/m^3 (lowest OEL in EU member states);
  - Conclusion (iii): above 350 mg/m^3 (highest OEL in EU member states; MOS of a factor of 2 with the NOAEL).

- short-term exposure of consumers/general public:
  - Conclusion (i): between 7 mg/m^3 (MOS of 100 with the LOAEL) and 250 mg/m^3 (lowest STEL in the EU for workers; MOS of 2-3 with the LOAEL);
  - Conclusion (ii): below 7 mg/m^3 (MOS > 100 with the LOAEL);
  - Conclusion (iii): above 250 mg/m^3 (lowest STEL in the EU for workers, MOS of 2-3 with the LOAEL).

- long-term exposure of consumers/general public:
  - Conclusion (ii): below 1.25-7 mg/m^3 (MOS of 100 with the NOAEL);
  - Conclusion (i) or (iii): above 7 mg/m^3, depending on MOS (irrelevant in practice).

The results of the risk characterisation in the TNO report are presented in Table C1.2.

Table C1.2: Risk Characterisation for Exposure to DCM in Paint Strippers in the TNO Report

Activity	Paint stripping by consumers and workers
Population exposed	Consumers/Professionals
Exposure level 8-hr TWA (mg/m^3)	***Consumers*** 460-2,980 (unventilated, 8 hr TWA) 60-400 (ventilated, 8hr TWA) ***Workers*** 350-420 (8-hr TWA average) 25-7,000 (8-hr TWA range)
Peak exposure (mg/m^3)	***Consumers*** Up to 14,100 (unventilated, worst case) 840-2,765 (1-hr TWA, unventilated) 129.5-948 (1-hr TWA, door open) 289 (2 hr average, well ventilated) ***Workers*** Up to 5,400
Evaluation	***Consumer application (unventilated)*** Unventilated consumer applications lead to exceeding even the regular 8 hr TWA occupational health standards. Short term exposure orders of magnitude higher than the derived short-term exposure standard for the general public.

Table C1.2: Risk Characterisation for Exposure to DCM in Paint Strippers in the TNO Report	
	Consumer application (ventilated) Even if ventilation is good, the short-term exposure seems appears to be at least a factor of 10-20 higher than the (stringent) short-term exposure standard for the general public of 7 mg/m^3. Even in well-ventilated situations, the lowest available short-term STEL for workers of 250 mg/m^3 may be exceeded. ***Professional/industrial application*** Long-term concentrations will in some cases exceed the 8 hr TWA limits. The average long-term exposure is within 8 hr TWA limit for workers. Peak concentrations will in some cases exceed the range of STELs for workers.
Overall risk characterisation	***Consumer application (unventilated)*** (iii) Risk reduction needed ***Consumer application (ventilated)*** (iii) Risk reduction needed/(i) more information needed ***Professional/industrial application*** (iii) Risk reduction needed/(i) more information needed
Source: TNO, 1999	

The TNO noted that "*as for consumer exposure, particularly the (unventilated) use of paint strippers by consumers may be most critical, since in such situations even the STELs for workers will be exceeded*".

C1.2 Review of the TNO Report by the CSTEE (2000)

The EU Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) evaluated the TNO report in 2000. Essentially, the risk calculations in the TNO report for various exposure situations associated with DCM manufacture and use were acceptable to the CSTEE (2000). However, the CSTEE noted that the report based its assessment of DCM hazards exclusively on non-cancer end-points, considering that DCM does not present a carcinogenic hazard to man. CSTEE found this conclusion is not justified and argued that, while accepting that any DCM-derived cancer risks for man may be very low, the available evidence does not exclude the possibility that DCM may be a human carcinogen. Other issues raised by the CSTEE were:

- there was no discussion of the genotoxicity of DCM;
- the use of a 10^{-4} lifetime cancer risk is presented as normal practice, whereas a 10-fold lower level of risk is generally considered as the minimum acceptable in most situations;
- dermal exposure is not considered; and
- environmental impacts, apart from spills, were not addressed.

Notably, adoption of a cancer based limit of exposure for the general population (e.g. 21 μg/ m^3 derived by the US EPA) would not change these conclusions, since the typical air concentrations are <2 μg/m^3 and <15 μg/m^3 for suburban and urban air respectively. As regards cancer risks from long-term exposure of workers, linear extrapolation from the above limit to the least stringent European TWA (350 mg/m^3) leads, after correction for exposure for 8 hours/day, 5 days/week, 44 weeks/year and 35 working years/life time, to a calculated cancer risk of about 1.5 x 10^{-2} (CSTEE, 2000).

C2. STUDY BY THE EXPERT TEAM FOR VAPOUR RETARDING ADDITIVES (ETVAREAD): "EFFECTIVENESS OF VAPOUR RETARDANTS IN REDUCING RISKS TO HUMAN HEALTH FROM PAINT STRIPPERS CONTAINING DICHLOROMETHANE"

C2.1 The Assessment of Risks from Vapour Retarded DCM-based Paint Strippers

The aim of the ETVAREAD study was to assess the risks to health related to the use of defined vapour retarded DCM-based paint strippers. The study team undertook measurements of air concentrations of DCM during the application of paint strippers on a 1m^2 chipboard surface inside a test room of the following dimensions: 2.5 x 2.5 x 2.4 m = 15 m^3. The aims were to assess:

- the effectiveness of different vapour retarded paint removers during:
  - application phase;
  - effecting time; and
  - scratch-off phase;
- the effectiveness of vapour retardation of paint removers applied on upright surfaces versus horizontal surfaces;
- the effect on DCM evaporation due to the application of paint removers to painted versus not painted chipboards (alkyd resin);
- the effect on DCM evaporation due to the application to different surface areas; and
- the influence of different ventilation conditions.

Table C2.1 presents the measurements of the concentration of DCM under different application conditions during consumer use.

Table C2.1: Exposure Levels under Different Application Conditions for Consumer Use (ETVAREAD Report)					
Application conditions	**Exposure level range (ppm)**		**Amount of stripper (ml)**	**Air exchange rate per hour**	**Ventilation conditions**
	From	**To**			
Worst case estimation	1,600	3,200	350	1	Windows and door closed
Test results (measured)	400	800	350	4	Insufficient through ventilation
Proper DIY use	160	320	350	10	Through ventilation
Proper DIY use, good ventilation	21	43	350	30	Good through ventilation
Worst case estimation	2,286	4,571	500	1	Windows and door closed
Test results (extrapolated to 500 ml)	571	1,143	500	4	Insufficient through ventilation
Proper DIY use	229	457	500	10	Through ventilation
Proper DIY use, good ventilation	76	152	500	30	Good through ventilation
Worst case estimation	4,571	9,143	1,000	1	Windows and door closed
Test results (extrapolated to 1000 ml)	1,143	2,286	1,000	4	Insufficient through ventilation
Proper DIY use	457	914	1,000	10	Through ventilation
Proper DIY use, good ventilation	152	305	1,000	30	Good through ventilation
Source: ETVAREAD, 2004					

Based on the LOAEL of 300 ppm (from ATSDR, 2000) and taking into account a margin of safety of 10 for the consideration of intraspecies variation and a margin of safety of 3 for the use of LOAEL instead of NOAEL, an acceptable level for acute exposure of 10 ppm results for consumers was calculated.

Table C2.2 presents the basis for risk characterisation for occupational (industrial/professional) uses and consumer uses in the ETVAREAD report.

<table>
<tr><td colspan="5">Table C2.2: Basis for Risk Characterisations in the ETVAREAD Report</td></tr>
<tr><td rowspan="3">Occupational</td><td colspan="2">Occupational Exposure Limits</td><td colspan="2">Exposure levels</td></tr>
<tr><td colspan="2">8h-TWAs: 35-100 ppm</td><td colspan="2" rowspan="2">21 to several thousand ppm</td></tr>
<tr><td colspan="2">15min STELs: 70-500 ppm</td></tr>
<tr><td rowspan="2">Consumers</td><td>Use conditions</td><td>Exposure assessment</td><td>Acceptable exposure</td><td>Conclusion</td></tr>
<tr><td>Open use (1000 ml), indoor, adequate to worst-case ventilation</td><td>152 to 9,143 ppm</td><td>10 ppm</td><td>Acceptable exposure in all cases exceeded
Adverse health effects and death in high exposures possible; risk reduction measures required</td></tr>
<tr><td colspan="5">Source: ETVAREAD, 2004</td></tr>
</table>

With regard to occupational exposure, ETVAREAD concluded that a risk related to the occupational use of DCM-based paint strippers cannot be ruled out and there is a need for risk reduction measures that ensure that all exposure levels are below established occupational exposure limits.

With regard to consumer exposure, ETVAREAD concluded that the acceptable exposure level is always exceeded; adverse health effects and under worst-case conditions even death cannot be ruled out. The authors argue that risk reduction measures are definitely required both to minimise exposure levels, and to reduce exposure of susceptible groups such as very young, elderly or infirm persons.

C2.2 Recommendations for Risk Management in the ETVAREAD Report

ETVAREAD assessed different risk management options and eventually recommended the following measures:

- ***industrial use***: paint removers in industrial installations that are covered by Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations are used in closed systems. Consequently there is no need to use vapour-retarded products.

  For the use of DCM-based paint strippers in industrial installations covered by the VOC Directive, there is no need for further regulation within the framework of Directive 76/769/EEC.

- ***professional use***: the project team recommended the following measures:

  - maximum weight loss 1.85%;
  - mandatory safety warnings and instructions on safe application conditions; and
  - prescription of appropriate equipment for the application.

- ***consumer use***: the project team recommended the following measures:

  - maximum weight loss 1.85%;
  - maximum volume of product containments 500 ml;
  - for liquid product containments that prevent unintentional spill (maximum spill 50%);
  - mandatory safety warnings and application conditions; and
  - prohibition of self-service sales and mandatory instructions from a qualified salesperson.

C2.3 The Evaluation of the ETVAREAD Report by SCHER

As SCHER (2005) notes, the most sensitive effect from short-term inhalation exposure seems to be on the CNS, and 193 ppm DCM in air gave neurobehavioral changes in humans after 1.5 to 3 hours. The SCHER did not see any reason to disregard this as the LOAEL in the risk characterisation, although ATSDR (2000) used a higher level (300 ppm) and this was also used in the ETVAREAD report. The report applied uncertainty factors of 10 for intraspecies variation and 3 for the conversion of a LOAEL to a NOAEL and concluded that 10 ppm is an acceptable level of DCM for acute exposure in air. The SCHER did not support the reduction of these uncertainty factors.

The concentrations measured in the exposure investigations by ETVAREAD were in the range 400 to 1,700 ppm. Those are all higher than the LOAELs discussed in the main text; therefore, the exposure to DCM during use of paint strippers based on this compound is of concern.

SCHER notes that the COHb formation was the basis for the recommendations from WHO Europe on air quality guidelines for ambient air (WHO, 1998). A maximum allowable increase of 0.1% in COHb from DCM led to a 24h guideline value of 3 mg/m^3 (0.84 ppm), and a weekly average of 0.45 mg/m^3 (0.13 ppm) (IMM, 1998). COHb formation seems to be the basis for most occupational threshold limit values for DCM.

In conclusion, SCHER (2005) noted that it is difficult to judge the influence of vapour retardants as the composition of the tested products is not given and the uncertainty in the measurements is not properly determined. It is also difficult to translate the laboratory results to real life situations as a rather high air exchange rate under optimal conditions was used, although the measured DCM concentrations seem to agree well with results from other studies referenced in the report. A shortcoming in the exposure assessment is that the dermal absorption has not been accounted for.

Neurobehavioral changes have been reported in humans after acute exposure to 193 and 300 ppm DCM in air. These values were exceeded in all experimental studies described in the report, and it is obvious that the exposure to DCM released from paint removers is of concern (SCHER, 2005).

SCHER argues that the most critical parameter influencing the exposure to DCM from paint strippers is the ventilation rate, and in practise it may be very difficult to obtain sufficient ventilation during winter in a basement room with small windows and no low ventilation ducts. In addition, there are data on unacceptable levels for outdoor use as well.

Finally, the unacceptably high concentrations of DCM measured in air in the ETVAREAD study were obtained using 350 ml paint remover on a $1m^2$ surface. Larger volumes and/or larger areas will give even higher exposure (SCHER, 2005).

ANNEX D:

DATA ON MEASURED EXPOSURE LEVELS AND ASSESSMENT OF THE IMPACT OF VAPOUR RETARDANTS ON EXPOSURE

D1. INTRODUCTION

The paragraphs below present an overview of measurements of exposure levels for DCM when paint strippers are used. This should not be considered as a comprehensive collection of exposure data but simply provides an indication of concentration levels during the use of DCM-based paint strippers.

D2. INFORMATION ON EXPOSURE LEVELS

D2.1 Exposure Data from Finland

The Finnish National Product Control Agency for Welfare and Health (2006) provided RPA with information from a survey by the Finnish Institute of Occupational Health which collected measurements during 1994-2003 in the medical industry, metal treatment industry and paint stripping. It found that 4% of the measurements taken exceeded the Finnish 8-hour concentration in air known to be hazardous (HTP-value) e.g. 350 mg/m^3.

D2.2 Exposure Data from France

A study on CMR products evaluated the number of persons (professionals) exposed to DCM at around 40,000. Between 2000 and 2006, 1,452 industrial atmospheric measurements have been recorded in the SOLVEX database (French Ministry of Labour, 2006a):

- on 60 measurements undertaken in less than 15 minutes period: 30% were above the 15-min STEL of 100 ppm; and
- on 1,088 measures done during 60 to 480 minutes period: 11.1% were above the 8h-TWA of 50 ppm.

D2.3 Exposure Data from Germany

Information on measurements of airborne DCM concentrations during paint stripping operations was submitted during this study by the German Insurance Industry (Berufsgenossenschaft der Bauwirtschaft, 2006b). The data are reproduced as Tables D2.1 and D2.2. The detail presented in Table D2.2 has been taken from the Annexes of the EVAREAD report (2004).

The measurements presented below suggests that the maximum concentrations as well as the mean concentrations may be much higher than the national OELs for DCM that are currently in force in a number of Member States.

Table D2.1: Exposure to DCM (mg/m^3) during Paint Stripping in Germany

	Number of measurements	Mean	95th percentile*	Minimum	Maximum
Paint stripping indoors, area >0.5 m^2	62*	1,373	2,457	294	3,035
Paint stripping outside	37**	524	1,339	158	2,275

Source: Rühl et al, 2004
*Note: * during 19 of 60 measurements the measuring range was exceeded, therefore the statistical values were restricted to 41 measurements*
*** the BASF measurements in Table D2.2*

D2.4 Exposure Data from the UK

The ETVAREAD report (2004) presented the results of measurements that were undertaken in the UK with the initiative of the UK industry and UK local authorities. These are reproduced here in Tables D2.3 and D2.4.

Importantly, these UK measurements appear to show exposure concentrations much lower than those reported in Germany (see above) and elsewhere. The few measurements that exceed the highest national OELs are shown in bold.

D2.5 Other Exposure Data from Member States

Rühl *et al* (2004) also provide an overview of measurements available on national databases in France, Norway and Finland. These are reproduced in Table D2.5 and show that some of these measurements are substantially high.

D2.6 Information from Industry Consultees

We have received information on the measurements of airborne DCM concentrations in a UK furniture (and metal) stripping firm in the early 1990s. The measurements were undertaken in six locations around the country by HSE and produced results that exceeded the limits in force at the time A report on the results were presented in the October 1993 issue of the Safety Management magazine of the British Safety Council.

These high levels were recorded despite the main site having fume extraction fans and the use a DCM-based stripper with vapour retardants. The owner of the stripping firm has suggested that the highest level of DCM fumes was in fact recorded not at the bath location (which was indeed over the limit) but at the wash-off area, reception area, and the back of the company's commercial vehicles

Table D2.2: BASF Measurements during Outdoor Paint Stripping in Germany					
Description/Source/Note	**Measurement time (min)**	**Mean (ppm)**	**Description/Source/Note**	**Measurement time (min)**	**Mean (ppm)**
BASF 1997, part 1, housing estate Paint Stripper: Settaquick, Fa VFG GmbH Hilden, 96% DCM			BASF 1997, part 2, Danube barrage Paint Stripper: Abbeizer mit der Krähe, Fa Hohmann, 93% DCM		
Sample number 1; stationary	115	452	Sample number 23, obere Kante; stationary	295	222
Sample number 2; stationary	115	240	Sample number 24, untere Bearbeitungsbühne; stationary	200	108
Sample number 3, personal	115	198	1; personal	115	169
Sample number 4; stationary	110	186	2; personal	115	528
Sample number 5; stationary	110	452	3; personal	115	1222
Sample number 6; personal; application 4 to 5 times	110	424	4; personal	115	389
Sample number 7; application	3	400	5; personal	115	217
Sample number 7; application	3	600	8; personal	115	306
Sample number 7; application	3	300	6; personal	115	694
Sample number 7; application	3	350	7; personal	115	500
Sample number 7; application	3	500	9; personal	120	389
Sample number 7; scratch off	3	150	10; personal	120	500
Sample number 7; application	3	400	11; personal	120	472
Sample number 7; application	3	400	12; personal	120	164
Sample number 7; application	3	800	13; personal	120	267
Sample number 7; application	3	850	14; personal	120	219
Sample number 7; scratch off	3	150	15; personal	120	417
			16; personal	120	158
			17; personal	120	556
			18; personal	120	278
			19; personal	120	181
			20; personal	120	528
			21; personal	120	361
			22; personal	120	244
			27 short period (3 min) measurements	3	100 – 1,900
Source: ETVAREAD, 2004					

Table D2.3: UK Industry and UK Local Authorities Measurements of DCM Exposure							
Description/Source/Note	**Mean mg/m^3**	**Min mg/m^3**	**Max mg/m^3**	**Description/Source/Note**	**Mean mg/m^3**	**Min mg/m^3**	**Max mg/m^3**
Case study 1: paint stripping of an article; double doors two meters from the work piece				Case study 3: paint stripping of 2nd and 3rd Floor stairway walls of a 6 floor building; Two local exhaust ventilation machines			
1 m down wind; application	247		459	Operator personal breathing zone during application (brush on the wall and stripping = scrape off)	86		
1 m up wind; application	35			Static during stripping	58		
Head height operator; application	247			Static, whole process	80		
Head height operator; scrapping off	**707**			Static background, 6th floor during final 50 minutes	8		
1 m down wind; scrapping off	177		1,413				
wood surface after stripping off	530						
Case study 2: On site paint stripping at a block of flats; tented sheeting used to protect work in progress; personal monitoring tubes, 3 static positions				Case study 4: stripping of textured coating from a ceiling; brush application 28 minutes; stripping 11 minutes; Three stage airlock at the door; all windows sheeted; one extractor unit machine for ventilation Personal monitoring operator during application and stripping 226	**710**		
Inside tent, static position 1	106						
Inside tent, static position 2	226						
Inside tent, static position 3	**357**						
Outside tent; worn by supervisor	21						
Inside tent, worn by 1st operator	208						
Inside tent, worn by 2nd operator	318						
Source: ETVAREAD, 2004							

Table D2.4: INEOS Chlor Ltd: DCM Paint Stripping Atmospheric Monitoring; during Professional Paint Removal from an External Façade (measurement April 2004)							
Description/Source/Note: INEOS Chlor, external facade, April 2003	**Mean mg/m³**	**Min mg/m³**	**Max mg/m³**	**Description/Source/Note: INEOS Chlor, external facade, April 2003**	**Mean mg/m³**	**Min mg/m³**	**Max mg/m³**
Paint removal section A (unsheathed)				***Paint removal section B (sheeted)***			
Application Product 1 (brushing) 22 minutes	122*	0	~400	Application Product 1 (brushing) 17 minutes	181*		~510
Effection time ~ 15 minutes		0	~10	Effection time ~ 29 minutes			~45
Removal time ~ 13 minutes scraping	44*	0	~105	Removal time 5 minutes + 5 minutes resting vacuum hot water wash device	101*		~250
Removal time ~ 56 minutes hosing	49*	0	~100	Removal time 16 minutes hosing			~330
Application product 2 ~20 minutes	73*		~130	Removal time 15 minutes scraping	169*		~280
Effection ~ 30 minutes				Resting time 59 minutes			~20
Removal ~ 110 minutes hosing	20*			Application P2 19 minutes brushing	64*		~110
Personal Monitor Operator TWA	34			Effection P2 31 minutes brushing			
Personal Monitor Assistant TWA	7			Removal P2 26 minutes hosing	121*		~240
Personal Monitor Analyst 1 TWA	8			Personal Monitor Operator TWA	31		
Personal Monitor Analyst 2 TWA	5			Personal Monitor Assistant TWA	5		
Application Product 1 (brushing) 22 minutes	122*	0	~400	Personal Monitor Analyst 1 TWA	22		
Source: ETVAREAD, 2004 *Notes: * 15-min TWA* *Product 1: paint remover, 82% DCM, Evaporation rate 1.05%, 25 l (1.5 per m²)* *Product 2: pigment residue remover, 53% DCM, Evaporation rate 0.43%, 37 l (2.2 per m²)* *Application: brushing, decanting from a ~ 15 l containment into working bucket ~ 2 l for application* *Stripping: hosing with high pressure hot water (80°C); scratching off at a small area of Section A*							

Table D2.5: Exposure Levels Measured in European Countries (National Databases)

France (COLCHIC-Database), measuring period: 1 to 8 h

Task	Year	Number of values	Range (mg/m^3)	Geometric mean (mg/m^3)	Median (mg/m^3)	Arithmetic mean (mg/m^3)	95th percentile (mg/m^3)
Stripping operations	1998 to 2002	122	0.25 to 2,723	17.2	17.5	163.35	956

Norway (EXPO-Database), 8-h TWA

Task	Activity	Year	Values (mg/m^3)
Stripping aeroplane, outside	Paint removing, cleaning	2002	3,802 (pers.)
Aeroplane maintenance, varnish removing, washing	Paint removing, cleaning	2001	2,319; 1,444 (pers.)
Rough washing of aeroplane parts	Degreasing, cleaning	2003	265; 236.5; 155; 85 (stat.)
Fine washing of aeroplane parts, outside	Degreasing, cleaning	2003	11 (stat.)

Finland (FIOH-Database), 8-h TWA

Task	Year	Values (mg/m^3)
Paint stripping outside the respiratory protective device	1997 1998	285; 428
Paint stripping inside the respiratory protective device	1997 1998	5; 2.2
Cleaning of paint containers	1994 to 1998	7; 7; 8
Glue stripping outside the respiratory protective device	1998	22
General air in corridor	1998	144

Source: Rühl et al, 2004
Notes: pers.: personal sampling; stat.: stationary sampling

A report prepared by health and safety consultants in 1993 on behalf of the company was made available to RPA. The report notes the following (Harper & Deane, 1993):

"*Some measurements have been carried out below the lid of the DCM tank in the free air space above the liquid and found concentrations of DCM in the range 14,000-20,000 ppm and about 4,000 ppm toluene. On at least one occasion lip exhaust ventilation was fitted to the stripping tank but this did not significantly reduce the hazards of employee exposure to DCM and the operator was successfully prosecuted under the Health and Safety at Work Act 1974. Excessive exposure to DCM may occur especially during:*

- *loading and removing furniture into and from the tank;*
- *paint removal; and*
- *tank cleaning*".

The company is not trading any more (although some of the sites referred to above may still be stripping furniture using DCM-based paint strippers) and the owner is now trading in alternative paint strippers.

D2.7 Information from the TNO Report

TNO (1999) reported several exposure level measurements for consumer, professional, and industrial use as follows:

D2.7.1 Direct Exposure – Consumer Use

- US EPA (1990) has estimated the consumer exposure based on an investigation of household solvent products. Estimated exposure levels ranged from **35 mg/m^3** to a few short-term exposures of **over 14,100 mg/m^3**. The majority of the concentrations were **below 1,770 mg/m^3**.

- ICI, a solvent producer, performed a test series on a number of paint stripper formulations used under varying conditions in a small room. In one test with through ventilation, a 2-h TWA exposure of **289 mg/m^3** were measured. Peak exposure occurred during application (**460 mg/m^3**) and during scrap-off (between **710-1,410 mg/m^3**, and never above **3,530 mg/m^3**). With no ventilation, worst-case exposure could reach **over 14,000 mg/m^3**, under which concentrations the work of an average DIY consumer would be impeded. Good ventilation, as recommended by the suppliers, would result in an 8-h TWA of **187-226 mg/m^3** (personal communication of ICI, as reported in IPCS, 1996).

- UK HSE (1998) refers to authors who found one-hour TWAs of **840-2,765 mg/m^3** (240 to 790 ppm) in an unventilated room and **129.5-948 mg/m^3** (37 to 270 ppm) with the door open. If this exposure were recalculated to 8-h TWAs, this would result in the somewhat lower values as reported by ICI.

- Slooff & Ros (1988) refer to Otson *et al* (1981), who give much higher figures for 8-h TWAs: **460- 2,980 mg/m^3** in unventilated rooms and **60-400 mg/m^3** in ventilated rooms.

D2.7.2 Direct Exposure – Professional Use

TNO believes that there is probably no fundamental difference between the application of paint removers by professional painters and consumers. Hence, the test situations and data described above were assumed valid for occupational exposure during professional use as well.

D2.7.3 Direct Exposure – Industrial Use

- US EPA (1990) showed a range for an 8-h TWA from **18 mg/m^3** to **1,770 mg/m^3** or more (IPCS, 1996).

- The UK HSE (1998) report on immersion stripping of wood reported higher values for the period between 1980 and 1994 (8-h TWAs ranging from **38.5 to 7,000 mg/m^3**, with about 700 mg/m^3 as a mean value), but somewhat lower values for the period between 1990 and 1994 (**35 to about 2,100 mg/m^3**, with an average of **350 to 420 mg/m^3**). The last-mentioned values may reflect improved health and safety measures. Yet, UK HSE advises caution with these results, as there were a low number of samples. Exposure in the lower range is feasible when protection measures such as LEV[1] are applied; without LEV and/or under poor ventilation conditions this can be a factor 4 or more. Also for immersion stripping of metal objects, exposure can be held **below 100 ppm** (or 350 mg/m^3) if appropriate protection measures are implemented. Paint removal from aircraft involves a spray process, leading to an exposure of **29 to 95 ppm** 8-h TWA (**mean 62 ppm or 210 mg/m^3**). Peak levels could be up to **1,600 ppm** or **5,400mg/m^3** (UK HSE, 1998).

- In the paint stripping industry for furniture without adequate control measures, exposure levels found were **between 258 and 3,812 mg/m^3** (US EPA, 1990).

D2.8 Information from Other Literature

Some additional monitoring data have been collected from NTP (2005) and OEHHA (2000) and are summarised in Table C4.6 below.

Table D2.6: Measured Exposure Levels from other Sources

Description/Source/Note	Mean	Min	Max
NTP (2005): NIOSH data for 1973-1974			
• servicing diesel engines	11 ppm		
• cleaning foam heads		3 ppm	29 ppm
• cleaning nozzles in plastics manufacture		5 ppm	37 ppm
OEHHA (2000): Anttila *et al*, 1993 A survey of occupational carcinogens by the Institute of Occupational Health, Finland: among the 17,118 registered workers about 2,000 workers in paint removal or pharmaceutical industries were exposed to DCM (TWA)	10 mg/m^3		
OEHHA (2000): Vincent *et al*, 1994 Aeronautical workshop, paint stripping off Boeing B747 in France; 8h-TWA		83 ppm	525 ppm
OEHHA (2000): Estill & Spencer, 1996			
Furniture stripping		600 ppm	1,500 ppm
After installation of ventilation	30 ppm		
Source: NTP, 2005 and OEHHA, 2000			

[1] This LEV is either a slot extraction at the rear of the immersion bath, or one or two axial fans on the wall a the rear of the tank.

Anundi *et al* (1993) studied the exposure to organic solvents among 12 graffiti removers in Sweden. Health effects were also assessed by structured interview and a symptom questionnaire. The concentrations of DCM, glycol ethers, trimethylbenzenes and NMP in the breathing zone of each worker were measured during one working day. The 8-TWA exposure to DCM ranged from 18 to 1,200 mg/m^3. Notably, the air concentrations of glycol ethers, trimethylbenzenes and NMP were low or not detectable. Anundi *et al* also asserted that the public is also exposed as the job is performed during daytime in underground stations. At least for short periods, bystanders may be exposed to high concentrations of organic solvent vapours. People with predisposing conditions, e.g. asthmatics, may risk adverse reactions.

The exposure of workers to DCM and phenol in an aeronautical workshop was measured by Vincent *et al* (1994) during stripping of paint from a Boeing B747. DCM exposure was measured during two work days by personal air sampling, while area sampling was used for phenol. During paint stripping operations, DCM air concentrations ranged from 299.2 mg/m^3 (83.1 ppm) to 1,888.9 mg/m^3 (524.7 ppm). The exposures to methylene chloride calculated for an 8-h work day ranged from 86 mg/m^3 (23.9 ppm) to 1,239.5 mg/m^3 (344.3 ppm).

Environmental and personal air monitoring conducted in the US State of Rhode Island have shown that automotive repair technicians may be exposed to metal particulates in sanding dust and DCM vapours during vehicle paint removal operations (Enander *et al*, 2004). Hand wipe samples demonstrated that metals in sanding dust adhered to the hands of workers throughout the duration of the workday and were available for incidental ingestion from the handling of food/non-food items and hand-to-mouth contact. DCM exposures were found to exceed the Occupational Safety and Health Administration's (OSHA) 8-hr TWA action level and permissible exposure limit (PEL) in a limited number of samples (120 and 26 ppm, integrated work shift samples).

D3. USE OF VAPOUR RETARDANTS IN DCM-BASED PAINT STRIPPERS

D3.1 Background to Vapour Retardants for Paint Strippers

Paraffin waxes are added to DCM-based formulations to counteract DCM's tendency to evaporate before the stripper has time to penetrate the (final) coat. Euro Chlor (2003) confirms that formulators of DCM have developed vapour-retarded products, to restrict the evaporation of solvent during paint stripping.

The responses submitted to the RPA questionnaire by manufacturers of DCM-based paint strippers giving the reasons for the introduction of vapour retardants in DCM-based paint stripping formulations are summarised in the box below.

Question: What has been the reason for developing these products (legislative requirements, innovation, desire to expand to new markets, pressure from competition, other)?	- *"Primarily part of the specification that product was designed around. Especially true for aerospace & defence products. Product development & innovation are other reasons.* (UK company)*"* - *"Vapour retardants are used to reduce the evaporation of DCM to atmosphere, which in turn keeps the 'active' ingredient in contact with the substrate for longer, making it more effective.* (Irish company)*"* - *"Our DCM-based paint strippers have always, for maximum effectiveness and to minimise the hazard of volatility, contained vapour retardants.* (UK company)*"* - *"Improved product performance & reduced vapour levels are key end user requirements.* (UK company)*"* - *"The formulation we produce has always contained a wax-based vapour retardant.* (UK company)*"* - *"It's a question of legislative requirements and innovation.* (Portuguese company)*"* - *"Purely, to prevent excessive evaporation of DCM during application.* (Portuguese company)*"* - *"Safety.* (Portuguese company)*"* - *"Quality.* (Greek company)*"* - *"The product has always contained vapour retardants* (Greek company)*."* - *"Innovation (improvement of stripping effect; protection of users).* (German company)*"* - *"Technical.* (Spanish company)*"* - *"Safety.* (UK company)*"*

It is our understanding that the introduction of vapour retardants in the DCM-based formulations was predominantly aimed at making the products more effective by "*extending the "active" use of DCM on the painted surface*". The introduction of vapour retardants, however, has other positive consequence too:

- it contributes to the reduction of the exposure of the operator to DCM vapours since it reduces the rate at which DCM vapours are released;
- it contributes to the reduction of waste since the slower evaporation of DCM allows for smaller quantities of the paint stripping product to be used (the product stays on the painted surface for longer and acts more effectively). The smaller quantity used results in smaller quantities of generated waste (spent material from which DCM escapes by evaporation, empty containers). The extent to which the use of vapour retardants reduces the exposure of the operator to DCM vapours is discussed in more detail in Section D3.6.

D3.2 History of Vapour Retardants

The German Federal Institute for Occupational Safety and Health (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin – BauA) has provided us copies of excerpts of publications dated 1944 (*Formulations for the Paints and Coatings Industry, Part 2, page 36 – 39, 1944*), 1946 (*Formulations Pocketbook for the Paints and Coatings Industry, page 231 - 232, 1946*) and 1968 (Farbe & Lack - 74. Jahrg. / Nr. 9 – 1968) in which the use of paraffins as vapour retardants in paint strippers is documented. Also, we have been provided with an excerpt of what appears to be a 1981 publication by the Dow Company (a manufacturer of DCM) under the title "*Methylene Chloride – The Versatile Solvent*" in which reference is made to the use of paraffins as vapour retardants in DCM-based paint strippers (BauA, 2006b).

Our understanding is that the technology of vapour retardants has not changed significantly over the years, at least over the last two decades. This assertion also takes into account the views of manufacturers of DCM-based paint strippers. Reponses we received to the question "*What has your clients' response been to your moving to products that contain vapour retardants?*" in the RPA questionnaire (as well as subsequent discussions with these companies) included:

- "*No response; we use vapour retardants since more than 30 years* (German manufacturer)."
- "*In our opinion there has been no really new technology concerning retardants* (German manufacturer)."
- "*To our knowledge, there is only one vapour retardant that is used, which is always wax based. This technology has not evolved at all, over the years* (Portuguese manufacturer)."
- "*The formulation we are using is quite old, and has the same vapour retardant since it started being used* (Portuguese manufacturer)."

- *"We have not moved, these are "old" formulations that have been marketed for 10 plus years* (UK manufacturer)*."*

- *"We have used vapour retardants for over 20 years… No fundamental change in the formulations or percentages for many years…I don't think that the technology has changed much over the years.* (Irish supplier)*."*

- *"Our products have always contained vapour retardants…Vapour retardation technology is based on the addition of paraffin wax. So far as we are aware, this technology has been commonplace for many years* (UK manufacturer)*."*

- *"They have been on the UK market for decades* (UK manufacturer)*."*

- "(we have been using the same wax) *since 1993 at least, as it provides an acceptable level of evaporation retardation* (UK manufacturer).

D3.3 How Vapour Retardants Work

Following the application of the paint stripper, vapour retardants 'orientate' to the surface of the paint stripping formulation and rapidly form a 'skin' over the surface, suppressing further evaporation of DCM. Under the 'skin', the solvent performs the job of removing the paint.

Nevertheless, this 'skin' needs to remain undisturbed to effectively control the release of vapours of DCM. As soon as the operator (his/her equipment) touches the surface of the 'skin', its continuity is broken and the evaporation of DCM (re-)starts. This effectively means that when the operator decants the stripper to a new container or scrapes the paint stripper off the surface of the substrate, there is a release of DCM vapours and consequent exposure of the operator to them. It has been suggested that especially when the paint stripper is used with hot water to flush the paint off, this evaporation will be increased as the boiling point of DCM is about 40°C.

As one formulator notes, the very act of DCM evaporation causes the surface temperature of the liquid to fall and this hastens the re-formation of the insoluble wax layer which becomes continuous and established once the liquid flow is stopped, i.e. when pouring from the original can is complete. Another formulator of DCM-based paint strippers suggests that after application of the paint stripper, it takes some time until the wax layer has been formed; during this time the exposure is always very high and similar effect occurs when the stripper is removed because the wax layer gets destroyed. "*This may be one of the reasons why the most accidents occurred despite the use of vapour retarded products*", the formulator has suggested.

D3.4 Are Waxes the Only Types of Vapour Retardants Used?

A German formulator of DCM-based paint retardants argues that all formulators actually use vapour retardants even if they do not clearly indicate so. In practice, DCM has a significantly high vapour pressure; therefore, every added component of lower vapour pressure acts as a vapour retardant. It is highly unlikely that DCM may be used on its own for paint stripping jobs (in any case, it is so volatile that it will practically be ineffective).

The formulator notes that, if one considers the term "vapour retardant" to represent only wax/paraffins, then a significant proportion of his portfolio would have to be considered to be non-vapour retarded. The company, like other companies, manufactures two generic types of paint strippers: liquids, without waxes (non-vapour retarded) and pastes (gel-type) with waxes (vapour-retarded). Each liquid has its paste equivalent. The choice between the two types will depend on the type of job at hand; for example, if the user was cleaning a paint spray gun, the use of a paste-type paint stripper would not be advisable as the paste would block the tiny nozzle in the spray gun. If a vertical surface needs to be stripped (as it happens with the majority of professional and consumer applications), a paste stripper would be employed as a liquid (non-vapour retarded) stripper would run off the vertical surface and have little to no effect on the coating to be stripped. Consideration is given to the material to be stripped, its shape and size, its location and so on before a choice of a product and vapour retardant is made.

It seems, therefore, that in industrial applications, non-vapour retarded products may well be used if considered to be more suitable. But even then, waxes as well as other types of vapour retarding agents may be used such as plastic granules and water.

Plastic spheres: this granulate may consist of polypropylene or polyethylene or some similar solvent-resistant plastic material. Its use may be desirable in a number of situations; for example, it may be needed to strip the paint from a complex surface such as a musical instrument (say, a trumpet – see description in the box further below). The instrument would need to be immersed in the bath for a specified time. If wax/paraffins were used, they would enter the smallest parts of the instrument (for example, the valves of the trumpet) and the operator would have to wash this residue off by rinsing with ('pure') stripper. Any residue on the main parts of the trumpet would have to be rinsed before the instrument is re-coated. This additional rinsing step can be considerably costly and time-consuming. Which plastic material these spheres are made of is important because some plastic materials are not resistant to DCM.

Example: A system for stripping paint off musical instruments

A German formulator has described a system where musical instruments are stripped (this is a real system used by one of his customers). The workspace is designed in accordance with German regulations and includes a suction system around the stripping bath, the bath itself (stainless steel with plastic liner and cover) and the appropriate ventilation. PPE includes a pair of gloves to remove the instrument from the bath (the formulator notes that "*more is not necessary*"). The room is not heated, even in winter.

The bath has a cover/lid and the DCM-based stripping liquid is covered with plastic granulate (which is not recommended by the formulator – he recommends the use of water which, in his opinion, provides easier, same evaporation prevention, easier cleaning of the instrument and reduces the need for rinsing after stripping).

The damaged instrument is first cleaned and rinsed to remove any dirt. Then it is immersed into the bath and the cover is closed. An hour later (as a maximum), the coatings from the surface of the instrument is removed without any problem, the company claims, on the basis of the type or age of coating). Subsequently, the instrument is taken out of the bath and because of the volatility of DCM it dries very quickly. Later on, it will be repaired, polished and given back to the owner.

The formulator was keen to add that a key difference between DCM-based paint strippers and alternative paint stripping formulations is their effectiveness on different coatings. The formulator suggests that, taking the musical instrument example, each manufacturer of good instruments will use its own or favourite coating. Their compositions may be significantly different; moreover, every coating will age in a different way. If the instrument is played rarely and then is kept indoors, stripping will be easy and possible with nearly every paint stripper. However, if the instrument has been used outdoors, the sun's radiation will affect the coating and stripping it becomes more difficult. Strong strippers like DCM-based ones will be needed or alternatively, a combination of other paint strippers. The formulator suggests that such a problem (i.e. the need for a combination of paint strippers) does not apply only to musical instruments. Another issue is the need to heat the bath of alternative paint strippers (usually to usually 30 to 40°C) to ensure the effectiveness of the stripping operation but this is costly and has the associated environmental consequences.

Water: A layer of about one to two centimetres may effectively hold back evaporation of DCM. Moreover, virtually no DCM will be taken out of the bath if the stripped part is taken out of the bath slowly. The water holds DCM back and, because of the higher density of DCM, it will fall back into the bath. After a short drying step, the instrument is clean and can be re-coated without problems. If the operator uses paraffins or plastics to cover the bath, he will inadvertently remove amounts of these materials from the surface of the stripped object every time the object is removed from the bath. The removal of this residue usually requires more effort than the drying off of water. Powder vapour retardants tend to be used for the stripping of objects with larger, uncomplicated shapes. On the other hand, water is not the preferred means of vapour retardation if the work piece to be stripped is sensitive to water (some metals, for example). Finally, the selection of vapour retardant depends on the used additives in the tank mixture.

Apart from the shape of the workpiece, the sensitivity of the workpiece and the presence of additives in the tank mixture, the choice of vapour retardant systems may also be affected by how a product will be used and in which country it will be utilised. What works in the Middle East may not do for Finland, for instance. The technology appears to have evolved slowly over the years and is slow to change. For example, in the

aerospace industry[2], once a product is approved, it becomes very difficult to get the airframe/engine manufacturer to change documentation and/or approve something else - unless they have a real need for it.

D3.5 Markets for Vapour-retarded DCM-based Paint Strippers in Europe

Table D3.1 presents the available information on the presence of vapour-retarded and non-vapour retarded products on the market in different Member States. It is not possible to conclusively identify in which markets one type of product or the other dominates, unless there is relevant information from the authorities or industry. Table D3.2, therefore, provides a summary indication of the overall situation.

[2] A German formulator active in the aerospace sector suggests that DCM-based paint stripper without vapour retardants have never been used. Thickened strippers with wax retardants have been used as have been tank-type strippers also with water top coats (for vapour control). Only DCM-based final wipe cleaning has been undertaken without retardants to obtain residue free surfaces. In Germany, liquid products are only used in dip tanks in industry and this use is regulated by the 2.BImSchV (encapsulated plants required).

Table D3.1: Presence of Vapour Retarded (VR) and Non-vapour Retarded (NVR) DCM-based Paint Strippers in Domestic European Markets					
Country	**Vapour retarded products Information from:**		**Non-vapour retarded products Information from:**		**Notes**
	IND	**AUTH**	**IND**	**AUTH**	
Austria	Possibly		Possibly		One manufacturer supplies both VR and NVR products to industry
Belgium	Possibly		Yes		Two companies sell NVR products (one of them supplies both types)
Cyprus		Yes	Yes		Despite earlier indications to the contrary, the Cypriot Department of Labour Inspection (2006c) has confirmed that both local manufacturers mainly use VR for the products (which find only professional/industrial uses); a limited tonnage of NVR product is used for cleaning purposes
Czech Republic			Yes		One manufacturer supplies NVR products to industry
Denmark	Yes				One company manufactures and supplies only VR products
Estonia				Yes	NVR products available to both professionals and consumers – Clarification has been sought (but not yet received) from the Estonian authorities
Finland	Yes	Yes		Yes	One company manufactures and supplies only VR products. The authorities suggest both VR and NVR products are available but the product register is unclear
France	Yes	Yes			The French authorities advise that all products on the market are VR
Germany	Yes	Yes	Yes		Several companies sell VR products. NVR products also supplied to the German market. Consultation with the authorities indicates that "*German products contain VR*"
Greece	Yes	Yes	Yes	Yes	The authorities suggest that 95% of products are VR
Hungary					No use of DCM-based paint strippers, according to the authorities
Iceland		Yes	Yes		Company that sells NVR products to industry, supplies small quantity
Ireland	Yes	Yes			Authorities and industry suggest that 100% of products are VR
Italy		Yes	Yes	Yes	The Italian authorities suggest that more than 95% of DCM-based paint strippers in the country contain vapour retardants. Also a company that sells NVR products to industry supplies small quantity
Latvia		Yes			No NVR products on the market, according to authorities
Liechtenstein					No information

Table D3.1: Presence of Vapour Retarded (VR) and Non-vapour Retarded (NVR) DCM-based Paint Strippers in Domestic European Markets					
Country	**Vapour retarded products Information from:**		**Non-vapour retarded products Information from:**		**Notes**
	IND	**AUTH**	**IND**	**AUTH**	
Lithuania		Yes	Yes	Possibly	Company that sells NVR products to industry supplies small quantity. Authority originally advised that 50% of products are NVR; in subsequent communication, it has suggested that the only local manufacturer (covering 7% of the market) uses VR. SDS from three other companies have been provided – these have no information on vapour retardants; however, one is from a UK company which is known to use VR
Luxembourg		Yes		Possibly	Safety Data Sheets submitted by authorities indicate use of VR products but not all components may be referred to
Malta	Yes	Yes		Possibly	The authorities are not certain whether NVR products are available
Netherlands	Yes		Yes		Two companies sell small quantities of NVR products (one of them supplies both types) and a third company manufactures VR
Norway		Yes			The authorities advise that DCM-based products are VR
Poland					No information
Portugal	Yes		Yes		Companies that manufacture VR and NVR supply their products to the Portuguese market
Slovak Republic	Yes		Yes		A small quantity of NVR products is supplied to companies involved in industrial uses. The authorities suggest 100% industrial use in the country
Slovenia		Yes		Yes	According to the Slovenian National Chemicals Bureau, only 6.63% of DCM-based paint strippers manufactured and used in Slovenia contain vapour retardants.
Spain	Yes		Yes		Company that sells NVR products to industry, supplies small quantity. Other companies supply VR products
Sweden			Yes		Company that sells NVR products to industry supplies small quantities.
Switzerland	Possibly		Yes		Two companies sell small quantities of NVR products (one of them supplies both types)
UK	Yes		Yes		Significant quantities of NVR are supplied to companies involved in industrial uses
Source: Consultation *Notes: IND = industry; AUTH = Competent Authorities* *The products that may or may not contain vapour retardants contain other substances as well (for instance, methanol)*					

Table D3.2: Overview of the Presence of DCM-based Paint Strippers with and without and Vapour Retardants in EU+EEA+Switzerland				
Countries with vapour retarded products only	**Countries with non-vapour retarded products only**	**Countries with both types**	**Unclear**	**No information**
Denmark France Ireland Latvia Norway	Czech Republic Estonia Sweden	Cyprus Finland Germany Greece Iceland Italy Lithuania Malta The Netherlands Portugal Slovak Republic Slovenia Spain United Kingdom	Austria Belgium Luxembourg Malta Switzerland	Liechtenstein Poland
Source: Consultation				

With respect to each country that appears to have non-vapour retarded products, the following apply based on information provided by companies responding to the RPA questionnaire (which may not be representative for each country):

- ***Austria***: small quantities are sold by a company supplying only companies involved in industry and professional uses (strictly no consumers) and there are currently national restrictions in place;
- ***Belgium***: small quantities are supplied for industrial/professional use only;
- ***Cyprus***: we contacted the two key manufacturers. Both companies use vapour retardants in their products. However, 20% of one company's production tonnage does not contain vapour retardants. The company explained that this is intended for use for surface preparation before dip tank stripping and for the cleaning of equipment (for example, nozzles of spraying equipment);
- ***Czech Republic***: according to the Czech National Institute of Public Health (2006), the majority of users are companies involved in industrial uses (and a small number of paint stripping tradesmen);
- ***Estonia***: the majority of (the tonnage of) DCM-based paint strippers is used by consumers, the rest by professionals;
- ***Finland***: no information on specific products sold in Finland is available; the Finnish National Product Control Agency for Welfare and Health (2006) notes that if

vapour retardants are not classified as dangerous, the Finnish product register might not include information on those substances;

- ***Germany***: non-vapour retarded products appear to be used essentially in industry when the use of such type of products is advantageous and, even then, other forms of vapour control are employed (plastics or water);

- ***Greece***: only 5% of products are non-vapour retarded according to the Greek General Chemical State Laboratory (2006b); the majority of the tonnage of DCM-based paint strippers is used by industry and the vast majority of users are companies involved in professional uses;

- ***Iceland***: according to the Icelandic Environment and Food Agency (2006b), the only product that appears to be non-vapour retardant is actually likely to contain a vapour retardant and, in any case, is imported in small quantities as a sample;

- ***Italy***: the vast majority of products (>95%) contain vapour retardants (Italian Ministry of Health, 2007). The only company that sells non-vapour retarded products supplies them to "*professional use in the aerospace business*". This is an 'industrial use' for the purposes of our report, as confirmed by the company itself;

- ***Lithuania***: according to the Lithuanian Environmental Protection Agency (2006a), consumers account for 85% of consumption. The situation with regard to the use of vapour retardants is unclear; the only local manufacturer uses vapour retardants (Lithuanian Environmental Protection Agency, 2007);

- ***Luxembourg***: the information submitted by the Luxembourgian Inspection du Travail et des Mines (2006a) is based on the contents of Safety Data Sheets. Companies do not have to register the composition of their products (some exceptions do exist for products like biocides and plant protection products) (Luxembourgian Inspection du Travail et des Mines, 2006c). During its enquiries, the Luxembourgian Inspection du Travail et des Mines received little information and most of the Safety Data Sheets were not readily available. The use of vapour retardants was not known at all, but this seems to be more a lack of information than the absence of such components in the DCM products) (Luxembourgian Inspection du Travail et des Mines, 2006c). Notably, the producers are located outside Luxembourg, and the products are mainly imported from Belgium, Germany or France. Thus, the products on the rather small Luxembourgian market do not differ in their components from the same products sold in the other three countries. In fact, the Safety Data Sheets for some of the products manufactured by companies that are known to use vapour retardants (waxes) do not mention waxes among their components;

- ***Malta***: the Malta Standards Authority (2006) suggests that the majority of products appear not to contain vapour retardants. The Authority has relied on information provided by suppliers/manufacturers and Safety Data Sheets and it is possible that vapour retardants are present in the formulations but they are undeclared. The

Authority has not come across any use of vapour retardants on site (Malta Standards Authority, 2007);

- ***the Netherlands***: the two companies that have directly confirmed the sale of non-vapour retarded products supply only uses involved in industrial and professional applications. Communication with the RIVM (2006c) suggests that out of the four companies contacted directly by RIVM (these cover 80% of the Dutch market), one supplies non-vapour retarded products for industrial uses only and vapour-retarding measures/materials (e.g. waxes) are sold separately. Another company stated that it does not use/produce any products based on DCM. Two companies did not respond (RIVM, 2006c);

- ***Portugal***: one manufacturer supplies non-vapour retarded products to the Portuguese market (industrial use for vehicle repair) while another supplies (but doe not appear to manufacture) non-vapour retarded products for industrial use in metal stripping[3];

- ***Slovak Republic***: the only company that supplies non-vapour retarded products supplies only to industry. Information submitted by the Centre for Chemical Substances and Preparations of the Slovak Republic (2006) suggests that 100% of usage occurs in an industrial setting;

- ***Slovenia***: the Slovenian authorities (Slovenian National Chemicals Bureau, 2007) have suggested that only a very small percentage of products on the Slovenian market contains vapour retardants. The authorities obtained this information from the register of companies that trade and manufacture dangerous chemicals. Reportedly, industrial uses account for 95% of the tonnage of DCM-based paint strippers used in the country;

- ***Spain***: the only company that supplies non-vapour retarded products supplies only to industry;

- ***Switzerland***: the Swiss Federal Office of Public Health (2006c) notes that companies may have indicated vapour retardants (wax) as "auxiliary agents" and this may prevent their identification in the product register. Of the fewer than 10 paint strippers registered in Switzerland for consumer use, all of them have been found to contain vapour retardants (paraffins/waxes) (Swiss Federal Office of Public Health, 2006d); and

- ***United Kingdom***: the companies that supply non-vapour retarded products to the UK market sell them to industrial (aerospace, metal treatment, vehicle repair) users.

Overall, the presence of non-vapour retarded products in national markets could be attributed to:

[3] This could be industrial use according to the classification we use in this report.

- sales to industrial users or professional users (in what could be considered to be an industrial use for the purposes of this report, such as vehicle refinishing, i.e. use in a permanent stationary technical unit with occupational health and safety rules applicable);

- the absence of specific mentions of waxes/paraffins from Safety Data Sheets that authorities may rely on to assess whether vapour retardants are indeed contained in preparations or not. Products that have positively been identified as vapour retarded may be accompanied by Safety Data Sheets that do not mention the presence of vapour retardants;

- lack of knowledge of whether additive vapour retardants (waxes, water, plastic) are used at the premises of the (industrial) users; and

- the need for a product suitable for cleaning purposes: consultation suggests that non-vapour retarded DCM-based paint strippers may be used for pre-treatment of a surface or for cleaning of equipment (the wax would clog the nozzle of spray equipment).

It should be made clear that the absence of vapour retardants from a formulation does not mean that a vapour retardant will not be ultimately used. With some formulations, the customer will simply add the vapour retardant as an additive, others will go into tanks with a lid to form a mechanical retardant. In conclusion, it appears that it is unlikely that non-vapour retarded products are used. The likelihood of this happening in professional uses is also small as this would make the use of the paint strippers impractical and ineffective. Especially for consumers who cannot use other additive vapour retardants, the use of paraffin waxes is universal. Only in Slovenia non-vapour retarded products appear to have a an unexpected strong presence; however, the basis of this information (product register) might be incomplete It is worth noting that industrial uses account for 95% of the tonnage of DCM-based paint strippers used in the country.

D3.6 Impact of Vapour Retardants on Risks from DCM-based Paint Strippers

D3.6.1 Analytical Methods for Measuring Evaporation Rates

Only one commercial analytical method for the measurement of evaporation rates has been identified. This method was developed in the early 1970's by a UK formulator (Nitromors) and is reportedly used by several UK paint stripper formulators for measuring vapour retardation of DCM-based paint strippers. This analytical method is also known as test method 127/1[4] and was referred to in the ETVAREAD report[5]. It is

[4] The numbering of the test method is the internal test method number used by key manufacturer in the UK.

[5] SCHER (2005) notes with regard to the ETVAREAD report: "*The "evaporation reduction rate" was known for some of the products, but the description of that parameter in an annex does not help the reader as it describes "percentage weight loss" and the formula given is wrong.*"

described in the box below (the information was provided by the main UK formulator of DCM-based paint strippers).

Test Method: Rate of Evaporation of DCM Based Paint Removers No: 127/1

Apparatus:

- Glass Petri dish with lid, 74mm diameter, 22mm height to DIM 12339 (Schott Duran Brand).
- 10 cm^3 plastic disposable syringe to BS5081.
- 250 cm^3 low form beaker.
- Electronic timer with 30-minute countdown facility.
- Balance capable of weighing up to 4 decimal places.
- Fume cupboard with adjustable sash and extraction that can be turned off.

Method:

1. Position balance in fume cupboard. Position the fume cupboard sash mid way with the extraction off.
2. Place a glass Petri dish on the balance and weigh to four decimal places record result as W1.
3. Transfer approx. 100 cm^3 of the paint remover under the test beaker, behind the draught screen. Leave this to stand for two minutes.
4. Withdraw 10 cm^3 of paint remover from the beaker into the syringe at a rate of 1 cm^3 per second.
5. Then discharge the paint remover into the Petri dish on the balance at a similar rate. When the syringe is half empty the timer should be started for a 30-minute countdown.
6. Upon the syringe being empty record the total weight of the glass Petri dish and the paint remover, record result as W2.
7. The balance, if fitted with access doors must have one left open throughout the test to ensure vapour is not restricted in any way.
8. After 30 minutes, record the total weight of the Petri dish and paint remover again, record result as W3.
9. Repeat the test two more times and report the average result.
10. It is important to maintain a calm environment in the vicinity of tests to avoid unwanted draughts and disturbance that may affect the test.
11. Tests should be performed at 20 ± 2°C and relative humidity of 55 ± 5%.

Calculation:

- Wt. of Petri dish empty = W1
- Wt. of Petri dish full = W2
- Wt. of Petri dish full after 30 mins = W3

$$\% \text{ Evaporation loss in mass} = \frac{(W2-W1) - (W3-W1)}{(W2-W1)} \times 100$$

Reporting of Results:

Report results as % w/w stating temperature and humidity readings.

Another method has been identified in a publication of the UK Ministry of Defence (UK Ministry of Defence, 2006). This standard was first developed in as early as July 1965 (this is the date of the first version of the relevant publication). Annex B of the Standard (Determination of Rate of Evaporation) describes the following test method.

UK Ministry of Defence Test Method: Rate of Evaporation of DCM Based Paint Removers

Apparatus:

- Flat bottomed glass dish, 75 mm in diameter, 12 mm deep.
- Glass hypodermic syringe without needle, 10 cm³ in capacity.

Method:

1. Weigh the glass dish to the nearest mg (m1). Quickly transfer approximately 50 cm³ of the sample to a 100 cm³ squat-form beaker and allow the beaker to stand in an atmosphere free from draughts for two minutes.
2. Draw into the syringe, at a rate of 1 cm³ per second, 10 cm³ of the paint remover from the beaker. Wipe off any excess on the outside of the syringe and weigh to the nearest mg (m2). Transfer, at a rate of 1 cm³ per second, the contents of the syringe to the centre of the dish.
3. Place the dish on a horizontal surface with free access of air but not exposed to draughts. Re-weigh the syringe (m3) and after 30 minutes re-weigh the dish (m4).

Calculation:

$$\text{Loss in mass} = \frac{(m2-m3) - (m4-m1)}{(m2-m3)} \times 100$$

The following comments may be made:

- the UK Ministry of Defence Test Method was developed a long time ago. This test method has been used over the years to develop products which were designed to meet the Ministry of Defence Standard specification, including weight loss with time. According to a UK formulator of paint strippers, the requirement for certain loss in mass with time was included in the specification in as to ensure that the vapour retardants are present and thus the stripper will stay on the work piece long enough for the de-bonding of the paint to occur;

- the method is simple and uses basic chemistry concepts;

- the method is very similar to the one used at present by (some) UK formulators, although the description of the method used by the formulators is more detailed. Interestingly, we have been advised that the 127/1 method was used by Nitromors (the old company) in the UK since a long time ago. When Nitromors was taken over by the current owner of the brand, there had been an effort to identify other analytical testing methods without success, so the old Nitromors method was updated. The original method was indeed based on the UK Ministry of Defence Standard test method. Therefore, effectively, the Ministry of Defence method, which was first developed in the 1960 and may has been amended on a number of occasions is the only method that has been used by the UK formulators since.

A German formulator who was involved in the ETVAREAD report has also noted "*when we made our measurements, we did not know the UK method described in the ETVAREAD report, but our method was similar*". We do not have any detail on the specifics of this method.

D3.6.2 Results Obtained with the Existing Analytical Methods

We asked manufacturers of DCM-based paint strippers whether they have used any analytical method (not only the 127/1 method) for the measurement of the evaporation rate of their products and what the results have been. A collection of responses (and the locations of the companies) is given below.

- Company A (DE): "Reduction of evaporation rate: > 90 %; reduction of exposure: no own measurements".
- Company B (GR): "*We are not capable of be measurably specifying it*".
- Company C (GR): "It has not been measured".
- Company D (IE): "The evaporation rate can be reduced from 10% (when no vapour retardant is used[6]) to less than 1.0%.
- Company E (PT): "*We calculated in a theoretic basis, by Clements Model, the DCM emission and it doesn't exceed the limit defined on Decreto de Lei 242/2001 (National Legislation). Besides, our paint strippers contain vapour retardants which reduce exposure to vapours and are labelled in accordance with EU Legislation on Dangerous Preparations*".
- Company F (PT): "It is not possible to answer the question as we have no means of measuring exposure reductions".
- Company G (ES): "*Weight loss of our products: below 1.85%*" (this was measured using the 127/1 analytical method).
- Company H (UK): "*95% reduction in exposure to DCM can be achieved with a vapour retardant*".
- Company I (UK): "*Unknown but estimation would be circa 2%*".
- Company J (UK): "*Weight loss due to DCM evaporation is below 1%*".

A UK formulator co-ordinated the measurement of the evaporation rate of products produced in Europe, including UK products, by using the 127/1 analytical method in the period 2000-2003; the results for non-UK products are shown in Table D3.3. At the time, UK products are said to have showed evaporation rates lower than 2%. Further results where obtained for the years 2003-2006.

[6] Note that the expected evaporation of pure DCM is 37% by weight under normal conditions of measurement (temperature, humidity, etc.).

Table D3.3: Evaporation Rate Test Results for Various European DCM-based Paint Strippers		
Product	**Country of origin**	**Evaporation rate (%)**
For the years 2000-2003		
A	Belgium	0.34
B	Netherlands	0.39
C	Denmark	1.87
D	Italy	0.39
E	Germany	3.44
F	Netherlands (a product different to the one above)	6.71
For the years 2003-2006		
E	Germany (as above) in 2003	7.60
E	Germany (as above) in 2006	1.70
G	Belgium	5.40
Source: Consultation *Note: testing undertaken by on behalf of a UK formulator.*		

In addition to the above data, the Irish Health and Safety Executive stated that, when the standard product of the main Irish manufacturer/supplier of DCM-based paint strippers is tested under the 127/1 analytical method, the resulting evaporation rate is well below 1.0% (Irish Health and Safety Authority, 2006a).

D3.6.3 Reproducibility of Results of the 127/1 Analytical Method

Formulators in the UK and Ireland that have used this method argue that the results they have obtained are consistent between different laboratories. The response of an Irish formulator to the Irish Health and Safety Authority agrees with this on saying that the method is "*quite reliable"* (Irish Health and Safety Authority, 2006b).

However, the results in Table D3.3 show some variability, especially with regard to the German product that has been tested on three different occasions. The UK formulator who organised the testing acknowledged this and added the following:

"(Our company has) *been using this method for several years and* (we) *are quire skilled in the method, but I have to say in our round robin results, in different labs, differences can be seen between samples which have good and not so good vapour retardation, but actual results vary. We are working on this to try to reduce the variability. However, in all the labs we can easily get results below 1.85% for standard UK products*" (note that this limit of 1.85% was included in the recommendations of the ETVAREAD report in 2004).

Moreover, while it has been argued that this method correlates well with real usage of products, we have reservations in agreeing with this assertion. We consider it unlikely that the exposure that may result during the real-life application of the paint stripper (when the occupational/consumer user interacts with the paint stripping product and the

wax 'skin' is frequently broken and vapours are released) can be 'replicated' by the process used in the 127/1 analytical method.

Importantly, SCHER in its 2005 Opinion on the ETVAREA report notes: "*This test must be difficult to reproduce between laboratories as it is based on the use of a fume hood with the fan off. The air flow over the glass dish is critical for DCM in paint strippers this test and that may be very different in different laboratories (and may also vary in one fume hood due to different meteorological conditions)*".

Finally, the UK formulators accept that the method is not yet standardised/harmonised. As one UK formulator put it "*we have discussed with other companies in the UK and Ireland the possibility of standardising this method. Currently there is no European Standard for paint removers as a category, and it was felt that this would be the best vehicle for including such a method*". In conclusion, if the method is a non-standardised one with results that may not be reproducible (which might be the case judging from the variability shown in Table D3.3), there would be implications in using this method to introduce an EU-wide restriction on the basis of maximum weight loss percentage. It is essential that when a restriction introduces a threshold limit, the relevant parameter (on this occasion the %weight loss) can be measured with confidence to ensure the enforceability and monitorability of the restriction. The box below explains the necessity of harmonised text methods to implement and monitor adherence to a restriction.

The Need for Harmonised Testing Methods

Where a restriction sets concentration limits for chemical substances contained in preparation, or in articles below a certain limit, it may be needed in cases to have harmonised testing methods to measure concentrations and assess the adherence to the limits with a certain precision, accuracy and reproducibility. An example is reported in the Directive 2004/21/EC which published the list of the testing methods developed by the European Committee for Standardization (CEN) for the application of the Directive 2002/61/EC on restrictions on the marketing and use of azocolourants.

As a final point, the available measurements of evaporation rates for products available in different countries are still very few and it is unclear how representative these products were or not. The UK formulator who organised the testing noted that it is problematic to obtain samples from Germany and France because DCM-based paint strippers are only sold to professionals, so are not available in ordinary self-service DIY stores. The formulator also said "*we have agreed a round robin test in four laboratories of different companies to review the situation again, as the last series was done several years ago*".

It should be noted that devising a harmonised test is not the only issue to be addressed before a limit on weight loss is used to introduce any restriction on the marketing and use DCM-based paint strippers. The key point is whether vapour retardants can actually ensure the reduction of exposure to such levels that the health and safety of the user are protected. The discussion in Section D3.7 below shows that this is not the case.

D3.7 How Effective are Vapour Retardants?

D3.7.1 The Results of the ETVAREAD Report

The ETVAREAD report (2004) has shown that the exposure values of vapour retarded products range from ca. 400 to ca. 1,000 ppm 25-min TWA. When vapour retardants are not used, the respective concentrations were measured at between ca. 1,500 and ca. 1,700 ppm respectively. It should be noted that two products called Kluthe 2 and Kluthe 3 used in the testing were not 'real' products marketed in Germany by the German manufacturer. As indicated by the company itself, for the investigation of the evaporation rates and the exposure of workers, Kluthe sent different samples to the BIPRO laboratory where the tests were carried out:

- Kluthe 1 was the standard product marketed for professional uses;
- Kluthe 2 contained only 50% of the vapour retardant of sample Kluthe 1; and
- Kluthe 3 contained no vapour retardant.

The company advised us that Kluthe 2 and 3 are not products on sale and they were made simply to give the study team the opportunity to investigate the influence of different concentrations of a vapour retardant in the same formulation. The company has emphasised its position that, to the best of their knowledge, every formulator in Germany uses vapour retardants (in the form of waxes).

The analysis in the ETVAREAD report suggests the following:

- exposure levels are lower when vapour-retarded products are used;

- paint strippers with an evaporation reduction rate ≥95% lead to exposure levels between 400 and 800 ppm which corresponds to exposure levels that are more than 50% reduced compared to those resulting from non-vapour retarded products (~1,500 to 1,700 ppm);

- a higher evaporation reduction rate (over 95%) does not automatically lead to lower exposure rates. In the test, a paint remover with an evaporation reduction rate of 99,2%, the exposure values where higher than when a product with an evaporation reduction rate of 97,5% was tested;

- exposure increases significantly during application of the paint stripper on the substrate and during scraping the tripper off the substrate. The increase during application and scratch off can be explained, according to ETVAREAD, with the effect of disturbance of the barrier ('skin') which builds up at the surface of the applied paint stripper by brushing or scratching. As soon as the barrier is disturbed, the evaporation of DCM increases and the DCM concentration in air increases[7];

[7] This is consistent with information from consultation. For instance, a manufacturer of DCM-based paint strippers who supplies the aerospace industry suggested that "*…the evaporation retardant is however not working, when parts are carried out from an open system tank (in tank type usage) and, for thickened*

- on the basis of previously reported test results, it can be concluded that during hosing (another common form of application for external walls) the exposure values are also increasing. ETVAREAD argues that on consideration of measurements undertaken in 2003 by a DCM manufacturer, hosing does not seem to be the critical phase;

- ETVAREAD suggests that vapour retardants are also efficient at vertical surfaces and that there is no difference between the exposure levels related to the use of vapour retarded paint strippers on vertical or horizontal surfaces. In fact, the measurements of exposure when vertical surfaces are stripped are lower than when horizontal surfaces are (614 ppm as opposed to 706 ppm). ETVAREAD does mention nevertheless that the accuracy of measurements was rather limited (±30%); and

- the amount of stripper used has an almost linear influence on the exposure level and allows the extrapolation of the test result to different application scenarios.

ETVAREAD also presents the results of measurements undertaken in the UK where exposure concentrations during paint stripping were measured. These test results showed mean exposure levels during application, scratching, and hosing off ranging from 44 up to 203 ppm under different application conditions (see Table D2.4 earlier in this Annex). These concentrations are much lower than what ETVAREAD measured. On this basis EVAREAD states that "*the recent measurements that have been performed in the UK with effectively vapour retarded products may indicate that modern* (i.e. products currently on the market)*, good vapour retarded paint removers may result in lower exposure values compared to those that have been used in former test series*". However, as discussed in Section D3.5, there is currently limited evidence that products sold to consumers and those involved in professional uses (for applications such as those assessed by ETVAREAD) do not contain vapour retardants and the vapour retardants used (waxes) have not changed for several decades. Therefore, the term "*modern, good vapour retarded paint removers*" does not appear to accurately reflect the current situation. ETVAREAD acknowledges that this is a controversial issue and hints to the possibility of the tests being undertaken under "*unrealistic test conditions*".

The overall conclusion was that exposure values for outdoor use range from minimum values around 20 ppm to above 1,000 ppm with mean values between below 100 ppm up to 475 ppm. For indoor use, exposure values range from below 100 ppm to several thousand ppm.

ETVAREAD argues that the crucial factor for exposure is ventilation; good ventilation (either sufficient through ventilation or sufficient active ventilation) can result in exposure values well below 100 ppm. However, the results of measurements show that even with what is called "through ventilation" (air exchange rates of up to 10, which is

strippers, during application and in the moment the paint breaks off. Own investigations revealed weight losses of 50% and more during breaking of the paint and falling down of paint particles, compared to only few percent loss during the 'silent' dwelling period before."

more than the rates in the average home and most definitely far from worst-case) the exposure levels can be up to 320 ppm for consumer use (350 ml of paint stripper used)[8].

It is important to note the comments SCHER made on the ETVAREAD report (SCHER, 2005). Two key points were made by SCHER:

- "*taking into account that the uncertainty in the results may be larger than what is indicated in the figures in the report it is difficult to say if there are any significant differences between the different experiments. The only comparison that can be made between paint strippers with and without vapour retardants present is between the three Kluthe products (Figure 4 in the report). The emission from the product with the lower concentration of retardant is not significantly different from that from the product without retardant even if only the uncertainty from the adsorbent tubes is taken into account. If other uncertainties are also taken into account it may even be difficult to see an influence of the higher concentration of the retardant*"; and

- "*the only results presented from the infrared measurements are given in Figure 6 in the report. If the mechanism for the vapour retardation is that the additives form a skin on the surface when the solvent is evaporated, these results do not support a substantial effect of the retardants. This would have decreased the evaporation mainly during the effecting period, not so much during the application and removal. The expected levels of DCM (11 to 160 ppm) discussed in the risk reduction section and in the conclusions are based on an air ventilation rate of 10 to 30 which are unrealistic. The indication of a decreased emission when the surface was painted could be expected as the paint will dilute the DCM concentration in the stripper*".

In other words, SCHER questions whether vapour retardants actually have an effect on the emissions (and subsequent exposure to) of DCM from the paint stripping formulations.

Finally, with regard to fatalities (and non-lethal accidents) associated with the use of DCM-based paint strippers, ETVAREAD points out that the information sources usually do not provide information whether the products in use contained vapour retardants. However, since the use of vapour retardants "*is state of the art since several decades, it can be assumed that probably all of the accidents have occurred although vapour retarded products have been used. The degree of vapour retardation of the corresponding products is not known…It can be assumed that the majority of accidents have occurred despite the use of vapour retarded products*". We would add that on the basis of our discussion in Section D3.4, when DCM-based paint strippers are used in an industrial setting, the vapour retardants employed may be of different nature to those used in products intended for professional and consumer use.

[8] As SCHER (2005) notes, "*The standard procedure used an air exchange rate of 4 which is higher than normal*."

D3.7.2 Information from Consultation

Some information has been collected on the effectiveness of vapour retardants during consultation. For instance, BAuA (2006a) pointed out that a vapour-retarded formulation was tested against alternatives for a German television programme and the measured exposure levels were found to exceed the (now revoked) German occupational exposure limit of 100 ppm (8h-TWA)[9]. The BAuA notes that "*as vapour retardance is a technology generally recommended in base formulation for paint strippers for more than 60 years, it is most probable that those DCM-based paint strippers which caused concern, led to so many incidents and exceeded the exposure limits were generally formulated with more or less vapour retardants. This seems even more plausible since ETVAREAD has shown, that even "modern"* (i.e. products currently on the market) *vapour retarded products exceed limit values, and this exceedance was seen in small scale applications under optimum ventilation conditions*."

Also the Berufsgenossenschaft der Bauwirtschaft (2006b) pointed to a study that was undertaken in 2004 on the comparison of DCM-based paint strippers from different countries and was reported by Rühl *et al* (2004). The results are provided in Table D3.4. A total of ten different paint strippers from the UK, Belgium and Germany were tested. During all but two measurements (No. 7 and 23), paint strippers containing vapour retardants were used.

Table D3.4: Measurements on Simulation of Stripping Work using DCM-based Paint Strippers (Germany, Belgium and the UK)

Product No.	Country	Measurement value in mg/m^3	Quantity in g/m^2	Change of air (h^{-1})	Ventilation
1	UK	2,329	350	4	A
2	UK	2,449	350	4	A
3	UK	1,702	350	4	A
4	BE	2,873	350	4	A
5	BE	2,097	350	4	A
6	DE	3,522	350	4	A
7	DE	5,918	350	4	A
8	DE	2,971	350	4	A
9	UK	1,858	350	4	A
10	UK	2,818	350	4	A
11	UK	608	87,5	4	A
12	UK	1,122	175	4	A
13	UK	1,764	350	4	A
14	UK	1,754	350	4	A
15	UK	1,849	350	4	A
16	UK	2,063	350	4	A
17	UK	1,591	350	6	A

[9] More detail may be found on this Internet site www.wdr.de/tv/q21/440.0.phtml.

Table D3.4: Measurements on Simulation of Stripping Work using DCM-based Paint Strippers (Germany, Belgium and the UK)					
Product No.	**Country**	**Measurement value in mg/m^3**	**Quantity in g/m^2**	**Change of air (h^{-1})**	**Ventilation**
18	UK	1,259	350	4	B
19	UK	3,002	350	4	B
20	UK	1,669	350	4	B
21	BE	2,445	350	4	B
22	DE	3,848	350	4	B
23	DE	6,719	350	4	B
24	BE	3,357	350	4	B
Source: Rühl et al, 2004 *Notes:* *A: Fresh air at floor level, outgoing air in working height* *B: Fresh air in working height, outgoing air at flow level*					

The conclusions from these measurements were:

- paint strippers containing vapour retardants lead to lower exposures compared to paint strippers without vapour retardants;
- all measured exposure levels were considerably higher than the highest European OELs of 350 mg/m^3 (8h-TWA), irrespective of the use of vapour retardants or not;
- the 95th percentile of the 24 measurements was 5,608 mg/m^3. If the two results relating to paint strippers not containing vapour retardants were excluded, the 95th percentile was reduced to 3,514 mg/m^3. This, the authors believe, was in fairly good agreement with the exposure levels observed in real life (some measurements of real life exposure levels are provided in the same study and were presented in Section D2 above).

Berufsgenossenschaft der Bauwirtschaft (2006b) also argues that, contrary to the conclusions of the ETVAREAD report, it considers that vapour retardants are not effective on vertical surfaces.

Finally, a number of manufacturers of DCM-based paint strippers expressed their views on the extent to which vapour retardants may control exposure to DCM. A total of six companies made the comments presented below. What is clear is that the use of vapour retardants (which goes back several decades) cannot be relied upon to deliver the required risk reduction on its own.

French branch of a German formulator:	"*Regarding the use in aerospace, DCM-based paint strippers have been used, and are still in use in far lower quantities, as tank strippers in open systems (for parts) and thickened strippers (for whole aircrafts). Both are only used with evaporation retardants. The evaporation retardant is, however, not working, when parts are carried out from an open system tank (in tank type usage) and, for thickened strippers, during application and in the moment the paint breaks off. Own investigations revealed weight losses of 50% and more during breaking of the paint and falling down of paint particles, compared to only few percent loss during the 'silent' dwelling period before.*"
German formulator:	"*...the exposure not only depends of the effectiveness of vapour retardants but also of other factors like* • *temperature during application;* • *dimension of the treated surface;* • *dimension of the room (a room may also be the area outside at a facade covered with a tarpaulin); and* • *ventilation / air exchange during application.*"
German formulator:	"(regarding the effectiveness of vapour retardants)*...to be honest – the way of using DCM strippers is more effecting on vapour quantity than anything else.*"
Portuguese formulator:	"*We are convinced that vapour retardants effectively reduce exposure to DCM, but we have no real data to confirm this assumption. Anyway, the only reason we use a very expensive raw material in our formulation is the assurance that it is effective, and this assurance was obtained not from tests made with our product but from information originated from the raw material supplier. Also, we don't have knowledge of accidents with the utilisation of paint strippers - by itself this fact can give us no assurance regarding safety, but certainly implies that the safety measures now implemented must have some level of efficacy.*"
UK formulator:	"*I would suggest that less than 2%* (weight loss) *is adequate, but this obviously depends on the conditions of use, how much paint stripper is used, how many applications, conditions of ventilation, etc.*"
UK formulator:	"*The effectiveness of vapour retardants has to be measured against the levels of DCM present where no vapour retardant is present. It has never been our assertion that a vapour retarded product does away with the need for effective PPE and engineering controls*."

ANNEX E:

AVAILABLE DATA ON ACCIDENTS AND FATALITIES INVOLVING THE USE OF DCM-BASED PAINT STRIPPERS AND ALTERNATIVE PAINT STRIPPERS

E1. INFORMATION ON ACCIDENTS IN EU MEMBER STATES

E1.1 Introduction

In the course of this study, information has been collected on accidents associated with the use of DCM-based paint strippers by consumers, professional users and industry users (morbidity data tend to refer to the first two categories of users only).

Following the completion of the TNO report in 1999, the ECSA Secretariat launched an enquiry among some fifty poison centres across Europe enquiring whether they knew of incidents relating to DCM, especially in three consumer applications: aerosols, adhesives and paint removers. The survey was undertaken in two phases: in phase 1, the rate of reply was about 20% with the most detailed information received from poison centres in Germany, the Netherlands and Spain. In phase 2 (launched in 2001), ECSA expanded its enquiry by requesting information on chemical alternatives of DCM and by paying for the information, if necessary; the total rate of response was 40%. This time, France and the United Kingdom provided the most detailed information (ECSA, 2002a).

A significant portion of the data presented below is from the above survey organised by the ECSA. In some countries (Austria, Belgium, Czech Republic, Ireland, Netherlands, Portugal, Slovak Republic and Spain) the poison centres covered the whole country and the replies truly reflect the national situation. In the other countries, each centre had only a regional coverage (ECSA, 2002a). In general, the absence of incidents with DCM in some countries might be due to deficiencies in the reporting system or to the fact that enquiries are based on trademarks and not chemical substances.

ECSA argues that the number of incidents reported to poison centres related DCM is very limited, especially compared to the number of units of paint stripper sold, and when there are incidents, they are mostly benign. Only very few serious cases are reported, and then they stem mainly from professional use - when the workplace safety standards were not implemented or from misuse (like ingestion despite warning labels and instructions). Severe incidents, when they occur, are often due to other hazardous substances accompanying DCM in some paint strippers. For example, the serious skin irritant/corrosive effects may be due to other components, e.g. hydrofluoric acid. However, DCM itself might cause a severely irritant effect if the exposure is occlusive and prolonged, so each case needs looking at carefully and caveats should be applied to any comment.

The following paragraphs present the available data on DCM-related morbidity for each country. Further below, a discussion is provided on the available mortality information. Information available on accidents relating to alternatives is discussed in Section E3.

E1.2 Accident Data from Austria

Based on data from the ECSA Survey (ECSA, 2002a), one single case with DCM had been reported since 1998: an adult working at home with a paint stripper containing 70% DCM. The intoxication could not be proven (ECSA, 2002a).

E1.3 Accident Data from Belgium

Based on data from the ECSA Survey (ECSA, 2002a), in 2001, 94 calls relating to paint strippers (whatever their composition) were received for 95 victims (89 adults, 5 children and one animal). Except for one suicide attempt and four professional exposures, all reported accidents were domestic. There were symptoms for 72 of them (76.6%), with the following breakdown:

- skin (irritation, burns): 36.63%;
- eyes (irritation, pain): 26.73%;
- digestive system (nausea, vomiting): 14.85%;
- general symptoms (headache, asthenia): 10.89%;
- respiratory symptoms: 5.94%;
- nervous system symptoms: 3.96%; and
- cardiovascular symptoms: 1.00%.

Products used:

- DCM-based: 56;
- products of unknown composition: 28;
- dimethylformamide-based strippers: 6; and
- other: 4.

In 37% of the cases the patient was attended to by a physician; in 17% of the cases, hospitalisation was advised.

ECSA concludes that calls related to the use of paint strippers mainly occur for DIY adult users using the product at home. Half of them required medical help and ECSA suggests that the use of appropriate protection equipment would allow the avoidance of most incidents (ECSA suggests (2007) "*gloves and eye protection equipment could have been sufficient to avoid problems*"). ECSA also notes that in many cases persons have said that they have been hit by splashing on opening the container (this is a known problem with lever lid cans under slight pressure).

E1.4 Accident Data from the Czech Republic

Based on data from the ECSA Survey (ECSA, 2002a), the Czech product database mentions 54 paint strippers, 35 of which contained DCM. Only 3 inquiries on paint strippers were recorded, none of which relating to solvents, rather alkalis. The total number of calls to the Toxicological Information Centre in Prague in 2001 was about 8,000 (from the whole of the Czech Republic).

E1.5 Accident Data from Finland

Based on data from consultation (2002-2005), the number of calls related to human exposure to DCM (suspected or real exposure) to the Finnish Poison Information Centre in the years 2003-2005 is detailed in Table E1.1.

Additional information from the Finnish Institute of Occupational Health provided to RPA by the Finnish National Product Control Agency for Welfare and Health (2006), suggests that the Finnish Register of Occupational Diseases includes 4 relevant incidents during 1998 – 2002, of which one was a severe brain damage in the furniture industry (most probably caused by DCM-based paint stripping).

Table E1.1: Calls to the Finnish Poison Information Centre relating to Exposure to DCM

Year	Number of calls	Routes of exposure (more than one possible)
2005	9 calls (4 definitely related to DCM paint strippers) 6 with reported symptoms	Inhalation: 3 Eye: 5 Dermal: 1
2004	8 calls (4 definitely related to DCM paint strippers) 7 with reported symptoms	Inhalation: 1 Eye: 2 Dermal: 4 Oral: 1
2003	7 calls (2 definitely related to DCM paint strippers) 6 with reported symptoms	Inhalation: 2 Eye: 3 Dermal: 3

Source: Finnish Poison Information Centre, 2006
Notes: The figures in parenthesis relate to accidents (based on spontaneous calls) involving DCM-based paint strippers as ascertained at the time. Information on hospital attendance is not available.

E1.6 Accident Data from France

E1.6.1 Data from the ECSA Survey (ECSA, 2002a)

Angers Poison Control Centre

A very detailed report was received by ECSA from the Angers Poison Control Centre (Table E1.2). This Angers centre covers officially a population of 6 million people from 11 "départements" in the centre and west of France (Centre and the Loire), but receives calls from a much wider area, which explains the apparently large number of calls.

More detailed information was provided by the French Ministry of Labour during consultation for this study (French Ministry of Labour, 2006a).

In total, 78 files of reported intoxications were associated with a total of 88 victims under four types of intoxication. There were:

- 51 cases of professional intoxications;
- 22 cases of DIY accidents; and
- 3 cases related to interior air pollution.

All cases were from painting or graffiti stripping accidents, except for an incident involving an industrial stripping solution which was stored in a tank. The average age was 32 years, ranging from 18 years to 80 years and the accidents mainly affected men

(17 women/71 men). The most frequent accidents were associated with cutaneous or ocular exposure; 26 accidents were caused by solvent inhalation as shown in Table E1.3.

Table E1.2: Accidents related to DCM-based Paint Strippers recorded by the Angers Poison Centre (France)				
1997				
Severity	**Sex/age**	**Products**	**Symptoms**	**Remarks**
Severe	M / 41y	Decalaminor (DCM + formic acid + phenol). Cutaneous and inhalation	Skin burns 2nd degree 15%, coma, metabolic acidosis. COHb max 6.8% at H8 (non smoker)	Workplace accident. Tracheal intubation, ventilatory support. Hospital stay 20 days
Severe	M / 33y	DCM. Paint remover inhalation. High pressure aerosol	Coma, pulmonary oedema, cardiac arrhythmias, COHb max 17.8%	Workplace accident. Ventilatory support. 4 days in intensive care unit.
Severe	M / 21y	DCM paint remover inhalation high pressure aerosol	Coma, pulmonary oedema, respiratory and cardiac failure, ventricular fibrillation	Workplace accident, death before hospital admission
Moderate	M / 29y	Decalaminor (DCM + formic acid + phenol) Cutaneous and inhalation	Skin burns first degree 25%, keratitis, COHb 2.8% (non smoker)	Workplace accident
Moderate	M / 31y	Decapant surpuissant (DCM 50% + phenol 24%)	Skin burns 20 cm^2	Workplace accident. hospital stay 2 days
Moderate	M / 26y	Décapant very strong (DCM and hydrofluoric acid 1%)	Finger burns	Workplace accident. Treatment 4 days at home
Moderate	M / 39y	Decapex (DCM 80% and ethanol 10%)	Skin burns first degree	Workplace accident, hospital stay 1 day
Minimal	M / 45y	Paint remover (DCM + methanol 5%)	Dizziness	DIY accident
Minimal	M / 31y	Decapnet (DCM + methanol) inhalation	Throat pain	DIY accident
Minimal	M / 34y	Decapant Diamantine (DCM) inhalation	Minor respiratory symptoms	DIY accident
Minimal	M / 26y	Alrey FC 90 (DCM 28% + isobutyl acetate 5% + white spirit). Ingestion	Dizziness, epigastric pain, COHb 6.8% (smoker)	Workplace accident, hospital stay 1 day
Minimal	M / 53y	Graffiti remover (DCM + phenol + formic acid)	Skin burns 5%, corneal irritation, COHb 1%	Workplace accident
Minimal	F / 44y	Decapex (DCM + methanol)	Dermal irritation	DIY accident
Minimal	M / 24y	Decolpint (DCM + acetic acid + formic acid).	Skin burns of the foot.	Workplace accident.
Minimal	F / 36y	Decap'facades (DCM) inhalation without mask	Dizziness, nausea, COHb 3.7 % (non smoker) plasma ethanol = 0	Workplace accident
Minimal	M / 31y	Paint remover (DCM + methanol) inhalation	Dizziness, nausea, abdominal pain	DIY accident

Table E1.2: Accidents related to DCM-based Paint Strippers recorded by the Angers Poison Centre (France)				
Minimal	M / 22y	DCM. Paint remover ocular route	Corneal irritation	Workplace accident
Minimal	F / 29y	Decapant 255 G (DCM + methanol) cutaneous	Skin irritation	DIY accident
1998				
Severity	**Sex/age**	**Products**	**Symptoms**	**Remarks**
Moderate	M / 24y	DCM inhalation	Dizziness, loss of consciousness, nausea vomiting, COHb 8.4%	Workplace accident. Hospital stay 1 day
Moderate	M / 27y	EPOXY 30 BS (DCM 71% + formic acid 5% + monochloroacetic acid 11%) cutaneous	Skin burn first degree 1%, keratitis, corneal oedema and ulcerations	Workplace accident. Hospital stay 5 days
Moderate	M / 41y	GELCIM T (DCM + methanol) inhalation of 30 kg used for paint stripping	Headache and inebriation, dizziness, COHb 18.5%	Workplace accident. Hospital stay 1 day
	M / 45y		Headache and inebriation, dizziness, COHb 14%	
	M / 24y		Headache and inebriation, dizziness, COHb 11.2%	
	M / 44y		Headache and inebriation, dizziness, COHb 12.8%	
	M / 40y		Headache, COHb 5%	
	M / 35y		Headache, COHb 8.5% (smoker)	
Minimal	M / 18y	DCM	Skin burn first degree of hands	Workplace accident. Medical consultation
Minimal	M / 19y	Decapex (DCM + methanol) used without gloves	Skin irritation	DIY accident
Minimal	M / 24y	Gramasol (DCM + formic acid) cutaneous contact 1 hour	Skin burn forearm 6 cm, secondary infection	Workplace accident
Minimal	F / 30y	Paint stripper (DCM) brief inhalation	Headache, COHb <2%	Workplace accident. Medical consultation
Minimal	F / 32y	Paint stripper (DCM) brief inhalation	Nausea, headache, COHb <2%	Workplace accident. Medical consultation
Minimal	M / 33y	V33 Super décapant, (DCM) gloves with holes	Finger burns	DIY accident
Minimal	M / 35y	Methoklone (DCM 94%) cutaneous + inhalation	Skin irritation, headache,	Workplace accident. Hospital stay 1 day

Table E1.2: Accidents related to DCM-based Paint Strippers recorded by the Angers Poison Centre (France)				
Minimal	F / 37y	Paint stripper (DCM) cutaneous	Skin burn of forearm, Phlyctena	Workplace accident. Medical consultation
Minimal	M / 40y	Condor decapant extra fort (DCM 82% + methanol 12%)	Skin irritation, erythema	Workplace accident
Minimal	M / 44y	Strip iso verre (DCM 60% + phenol 5% + hydrofluoric acid 4%)	Skin burns of fingers	Workplace accident. Treatment by calcium gluconate gel
Minimal	M / 35y	Veritt paint remover (DCM +methanol) ocular	Conjunctivitis	DIY accident
Minimal	M / 10 y	Graffiti remover (DCM) in aerosol, oral route	Vomiting	Home
Minimal	F / 44y	Decapex (DCM + methanol)	Phlyctenas et skin irritation of hands	DIY accident
	M / 26y	DCM + formic acid + HF. Worn gloves	Finger burns	Workplace accident. Treatment 7 days
Minimal	M / 24y	DCM, high pressure ocular	Ocular pain	Workplace accident
Minimal	F / 22y	V33 superdecapant (DCM). Paint stripping without gloves	Skin irritation	DIY accident
1999				
Severity	**Sex/age**	**Products**	**Symptoms**	**Remarks**
Moderate	M / 24y	REGOR CAP (DCM + methanol 10%) Inhalation	Headache, dizziness, tinnitus, COHb 2.3% max H6.	Workplace accident. Hospital stay 1 day
Minimal	M / 44y	DCM 90% + HF 2% cutaneous route	Skin burn of fingers	Workplace accident. Medical consultation
Minimal	F / 25y	DCM, short inhalation	Throat irritation	Workplace accident
Minimal	M / 48y	DCM, inhalation	Asthenia, headache, vomiting nauseas, erythema, COHb 1% at day 3	Workplace accident. Hospital stay 1 day
Minimal	M / 50y	DCM + phenol + methanol	Erythema	Workplace accident. Medical consultation.
	M / 42y			
Minimal	M / 36y	DECAPEX (DCM), cutaneous, right hand	Crumpled skin	DIY accident
Minimal	F / 22y	DCM cutaneous		Workplace accident
Minimal	M / 25y	DCM cutaneous	Skin burn of forearm, erythema	Workplace accident. Medical consultation and decontamination
Minimal	M /2.5y	DCM + methanol 9%, cutaneous	2nd degree skin burn of chest	DIY. Medical consultation

Table E1.2: Accidents related to DCM-based Paint Strippers recorded by the Angers Poison Centre (France)				
Minimal	M / 25y	DCM cutaneous and inhalation	Erythema face and hair	Workplace accident. Hospital stay 1 day
Minimal	M / 27y	Décapant super (DCM + HF) Working without gloves	Insomnia, finger burns	Workplace accident. Medical consultation
Minimal	M / 34y	Décapant super (DCM + HF) Working without gloves	Insomnia, finger burns	Workplace accident. Medical consultation
Minimal	M / 46y	DCM, inhalation (working without mask)	Inebriation, cough, COHb?	Workplace accident. Medical consultation
2000				
Severity	**Sex/age**	**Products**	**Symptoms**	**Remarks**
Moderate	M / 26y	Decapant 802 (DCM 84%, HF1 %) without gloves	Skin burns of hands	DIY. Medical consultation, calcium gluconate, surgical nail excision
Minimal	M / 33y	SNODEX (DCM) cutaneous	Erythema	Workplace accident. Medical consultation
Minimal	M / 18y	DCM + methanol – cutaneous	Phlyctenas	Workplace accident. Medical consultation
Minimal	F / 34y	Decapant neutre (DCM) ocular	Conjunctivitis	DIY accident
Minimal	M / 30y	Decapeint (DCM + methanol)	Burns of hands	DIY accident. Medical consultation
Minimal	F / 50y	Decap'L (DCM) aerosol inhalation	Vomiting, dizziness, COHb 5% H24	DIY. Medical consultation
Minimal	M / 36y	DCM aerosol ocular	Conjunctivitis	Workplace accident
Minimal	M / 12y	Decap extra fort (DCM + methanol)	Conjunctivitis	Accident at home
Minimal	M / 15y	DCM - cutaneous	No symptom	
Minimal	F / 25y	DCM	Conjunctivitis	Medical consultation
2001				
Severity	**Sex/age**	**Products**	**Symptoms**	**Remarks**
Severe	M / 80y F / 80y	Paint remover (DCM) applied on exterior walls of their house. Pollution of indoor air by mechanical ventilation	Dizziness, nausea, COHb 19.8 %	Air pollution. Hospital stay 1 day. Oxygen therapy
Severe	M / 50y	DCM + methanol + trichloroethylene used in cellar.	Loss of consciousness, inebriation, COHb 25%. Trichloroacetic acid in urine 26 mg/g creatinine	DIY accident. Hospital stay 1 day oxygen therapy. No other cause of CO poisoning in the cellar
Moderate	M / 40y	Inhalation, DCM + methanol	Skin erythema, dizziness, tachycardia,	Workplace accident, oxygen therapy,

Table E1.2: Accidents related to DCM-based Paint Strippers recorded by the Angers Poison Centre (France)				
			inebriation, excitement, COHb 21%	hospital stay 1 day
Moderate	M / 21y	Tecs Vitcap (DCM + formic acid + monochloroacetic acid). No gloves	Skin irritation, headache, paraesthesia. COHb 8%. Non smoker	Workplace accident. Hospital stay 1 day
Moderate	M / 3 y	DCM, eye contact	Conjunctivitis, keratitis; corneal oedema and ulcerations, decreased eyesight	Workplace accident. Several ophthalmologist consultations
Moderate	M / 25y	DCM, eye contact	Keratitis, corneal ulcerations	DIY accident. Medical consultation
Minimal	M /16y	Paint remover DCM, spilled into the shoe	Phlyctena	Workplace accident
Minimal	M /27y	DCM aerosol, ocular	Conjunctivitis	Workplace accident. Medical consultation
Minimal	M /38y	DCM	Conjunctivitis	DIY accident
Minimal	M /33y	DCM	Conjunctivitis	Workplace accident. Medical consultation
Minimal	F / 30y	DCM, no gloves	Skin irritation	DIY accident
Minimal	M /31y	Progal S 88 (DCM + monochloroacetic acid). Short cutaneous contact	1st degree burn of hand	Workplace accident. Medical consultation
Minimal	M / 41y	Paint remover (DCM 90%+ formic acid 5%)	Skin irritation	Workplace accident. Medical consultation
Minimal	F / 23y	DCM	Conjunctivitis	Workplace accident
Minimal	M / 20y	DCM +phenol	Skin irritation	workplace accident
Minimal	F / 37y	DCM ocular	Conjunctivitis	Workplace accident
Minimal	F / 30y	Paint remover DCM + methanol	Conjunctivitis	DIY accident
Minimal	M /42y	Paint remover (DCM 60% phenol 25%).	Skin irritation, conjunctivitis, COHb 0,3% at H6	Workplace accident
Note: See Table E1.4 for a summary of accidents from the Angers Poison Centre for the years between 2002 and 2006.				

Table E1.3: Accidents reported by the Angers Poison Control Centre (France, 1997-2001)			
Types of Exposure Associated with Accidents			
Exposure route		**Number of cases of intoxication**	
Cutaneous		35	
Ocular		15	
Cutaneous + ocular		2	
Inhalation		21	
Cutaneous + inhalation		5	
Chemical Substances Associated with Accidents			
Products		**Cases of Intoxication (n)**	
DCM		17	
DCM + methanol + paraffin		29	
DCM + ethanol + paraffin		3	
DCM + formic acid		7	
DCM + acetic acid		1	
DCM + phenol		7	
DCM + monochloroacetic acid		6	
DCM + hydrofluoric acid		6	
DCM + white spirit		2	
Types of Symptoms Associated with Accidents			
Symptoms	**Frequency (n)**	**Symptoms**	**Frequency (n)**
Cephalalgias	6	Renal insufficiency	0
Intoxication	8	COHb increase	13
Short loss of consciousness	2	Irritation of throat	3
Coma or convulsions	4	Cutaneous erythema	20
Ear ringing, ataxia	8	1st degree burn	17
Pulmonary oedema	2	2^{nd} degree burn	2
Arrhythmia supraventricular	1	Phlyctens	5
Ventricular arrhythmia, FV	3	Aspect of hardened wrinkled skin	2
Disturbed re-polarisation	2	Conjunctivitis	14
Metabolic acidosis	4	Keratitis, corneal ulcerations disturbed re-polarisation	6
Biological hepatitis	1	Vision reduction	2
<u>Severity of Accidents</u>			
Severity	**Cases (victims)**	**Hospitalisation**	
Severe	5 cases (8 victims)	1 to 20 days. **1 death**	
Moderate	13 cases (15 victims)	1 to 5 days (average 1.8 days)	
Minor	60 cases (65 victims)	2 hospitalisations for 1 day; consultations for the others	
Source: French Ministry of Labour, 2006a			

Table E1.3 also shows the substances associated with different cases of intoxication and the severity of the accidents. DCM is associated with alcohols, acids or solvents in more than 75% of the cases. The symptoms experienced by the victim depended on the exposure route. Generic symptoms were only observed in inhalation or massive cutaneous exposures. There were no cases of ingestion among the data presented by the Angers Poison Control Centre. Five example cases are discussed in the boxes below.

Example case 1: File 98-13335

Six builders aged 24 to 45 years were made responsible for stripping the paint off a large room in a building and coat the walls with a brush. They were in an enclosed space and were protected by masks made from cardboard. After having used 30kg of the GELCIM T gel (DCM, methanol), they showed signs of cephalalgias, instability, and intoxication. Three hours after admission into hospital, their proportions of venous COHb varied between 8.5% and 18%. The builders were all given a 24 hours oxygen treatment; they were cured.

Example case 2: File 97-12337

Two workmen aged 21 and 33 years were made responsible for paint stripping the interior of a water tower using a product containing DCM and a hydrocarbon type white spirit by karsher pulverisation. The masks they were using were not functioning very well, which caused them to remove them on several occasions. 30 minutes into their job, the workmen felt faint and so they went to get some air at the top of the water tower, after which they went back to work. 30 minutes later they were found unconscious by another worker. The doctor detected convulsions, a state of shock, and a bilateral OAP in both victims. Both patients were incubated and given oxygen. The 21 year old died of an OAP, shock, circulatory arrest and recurring ventricular fibrillations. The 33 year old showed signs of re-polarisation problems at the ECG (myocardic ischaemia), coma and disturbed ventricular rhythm. There was a metabolic acidosis, COHb 6% at admission then 18% with H6 in pure oxygen ventilation then 6% with H24. Within three days he recovered without any hepatic or renal complications.

Example case 3: File 97-2903

Two workmen aged 41 and 29 years were victim of projectile release from a product in a tank (Decalaminor DCM 65%, phenol 23%). They were immediately showered and decontaminated by firemen without any ocular rinsing. They had 2nd degree burns on approximately 15% of the body surface, especially around the face and chest, an obnubilation, laryngeal ailments and coughing from one of the workmen who was incubated. A cutaneous decontamination by PEG 4000 was carried out at the hospital because of the presence of phenol in the stripping solution. Keratitis was observed on both victims. On a biological level, there was a minor metabolic acidosis and the carboxyhaemoglobin was at 8% of the maximum; this is considering the fact that early on they were given an oxygen treatment (non smokers). No hepatic or renal complications were observed over the course of the three days these patients were treated with N-acetylcysteine. The treatment for burns required 8 and 10 days of hospitalisation.

Example case 4: File 32109

An 80-year-old couple asked an approved company to repaint the external wooden walls of their house. The walls were stripped in a day with DCM in gel form; the couple remained in the house with all doors and windows closed. That evening they showed signs of nauseas and asthenia. The next morning, when they woke up, they showed signs of cephalalgias, ataxia, asthenia, and confusion; it was at this point that the painter discovered them and could sense a strong smell of solvent odour in the house. That same morning at the hospital, their proportions of COHb were 18% and 19%, and no signs of clinical or electric coronary signs were shown. They left the hospital after 24 hours of oxygen treatment. The medical investigation of the residence did not find any source of CO or any apparatus with combustion. The only assumption was that they were intoxicated by DCM, which would have diffused into the inside of the house.

Example case 5: File 39219

A builder from a small company was given the task of stripping pieces of wood by dipping them into a bath of DCM and methanol. Although he performed this job for several years on a regular basis, one morning he worked

without his mask. This caused him to faint around midday and receive a projection on the face. He was admitted to hospital around 2pm by which point he was agitated, had tachycardia, and an erythema on the chin and cheekbones. There were no signs of coronary defects. A COHb test was performed, which came back as 21% positive; this level remained stagnant for the following four hours. The next day at midday, the level had decreased by 4% after 24 hours of oxygen treatment, which then decreased to 4% the following day at midday after 24h from oxygenation. An air vent has since been installed.
Source: French Ministry of Labour, 2006a

Discussion of Statistical Analysis of Results

An analysis made available to RPA by the French Ministry of Labour (2006a) emphasises the fact that intoxications from DCM are not a rare occurrence. The data from Angers show that the majority of accidents are predominantly of minor severity, in both DIY and professional/industrial accidents. On the other hand, moderate or severe accidents caused by direct or indirect (air pollution) exposures were more predominant in cases of professional (occupational) activities rather than DIY use of DCM-based paint strippers.

Skin exposure: The majority of accidents in this research are skin burns. Their severity is mainly linked to the spread of the burn on the injured surface and to the timing at which rinsing with clear water took place. Although the lesions last less than 10 days, they can be very painful for the first few days. The paraffin in certain stripper gels can limit the effectiveness of rinsing with clear water, thus prolonging the rinsing time. A particular aspect of wrinkled skin on an erythema was observed twice, but this could be the result of a mistaken diagnosis between the burns caused by dimethylformamide or N-methyl-2-pyrrolidone. Topical burns on hands or small surfaces do not result in systemic symptoms. Only two victims from this data series that incurred burns from DCM covering 15% of their body surface had obvious signs of intoxication. The risk of general intoxication via the percutaneous way was recently reinstated, although the associated inhalation or ingestion cannot be conclusively excluded (Weber *at al*, 1990).

Ocular exposure: Ocular projections result in conjunctivitis, which can be quickly treated but cause corneal ulcerations. An oedema of the cornea can be observed as well as a decrease in vision in the event of delayed rinsing. An ophthalmologic consultation is advised if the ocular signs persist after rinsing or if there is a decrease in vision.

Inhalation exposure: The accidents by prolonged inhalation, especially in an enclosed atmosphere and without a suitable mask are the main reasons for the most severe systemic intoxications. Inhalation is a very good way for absorbing DCM; this also quickly sets off systematic symptoms from the solvent such as giddiness, nausea etc. The neurological signs of a severe intoxication include the loss of consciousness, confusion, coma and convulsions. These neurological signs are caused by the solvent but are also the result of its metabolite, carbon monoxide.

Metabolism issues: The biological marker of this intoxication can result from the doses of DCM detected in the blood, but is predominantly due to the levels of carboxyhaemoglobin. The work of Stewart in 1972 was the first to acknowledge that the

effects of DCM are metabolised into carbon monoxide by the P450 cytochrome; carbon monoxide concentrations increase during the 4th and 8th hour in the event of important exposure. The consequences of this endogenous production of CO are more important than those of the traditional intoxications with carbon monoxide for the same oxycarbonaimia. This is because the tissues produced from CO concentrations have a higher significance than the carboxyhaemoglobin doses. Moreover, the cytosolic metabolisation also leads to formaldehyde and the formic acid as well as intermediary metabolites that are capable of nucleophilic acylation. This would explain the acidosis and the visceral neurological, hepatic, pancreatic or renal attacks (Ahmed *et al*, 1980).

Strasbourg Poison Control Centre

According to the results of the ECSA survey (2002a), this Poison Control Centre reported two observations:

- ***in 2000***: man - 28 years old - inhalation and dermal exposure to DCM in a coffee production industry - consciousness loss - recovery - Blood concentration of DCM : 24mg/l - Carbon monoxide in blood : 0%; and

- ***in 2001***: man -17 years old - consciousness loss after one hour of utilisation of a paint stripper (methanol and DCM). Recovery - COHb on admission in the intensive care unit: 1.7% (H2). COHb 8 hours after exposure: 6.6%.

E1.6.2 Data from Consultation with the French Authorities

Overview of Data Collected in August-September 2006

The French Ministry of Labour has provided an overview of data on accidents from a wider area rather than just for the Angers Poison Control Centre discussed in the ECSA report. Since 1990, at least 5 fatalities of employees involved in professional uses have been described in France (French Ministry of Labour, 2006a):

- in 1990: a 38-year old painter found dead after applying a stripping gel with hand brush inside a water tower;
- in 1992: a 55-year old man in charge of applying water-tightness product inside an indoor swimming pool;
- in 1994: a 44-year old paint stripper found lying over a tank of liquid containing more than 50% of DCM;
- in 1997: a 47 year old man after an overflow of a tank; and
- in 1997: a 35-year-old paint stripper lying near an open stripping fluid storage (200 litres container).

Seven other serious accidents are recorded in the EPICEA database. The common factor of these casualties seems to be a lack of aeration of the room or a massive exposure (overflow, large storage tank, etc.).

Detailed Analysis of Data Collected in August-September 2006

The French Ministry of Health organised the collection of information on accidents relating to exposure to DCM-based paint strippers following a request from RPA. Furthermore, on 24 August 2006, the French Directorate-General of Health solicited the co-ordinating committee of toxicovigilance as a means of obtaining data on the number of cases of intoxications related to the use of paint strippers containing DCM received by Poison Control Centres (centres of anti-poison and toxicovigilance - CAPTV).

An analysis of the national database of the products and compositions (BNPC) of the Information System of the Poison Control Centres (Système d'information des centres antipoison - SICAP) was carried out in order to obtain the list with the composition for the preparations containing DCM that were available in the BNPC on the 31/08/2006. From this list, a cross-examination of the intoxication cases from the national database (BNCI) of the SICAP was performed on the 13th September 2006 to help identify the number of people exposed to, and the deaths related to paint strippers containing DCM.

The BNCI currently includes data from the CAPTV of Paris and Angers dating back to July 1999 and from the CAPTV of Nancy from 2004. All in all, the files which were dealt with by the anti-poisons centres of Angers, Nancy and Paris represent approximately a third of all the notifications in the ten French anti-poisons centres.

As the Ministry has advised, as a result of the relatively short time for response, a cross-examination was not performed on all the local databases from anti-poison centres.

The number of people exposed to paint and varnish strippers containing DCM per annum and for each of the three Poison Control Centres for which the BNCI had data for is presented in Table E1.4 below. In addition, Table E1.4 also comprises the total number of cases per annum per Poison Control Centre.

Table E1.4: Number of People Exposed to DCM-based Paint Strippers in France (1999-2006)

Year	CAPTV Angers	CAPTV Paris	CAPTV Nancy	No. of DCM cases	Total no. of cases
1999	11	12	-	**23**	**22,201**
2000	29	21	-	**50**	**53,118**
2001	33	23	-	**56**	**52,224**
2002	28	24	-	**52**	**54,459**
2003	37	22	-	**59**	**52,823**
2004	38	20	2	**60**	**56,280**
2005	30	15	5	**50**	**60,544**
2006	18	12	3	**33**	**35,740**
Total	***224***	***149***	***10***	***383***	***387,389***

Source: French Ministry of Labour, 2006a

Table E1.5 below indicates the number of people exposed to paint and varnish strippers containing more than 50% DCM, per annum and for each of the three Poison Control Centres; only three cases of intoxication were listed for paint removers containing less than 50% DCM (one case <10%; and two cases between 10 and 50%). **Two deaths** were reported by the Poison Control Centre of Angers in 2002 and 2005 relating to paint removers containing more than 50% DCM.

Table E1.5: Distribution of the Number of People Exposed to DCM-based Paint Strippers containing more than 50% of DCM

Year	CAPTV Angers	CAPTV Paris	CAPTV Nancy	No. of DCM cases
1999	11	12	-	**23**
2000	29	20	-	**49**
2001	32	23	-	**55**
2002	28	24	-	**52**
2003	37	22	-	**59**
2004	38	20	2	**60**
2005	30	15	5	**50**
2006	17	12	3	**32**
Total	***222***	***148***	***10***	***380***

Source: French Ministry of Labour, 2006a
Note: We assume that the term "people" refers to both consumers and occupational users.

Data from the Bordeaux Poison Control Centre

Following direct communication with the Bordeaux Poison Control Centre, data were collected for the years 2000 to 2005; the Centre covers 4.6 million inhabitants (Bordeaux Poison Control Centre, 2006). Among the recorded accidents there are the following two cases of severe intoxication:

- in 2001, a 45-year-old man had undertaken paint stripping for 3 months without particular protection. He complained for respiratory problems and gastric burns; medical consultation followed as well as symptomatic treatment and cure after introduction of personal protection measures; and

- in 2002, a 34-year-old man used a DCM-based paint stripper without a protective mask during a whole day. He was hospitalised for 48 hours in the Pneumonology Department with a feverish pneumonopathy; recovery ensued.

E1.7 Accident Data from Germany

E1.7.1 Data from the ECSA Survey (ECSA, 2002a)

Göttingen Poison Control Centre

Information provided by the University of Göttingen for North Germany is presented in Table E1.6.

Table E1.6: Cases of DCM Exposure at the GIZ-Nord Poison Control Centre (Germany, 1996-1999)

Year	Symptom severity					Number of DCM-related cases	Number of all cases
	Severe	Moderate	Minimal	No symptoms	Unknown		
1996	2 (a)	1 (b)	6	1	4	14	14,034
1997	1 (c)	3 (d, e, f)	4	3	4	15	18,065
1998	1 (g)	0	5	1	2	9	20,080
1999		0	0	1	2	15	22,393

Source: ECSA, 2002a

Remarks on severe or moderate cases:

a) DCM as extraction medium for coffee production, inhalation, 2 adult men at workplace: strong COHb, HBO therapy (no data on symptoms);

b) paint stripper inhalation, adult man: vomiting, headache, breast pain;

c) paint stripper inhalation at home: throat paint, dyspnoea 33 h after use, tracheotomy;

d) paint stripper inhalation, adult man at home: patient found comatose, paint stripper spilled on floor, healing without residual damage;

e) unknown product type, man 27 yr at workplace: DCM spilled on floor, adult patient, weakness, headache, vertigo;

f) unknown product type, DCM high pressure injection into hand, man 41 yr at workplace: pain, inflammation; and

g) paint stripper, inhalation, man 53 yr at workplace: cardiac arrest, reanimation, brain oedema.

Berlin Poison Control Centre

Berlin is the largest poison centre of Germany (48,000 calls yearly) and has the most cases with paint strippers (few cases related to adhesives and aerosols). Due to restrictions in the use of chlorinated solvents, the number of cases has fallen dramatically in recent years and represents only a fractional amount of the total number of calls. The centre actively promotes the substitution of hazardous products.

Bonn Poison Control Centre

No cases involving DCM-based paint strippers.

Mönchengladbach Poison Control Centre

No incidents reported.

E1.7.2 Data from Consultation (1984 – 2006)

Information on accidents (including fatal ones) in Germany has been submitted from a variety of sources and is presented below. It is possible that there is some overlap in this information.

Information from the Bundesinstitut fur Risikobewertung (Federal Institute for Risk Assessment)

The Bundesinstitut fur Risikobewertung has registered information about accidents caused by chemicals or chemical products in a database since 1990. Under the keyword "paint strippers", there are cases collected not only related to DCM but also to different chemicals or the toxicological relevant substance may be unknown. The Bundesinstitut fur Risikobewertung has provided a list with all available detail and this is reproduced as Table E1.7.

The key points made by the Bundesinstitut fur Risikobewertung include the following:

- exposure to DCM **in general** without mentioned relation to paint strippers included 68 cases in the years 1990 to 2006;
- there are 104 cases registered in the period 1990 to 2006 as paint strippers in general; in these cases, the toxicologically relevant substance is mentioned but is mostly different from DCM (for example, formic acid or hydrofluoric acid) or it is unknown;
- out of these 104 registered accidents, there are 6 cases with paint strippers in which DCM is exactly notified as the toxicologically relevant substance. This information is mostly based on the relevant medical reports, so the Bundesinstitut fur Risikobewertung holds limited details about the circumstances under which the accidents occurred;
- the Bundesinstitut fur Risikobewertung registered one fatality caused by a DCM-based paint stripper (**workplace related**) in the year 2002; and
- in general, the reported accidents **are mainly workplace-related**. Out of the 104 accidents linked to paint strippers, **only 4 cases are consumer-related**.

Table E1.7: Data on Accidents related to "Paint Strippers" in Germany (1990-2006)

Year of registration	Number of cases	Degree of symptoms	Tox. relevant substance	Way of intoxication	Type of use
1990	1	1 moderate	DCM	Inhalation	Consumer
1992	1	**1 severe**	DCM	Inhalation	Consumer
1993	1	1 moderate	?	Inhalation	Consumer
1996	2	1 light, **1 severe**	Hydrofluoric acid	Symptoms: skin/eye	Workplace
2000	10	5 light, 5 moderate	1 light: DCM - others: ?	Skin	Workplace

Table E1.7: Data on Accidents related to "Paint Strippers" in Germany (1990-2006)					
Year of registration	**Number of cases**	**Degree of symptoms**	**Tox. relevant substance**	**Way of intoxication**	**Type of use**
2000			1 mod: formic acid,	Skin	Workplace
2001	27	24 light, 3 moderate	11ight: DCM - others: ?	Inhalation	Workplace
2002	19	17 light, l moderate, **1 fatal**	11ight: DCM - others: ?	Inhalation	Workplace
2002			**Fatal:** DCM	Skin/inhal.	Workplace
2003	10	9 light, l moderate	?	Mod.: inhal.	Workplace
2004	9	9 light,	?	Inhalation	1 x consumer
2005	15	15 light	?	?	Workplace
2006	9	8 light, 1 moderate	?	Mod: eye	Workplace

Source: Bundesinstitut fur Risikobewertung, 2006a
Notes:
- *light symptoms: remitting spontaneously;*
- *moderate symptoms: longer lasting and need of medical care but no lasting defect;*
- *severe: life-threatening symptoms and or lasting defects;*
- *fatal: fatality.*

With regard to the severity of the accidents, the following information has been provided:

- within the total number of 104 registered accidents, 75 cases were associated with **light symptoms**. In these cases, the toxicological relevant substance is not obvious by searching the Bundesinstitut fur Risikobewertung database. It can be assumed that among those there are cases related with DCM-based paint strippers, so the total amount of registered accidents related to DCM paint stripper would be higher than the above shown number of six;

- details about the **severe accidents** related to the use of DCM-based paint strippers are available:

  - 1990: 32 year old man, consumer, inhaling of DCM fumes; symptoms: difficulty in breathing, headache, eye irritation; restitution without lasting defect; and

  - 1992: 31 year old man, consumer, inhalation; symptoms: headache, nausea, vomiting; neuropathy as lasting defect; and

- the only one **fatal accident** is reported in the box below as a special case report, published in the annual brochure of the Bundesinstitut fur Risikobewertung in 2002 "Cases of Poisoning Reported by Physicians".

Example case: Fatal Accident reported by the Bundesinstitut fur Risikobewertung in 2002

In the context of his occupation as a painter, a patient aged 66 had been using a paint stripper containing 92% DCM and <10 % formic acid over periods of several hours for more than three days in an unventilated room (ca. 15 x 25 x 5 m). During such work, he did not continuously wear a protective mask. After a period of 11 days, the patient developed a global respiratory insufficiency with a lethal outcome. The safety at work regulations had not been adhered to since the accident investigation report stated that although the patient had received a protective mask, he did not always wear it. In addition, the safety regulations require wearing of a self-contained respirator in case of exposure over extended periods. The protective gloves, which the worker had received, were replaced with leather gloves after a very short period. Therefore, it has been assumed that the total exposure had exceeded the (then) fixed limit concentration of the substance in workplace air (100 ppm = 350 mg/m^3).

Information from the Berufsgenossenschaft der Bauwirtschaft

We have been provided with an account of fatal and non-fatal accidents in the workplace that have occurred between 1984 and 2006 in Germany and which have been associated with the use of DCM-based paint strippers. These are presented in Table E1.8.

Table E1.8: Statistical Data on Accidents involving DCM-based Paint Strippers in Germany (1984 – 2006)

Composition of paint stripper	Victims	Year	Source
70% DCM, 10% methanol, 10% xylene	1 injured	1984	Bau BG, Frankfurt
70% DCM, 10% methanol, 10% xylene	1 injured	1985	Bau BG, Frankfurt
Contains DCM (unknown concentration)	1 injured	1985	Württ. Bau BG
Over 70% DCM	**1 fatality**, 1 injured	1985	BG Glas und Keramik
Contains DCM (unknown concentration)	2 injured	1988	Südwestl. Bau BG
77% DCM, 8% isopropyl alcohol, 5% benzyl alcohol, others	**1 fatality**	1989	Bau BG Hannover
	1 fatality		
90% DCM, 5% methanol	**1 fatality**	1990	Literature
Contains DCM (unknown concentration)	**1 fatality**	1992	Masch BG
50–100% DCM, 10–25% ethanol, butyl alcohol	1 injured	1997	Bau BG Hannover
50–100% DCM, 10–25% 2-propanol, butyl alcohol	1 injured	1997	Bau BG Hannover
50–100% DCM, 10–25% 2-propanol, butyl alcohol	**1 fatality**	1998	Bau BG Hannover
50–100% DCM	1 injured	1999	BG Bau Frankfurt
84% DCM and alcohol	**1 fatality**	2000	Literature
92% DCM, 1–10 % formic acid	**1 fatality**	2002	Tiefbau-Berufsgenossenschaft
Over 70% DCM	2 injured	2004	Bau BG Rheinland und Westfalen
Over 70% DCM	1 injured	2004	Bau BG Hamburg
Contains DCM (unknown concentration)	1 injured	2004	RP Kassel
85–95% DCM, 4–5% methanol, 1–2 % butyl glycol	1 injured	2005	BG Bau, Hannover
Contains DCM (unknown concentration)	1 injured	2005	BG Bau, Wuppertal
Contains DCM (unknown concentration)	2 injured	2006	Sozialministerium Hessen

Source: Berufsgenossenschaft der Bauwirtschaft, 2006a

We have enquired about the possible links between the data presented by the Bundesinstitut fur Risikobewertung and the Berufsgenossenschaft der Bauwirtschaft. It appears that each institution has its own database without direct connection to each other. The reasons for the four fatalities presented above not appearing in the Bundesinstitut fur Risikobewertung data is that from the beginning of compulsory notification introduced by legislation in 1990 (first amendment to the Chemicals Act (ChemG)) until the year 2000, the Bundesinstitut fur Risikobewertung did not regularly receive information on workplace-related accidents. However, from year 2000 onwards, the number of notifications has increased. This was due to an agreement with the Berufsgenossenschaften der Bauwirtschaft (the professional insurance bodies in Germany responsible for occupational safety, health protection and accident insurance). According to this agreement, the Berufsgenossenschaften der Bauwirtschaft directly report all notifications on cases of acute health impairment after contact with chemicals or chemicals products to the Bundesinstitut fur Risikobewertung (Bundesinstitut fur Risikobewertung, 2006b).

Information from the Erfurt Poison Control Centre

In the last ten years (1996-2005), the Erfurt Poison Control Centre collected data for six incidents in which exposures to DCM from the use of DCM-based paint strippers occurred. No fatalities have been registered in that period. The total number of exposures registered in our poison centre is 88,100 for the years 1996 to 2005 (GGIZ Erfurt, 2006). The relevant information is presented in Table E1.9.

Table E1.9: Data on Accidents involving DCM-based Paint Strippers registered by the Erfurt Poison Control Centre (Germany, 1996-2005)

Medical History	Clinical Features	Advices of the PIC	Outcome
Painter; he worked few days for 8 h everyday; airway protection is unknown	During working nausea, headache, giddiness; normally symptoms were disappeared after the end of exposure until the next morning; at the time of call weakness and giddiness lasting longer than 24 h	Stop of exposure; fresh air and oxygen; control of carboxyhaemoglobin, methanol, and formic acid plasma levels; control and correct acid-base balance	Sequelae possible
Handyman; he worked for short time; contamination of the mouth, no ingestion	Burning sensation (oral mucosa)	Decontamination of mucosa; ingestion of indifferent fluid for washing-up and dilution	Unknown
Handyman; she worked two times (day 1 -7h; day 2 - 3h; interval 7 days) indoor (with open windows); she developed disease 12 day after the second exposure	Initial no symptoms; later (day 12 after last exposure) collapse caused by biliary colic; diarrhoea, hepatomegalia, metabolic acidosis, ammoniaemia, and increase of transaminases	Causality uncertain; symptomatic measures as in toxic hepatic injury	Unknown
Handyman; he worked outdoor without airway protection 3 hours before	Headache, irritation of airways	Stop of exposure; fresh air; no further measures	Unknown
Handyman; he worked for undefined times at weekend two days before	General malaise	Fresh air; symptomatic measures if necessary	Unknown

Table E1.9: Data on Accidents involving DCM-based Paint Strippers registered by the Erfurt Poison Control Centre (Germany, 1996-2005)			
Medical History	**Clinical Features**	**Advices of the PIC**	**Outcome**
Painter; he worked without airway protection the day before	During working nausea, giddiness, oppressive feeling, cardiac palpitation; symptoms disappeared after exposure spontaneously	Fresh air; symptomatic measures if necessary	Unknown
Source: GGIZ Erfurt, 2006			

Information from the Göttingen Poison Control Centre

During the years 1996-2005, the GIZ-Nord Poisons Centre in Göttingen was consulted in 85 cases regarding exposure to DCM, including 25 cases at the workplace. To put this into context, a total of 250,000 consultations were conducted within that period. No fatalities were reported and no further detail is available on the circumstances of the accidents (Giz-Nord, 2006).

Information on an Accident involving DCM and Formic Acid

During consultation with GIZ-Nord, information was supplied on an accident involving a DCM-based paint stripping formulation.

As reported by Sydow *et al* (2006), a healthy two-year-old boy intended to drink from an almost empty 10-litre container of a paint remover for professional use in his parents' professional workshop. According to label and safety data sheet the product contained 3.6% formic acid and 85% DCM. The boy tipped it over, thus contaminating the chest, the front side of arms and legs, lips, parts of the throat, nose and neck, but not the eyes. Only minutes after exposure clothes have been removed and the skin was carefully decontaminated using a shower. The patient was treated at the University Hospital of Göttingen. Within the next 24 hours, skin irritation developed on 40 percent of the body surface but neither signs of metabolic acidosis nor any toxic organ damage were observed. The boy was transferred to the burn injury treatment unit for children at Children's Hospital Park Schönfeld in Kassel. Clinical observation and histological analysis of a skin sample from day 2 showed epidermic necrosis but no damage of the dermis. Within a three-month treatment period at the hospital the patient received two split skin transplants. No severe complications developed during the treatment and one year of follow up observation.

The authors note that the labelling of the container was confusing (although they do not specify in which particular regard) and emphasise that simultaneous dermal exposures to 5.6% formic acid and DCM have caused severe skin corrosion without signs of systemic intoxication; synergistic toxic effects of the ingredients (and maybe the absence of water) may have caused severe symptoms (Sydow *et al*, 2006).

E1.8 Accident Data from Greece

E1.8.1 Data from Consultation

No accidents or fatalities have been reported and no exposure risk (allergy, asthma) appears when used under adequate ventilation. These products are mainly used between March and October, period of time where the weather in Greece is good and users can work with open windows (Greek General Chemical State Laboratory, 2006b).

E1.9 Accident Data from Hungary

E1.9.1 Data from Consultation

Although cases of intoxications by chemical agents are collected by the Hungarian National Institute of Chemical Safety, categories are wider than only one substance. DCM is in the category of organic solvents among several similar substances. Therefore, information specifically related to DCM cannot be derived (Hungarian National Institute of Chemical Safety, 2006).

E1.10 Accident Data from Iceland

E1.10.1 Data from Consultation

There were two reported incidents (accidents) in 2003 (one reported involving DCM, the other involving an unspecified paint stripper). One incident in 2004 involving DCM was also reported. No fatalities have ever been known (Icelandic Environment and Food Agency, 2006a).

E1.11 Accident Data from Ireland

E1.11.1 Data from the ECSA Survey (ECSA, 2002a)

Table E1.11 shows a summary of all cases relating to DCM-based paint strippers and to DCM more generally for the years 1999-2002. ECSA notes that most cases involving paint strippers relate to minor exposure in a domestic setting. Cases relating to DCM of unknown source tend to occur in the workplace. In both cases, symptoms are usually mild. The Dublin Poison Control Centre does not routinely follow up enquiries relating to this product so there is no information as to the outcome of the cases.

E1.11.2 Data from Consultation (2002-2005)

Consultation with the Irish Health and Safety Authority provided data that expand the list of observations presented in Table E1.11. Table E1.10 covers the remainder of 2002 and reaches up to September 2005.

Table E1.10: Data on Exposure to Products containing DCM in Ireland (2002-1995)						
Date	**Product**	**Age**	**Circumstances**	**Location**	**Severity**	**Outcome**
23/03/02	DCM	?	Accidental Inhalation	Home	Minor	Not followed up
25/03/02	DCM	38	Accidental Inhalation	Home	Minor	Not followed up
06/03/03	DCM	15	Intentional Inhalation	Residential Care	Unknown	Not followed up
12/08/04	DCM	Adult	Inhalation	Workplace	Minor	Not followed up
16/07/04	DCM	16	Inhalation	Workplace	Unknown	Recovered
03/11/04	DCM	37	Inhalation	Home	Minor	Not followed up
04/03/05	DCM +acid + Et_3N	19	Inhalation	School	Minor	Not followed up
13/09/05	Renovic (DCM)	22	Skin Contact	Workplace	Minor	Not followed up
Source: Irish Health and Safety Authority, 2006a						

Ireland's main manufacturer of DCM-based paint strippers operates a Technical Support Line and has indicated that no health and safety issues have been reported to him in relation to his DCM-based paint stripper products.

Overall, there have been no reported fatalities associated with the consumer use of DCM in paint strippers on the Irish market. Also, the Irish Health and Safety Authority does not have any reported fatalities due to DCM-based paint strippers in their database of workplace fatalities (Irish Health and Safety Authority, 2006a).

Table E1.11: Incidents relating to DCM (Ireland, 1999-2002)				
Incidents relating to DCM-based Paint Strippers				
Year	**Age**	**Sex**	**Circumstance**	**Symptoms**
1999				
(4 cases out of 14,654)	Adult	F	Domestic use. Small amount splashed onto hand.	Temporary paraesthesia on hand
	Unknown	F	Domestic use. Splashed into eye	Asymptomatic
	13mths	F	Domestic use. Skin contact	Redness on skin, no discomfort
	Adult	M	Domestic use. Splashed into eye	Slightly red but not causing pain
2000				
(8 cases out of 14,389)	Adult	F	Domestic use. Splashed onto skin	Mild irritation soon after use
	13mths	F	Domestic use. Child licked paintbrush	Asymptomatic
	18yrs	M	Domestic use. Splashed onto hand	Stinging, red spots on hand
	13mths	F	Domestic use. Ingested "a few mls"	Redness around mouth, otherwise clinically well
	Adult	M	Used in workplace and splashed into eye	Asymptomatic
	Adult	M	Domestic use. Dripped onto hand from paintbrush	Open cuts on hand stinging. Asymptomatic after irrigation
	2yrs	M	Decanted into 7-Up bottle. Unknown amount ingested	Nausea, vomiting, abdominal pain
	1yr	M	Domestic use. Ingested "a few ml"	Patient admitted for 24 hr observation, COHb 1.3%
				Tummy upset 3 days but otherwise well
2001				
(4 cases out of 16,241)	19yrs	M	Decanted into coke bottle in workplace. 5-10mls ingested	Vomited immediately afterwards, otherwise well
	3yrs	M	Domestic use. Ingested "a few drops".	Crying but no irritation seen
	Adult	F	Domestic use. Splashed into eye	Asymptomatic
	Adult	F	Domestic use. Splashed onto eyelid	Eyelid is red but irrigated and no irritation in eye

Table E1.11: Incidents relating to DCM (Ireland, 1999-2002)				
Incidents relating to DCM-based Paint Strippers				
Year	**Age**	**Sex**	**Circumstance**	**Symptoms**
2002				
-	18mths	F	Toothbrush was used for painting; child licked off residue	Asymptomatic
Incidents relating to General Exposure to DCM				
1999				
(3 cases out of 14,654)	27yrs	F	Domestic use. Splashed into eye.	Asymptomatic
	21 yrs	M	"Anti-splatter liquid" used in work. Splashed into eye	Eye is red but not painful
	35yrs	M	Teacher in school lab. Splashed into face and eye	Blistering on skin and pain in eye
2000				
(4 cases out of 14,389)	24yrs	M	Accidentally inhaled in workplace	Chest-tightness but CXR clear
	11yrs	M	Using science kit and it splashed onto hand. Licked it off	Asymptomatic
	25yrs	F	Unknown circumstance. Eye contact	Conjunctival spotting
	23yrs	M	Splashed onto skin in workplace	Coma initially, then agitation & thrashing around
2001				
(2 cases out of 16,241)	Adult	M	Accidental inhalation in workplace	Neutropenia (but patient has haemochromatosis).
	Adult	M	Splashed onto skin in workplace	Irrigated immediately and asymptomatic
2002				
-	Adult	F	Querying effects of long-term occupational exposure	Chronic headache and nausea
	27yrs	M	Exposure to "Tar Dust" in workplace	URT irritation and persistent coughing for 2 days;
				put on steroids; asymptomatic at 4 days post exposure
Source: ECSA, 2002a				

E1.12 Accident Data from Italy

E1.12.1 Data from the ECSA Survey (ECSA, 2002a)

Milan Poison Control Centre

In 1997-1998, 220 phone calls related to suspected exposure to DCM, mainly in paint strippers. Detailed information was not obtained.

Rome Poison Control Centre

Among 13,125 phone calls in 2001, 42 were related to paint removers. Among them:

- 38 involved products with unknown name and composition *(acqua regia minerale*[1]/solvents/nitrocellulose thinners):
  - *20 cases concerned children*: 18 ingestion of small quantities, generally without or with very mild symptoms; 2 inhalation with mild symptoms; and
  - *18 cases concerned adults*: 10 ingestion of small quantities, of which 5 did not complain of symptoms and 5 of oesophagus burn, cough, dyspnoea, headache, tremors; 5 inhalation without or with very mild symptoms; 3 cutaneous contact with erythema; and
- only 4 involved products containing DCM:
  - 1 man, 30 years old, inhalation: dyspnoea;
  - 1 man, 48 years old, cutaneous and eye contact: erythema and ocular burn;
  - 2 men, 40 years old and 45 years old, inhalation: tremors; and
  - 1 man, 40 years old, inhalation: ocular burn.

Bergamo Poison Control Centre

Between 2000 and the middle of 2002, there were only two cases of incidents involving DCM:

- male, 31-year-old, accidental splash in one eye of paint stripper with DCM; symptoms: conjunctival hyperaemia, irritation; no corneal damage; treatment: ocular wash with normal saline, antibiotic cream; and
- male, 26-year-old, 3-hour inhalation exposure of paint stripper with DCM during normal use; symptoms: confusion, dizziness, nausea, vomiting, mild acidosis, low carboxyhaemoglobin (6.4%) in non-smoking patient; electrocardiogram, thorax radiography and laboratory analyses were normal; treatment: oxygen by mask, fluid

[1] Aqua regia, literally, "royal water", is an acid "capable of dissolving gold" which is prepared today by mixing a three-to-one ratio of hydrochloric acid and nitric acid.

infusion; spontaneous resolution of acidosis; discharged in good conditions after 3 days.

The year when these accidents took place is unknown, however, on the basis of the information that was obtained through consultation and is presented in Table E1.12, the second accident (involving the 26 year old male) could have been the accident referred to at the top of the table.

Trieste Poison Control Centre

No incidents with DCM or with any other type of paint stripper have been recorded.

E1.12.2 Data from Consultation

Bergamo Poison Control Centre

More recent information has been provided during consultation on eight incidents recorded by the Poison Control Centre of Bergamo and is presented in Table E1.12.

Table E1.12: Accidents from the Poison Control Centre of Bergamo								
Date	**Age/ gender**	**Hospitalisation**	**Type of product**	**Relevant**	**Location**	**Exposure type**	**Symptoms**	**Description**
03/03/2002	26, M		Paint remover	DCM	At home	Inhalation		Patient exposed to the vapours of DCM and MeOH
06/03/2002	27, M	Yes		DCM and mineral oils	Other	Inhalation		Pulmonary exam presently referred to as negative
10/01/2003	17, M		DCM	DCM	At home	Ocular	Minor cutaneous irritation	Affected the face from liquid paint remover when opening the packaging; washed the skin with water and soap, and washed abundantly the eye as well; irritation regressed already; further wash and application of chamomile eye drops
29/08/2003	31, F (pregnant)		Paint remover	DCM+ trichloroethylene	Industrial	Multiple	Cutaneous and otolaryngological irritation	3-month pregnant, she splashed her face and eyes while unscrewing the lid of the product; possible inhalation is mentioned. Advised to wash abundantly with running water and go for a visit to doctor del
04/05/2004	65, M	Yes	Paint remover	DCM	Industrial	Cutaneous	Burning of the eyelid	Splashed a drop of the product on upper eyelid warning with immediate burning. No ocular lesions.
27/04/2005			Hatron 3cl	Fluorinated hydrocarbons+DCM	Industrial	Inhalation	Oculist noticed: light lesion from corneal causticity Light hyperaemia in the affected area	Inhaled and splashed himself while decanting the product. Undressed immediately and decontaminated according to the indications seen on the cover of the product. At present asymptomatic, light hyperaemia in the affected cutaneous area.
26/07/2005	48, M	Yes	Paint remover semi-fluid	Methanol+ DCM	Industrial	Ocular	Hyperaemia	Advised to visit the oculist. Result: no corneal lesions, Tobradex therapy
06/06/2006	54, M	Yes	Paint remover	DCM	Industrial	Cutaneous	Irritation of face	When opening the packaging splashed the face with a few ml of the product; immediately washed
Source: Italian Ministry of Health (information submitted to DG Enterprise and Industry)								

E1.13 Accident Data from Lithuania

E1.13.1 Data from Consultation (1999-2005)

In 1999 State Quality Inspectorate (now known as the State Non Food Products Inspectorate under the Ministry of Economy) had received one complaint about intoxication concerned with incorrect labelling information on a paint stripper package (Lithuanian Environmental Protection Agency, 2006a).

According to the data from State Patient Fund under the Ministry of Health, in Lithuania, there were no reported incidents involving exposure to DCM between 2002 and 2005. The Poisoning Control and Information Bureau has not received any complaint concerning DCM exposure (Lithuanian Environmental Protection Agency, 2006a).

E1.14 Accident Data from Luxembourg

E1.14.1 Data from Consultation

According to the Luxembourgian Inspection du Travail et des Mines (2006b), no incident or accident has been registered in relation to potential exposure to DCM in Luxembourg in the last five years.

E1.15 Accident Data from Malta

E1.15.1 Data from Consultation

No industrial or professional accidents involving DCM have ever been reported to the Malta Occupational Health & Safety Authority (OHSA). However, OHSA is aware of significant under-reporting of minor accidents involving chemicals. Major accidents are always reported in view of legal obligations relating to the national insurance scheme (Malta Standards Authority, 2006).

One manufacturer reported incidents caused by build up of vapour in cans, leading to some lids flying off and injuring workers. No reports of any consumer incidents are available neither is information available on possible long-term effects from exposure to DCM in paint strippers (Malta Standards Authority, 2006).

E1.16 Accident Data from the Netherlands

E1.16.1 Data from the ECSA Survey (ECSA, 2002a)

For 1997, 1998 and 1999, there were respectively 12, 14 and 17 incidents. The routes of exposure were as shown in Table E1.13. These routes of exposure were sometimes combined resulting in a total higher than the number of cases. According to ECSA, some

of the cases were due to paint strippers, but in most cases the exact product and/or exposure conditions were unknown. A few cases of dermal exposure to paint strippers resulted in dermatitis. Eye exposure resulted in conjunctivitis, pain and lachrymation. In a few cases of inhalation (probably involving industrial exposure), dizziness and loss of consciousness was reported. Not all cases resulted in symptoms.

Table E1.13: Routes of Exposure for DCM-related Incidents in the Netherlands (1998-1999)		
Route of exposure	**Number of cases per year**	
	1998	**1999**
Ingestion	1	1
Dermal exposure	3	8
Eye exposure	4	4
Inhalation	9	9
Source: ECSA, 2002a		

E1.16.2 Data from Consultation (2003-2005)

According to the Dutch National Poisons Information Centre, the reported number of incidents (where physicians consulted the National Poisons Information Centre in case of a poisoning) for the years 2003-2005 are as follows (RIVM, 2006a):

- 2003: 21 incidents;
- 2004: 20 incidents: and
- 2005: 25 incidents.

E1.17 Accident Data from Portugal

No information has been received from the Portuguese authorities (the ECSA Survey of 2002 also revealed no accident data).

E1.18 Accident Data from the Slovak Republic

No information has been received from the Slovak authorities (the ECSA Survey of 2002 also revealed no accident data).

E1.19 Accident Data from Slovenia

E1.19.1 Data from Consultation

In years between 2000 and 2005, five accidents involving DCM were reported in Slovenia. These accidents happened at work (one female, two males), with symptoms: nausea, unconsciousness, headache, vomiting, skin burn, 8-10 % of COHb. Another two poisonings happened accidentally to consumers. One person accidentally drunk up preparation with DCM, while another person (a painter) was poisoned due to inhalation. He was in a small closed room, while the container with DCM was opened. There were no severe consequences (Slovenian National Chemicals Bureau, 2007a).

E1.20 Accident Data from Spain

E1.20.1 National Institute of Toxicology

The Spanish National Institute of Toxicology registered 198 relevant calls from 1991 to mid-2000. These are described in Table E1.14.

Table E1.14: Incidents involving DCM (Spanish National Institute of Toxicology, 1991-mid 2000)

Relevant products	Total number of cases	Exposure type (number of cases and symptoms)
Paint strippers	12	- Accidental ingestion of the product (3 cases, gastrointestinal irritation); - inhalation (2 cases, respiratory disease accompanied by headaches and general indisposition); - eye contact (3 cases, ocular irritation, pain, conjunctivitis; and - contact with skin (4 cases, burns)
Adhesives	1	- Inhalation (neurological alterations characterised by ataxia, paraesthesia, obnubilation and unresponsive pupils)
Aerosols (with DCM being the active ingredient)	27	- Inhalation (respiratory and neurological problems characterised by irritation of the respiratory tract, dyspnoea, headaches, dizziness, nausea, ataxia, paraesthesia, sensation of inebriation); and - oral, skin or eye contact (symptoms limited to the contact area, which can result in burns in case of persistent exposure)
Aerosols (DCM is associated with other active ingredients)	Unknown	- Respiratory and neurological symptoms, but no further information available, because toxicity could be due to the associated ingredients

Source: ECSA, 2002a

E1.20.2 Barcelona Poison Control Centre

Only one incident with DCM between 1994 and mid-2002: eye contact resulting in irritation and ocular anaesthesia.

E1.21 Accident Data from Sweden

E1.21.1 Data from Consultation

In the ECSA report (2002), no cases were reported, even for the remaining professional authorised uses. However, according to information provided from the Swedish Poisons Information Centre, twenty acute incidents have been reported from the year 2003 until the end of August 2006 (Swedish Chemicals Inspectorate, 2006):

- seven of the incidents were reported during the year 2003;
- five incidents were reported during each of the years 2004 and 2005; and
- until the end of August 2006 three incidents had been reported.

Six of the twenty incidents were related to professional use and nine of them to consumer use. Regarding the remaining five incidents, there is no information on the conditions causing the incident. The routes of exposure were:

- eyes exposure (nine incidents);
- skin exposure (six incidents);
- inhalation exposure (three incidents); and
- oral exposure (two incidents).

E1.22 Accident Data from Switzerland

E1.22.1 Data from the ECSA Survey (ECSA, 2002a)

Ninety-three calls relating to DCM were recorded between 1995 and 1999. According to ECSA, a second search in the database from 1997 to 2001 showed 62 cases related to DCM. From the latter, 13 cases, all involving adults, had a medical feedback (see Table E1.15). ECSA notes that all cases were relatively benign (further detail on the outcome of each case is not available).

Table E1.15: Incidents related to DCM involving a Medical Feedback (Switzerland, 1997-2001)

Date	Sex	Circumstances	Route	Severity	Symptoms
19.11.1997	M	Acute accidental domestic	Oral, one swallow	No symptoms	No symptoms
27.01.1998	M	Chronic accidental occupational	Inhalation	Minor symptoms	Minor conjunctivitis, pharyngitis, shortness of breath and dry cough, no symptoms after 10 days
07.04.1998	M	Acute accidental occupational	Squirt into eye	Moderate symptoms	Inflammation, corneal lesion
08.08.1998	F	Acute accidental domestic	Eye contact	Minor symptoms	Burning in the eyes, inflammatory symptoms
11.03.1999	M	Acute accidental occupational	Inhalation	Minor symptoms	Eye irritation, light respiratory troubles
19.03.1999	F	Acute accidental occupational	Inhalation	No symptoms	No symptoms

Table E1.15: Incidents related to DCM involving a Medical Feedback (Switzerland, 1997-2001)					
Date	**Sex**	**Circumstances**	**Route**	**Severity**	**Symptoms**
08.07.1999	M	Acute accidental occupational	Inhalation	Minor symptoms	Dry cough
24.08.1999	M	Acute accidental occupational	Cutaneous	Minor symptoms	Erythema
27.03.2000	M	Acute accidental occupational	Inhalation	Minor symptoms	Strong fatigue
02.10.2000	F	Acute accidental domestic	Eye contact	Moderate symptoms	Painful reddened eye, reduced visual performance, large erosion cornea
18.07.2001	M	Acute accidental occupational	Eye contact	Minor symptoms	Red eyes with flow of tears
23.07.2001	F	Acute accidental domestic	Cutaneous	Minor symptoms	Reddened conjunctiva, initial headache, nausea, reddening of skin
25.09.2001	M	Acute accidental occupational	Eye contact	Minor symptoms	Conjunctival hyperaemia
Source: ECSA, 2002a					

E1.22.2 Data from Consultation

Information has been received from SUVA in the form of a leaflet titled "Dichloromethane (DCM), Paint strippers, Accidents" and dated 21 December 2004 (SUVA, 2004). According to the leaflet, in Switzerland, there are documented cases of acute specific damage caused by "halogenated organic compounds" with regards to the Guidelines for the Prevention of Accidents (UVV), Article 14, Appendix 1.1. Between 1993 and 2003, SUVA recorded 181 accepted cases (132 occupational diseases, 49 acute injury), of which 35 (20 occupational, 15 acute) were directly attributed to DCM. The number of DCM cases has stayed relatively constant for the last ten years.

In the same period, SUVA's Chemistry section dealt with 15 cases caused by "halogenated organic compounds". In five cases, DCM was the cause of the accidents (four cases involving paint stripping in the painting and decorating industry, one case in the metal processing industry). One of these accidents was fatal(SUVA, 2004). On this accident, we received further detail by SUVA (2007). It appears that a painting and decorating firm was contracted to carry out renovations in bathrooms and kitchens in flats. The complete removal of old paint was carried out using a product that contained mainly DCM and up to 8% methanol. The victim, an experienced male painter and decorator, started work in the bathroom in the morning. At approx 1pm, his boss found him lying dead in the bathtub. The following relevant conditions were observed and later documented: (a) the door to the bathroom was closed; (b) the window was only half open; (c) all the walls had been treated with DCM-based formulation; (d) respiratory protection mask with active carbon filter was lying unopened and unused in the hall; (e) the day of the accident was an unusually hot summer's day.

E1.23 Accident Data from the United Kingdom

E1.23.1 Data from the ECSA Survey (ECSA, 2002a)

Edinburgh (Scotland) National Poisons Information Service

Table E1.16 details the telephone enquiries to National Poisons Information Service, Edinburgh concerning DCM-based paint strippers from 1997 to mid-2002. Out of a total number of 36,257 telephone enquiries in that period, 17 (0.05%) involved DCM-based paint strippers. ECSA notes that all the incidents were minor.

Table E1.16: Incidents related to DCM-based Paint Strippers (Scotland, UK, 1997-mid 2002)

Date	Age, gender	Route of exposure	Features
Mar 1997	62, M	Eye contact	Red, cloudy, painful
Mar 1997	47, F	Inhalation	Throat and mouth irritation
Sep 1997	NK	Skin contact	Not known
Sep1997	M	Eye contact	Not known
Apr 1998	33, F	Skin contact	Very cold tight hands
Jan 1999	36, M	Eye contact	Discomfort
Mar 1999	28, F	Ingestion	None
May 1999	25, M	Ingestion	Nausea, vomiting short of breath
Jun 1999	24, F	Skin contact	Superficial burns on buttocks and legs
July 1999	80, F	Inhalation	Sore throat, chest discomfort
Oct 1999	28, M	Eye contact	None
May 2000	30, M	Eye contact	Pain
May 2000	60, F	Eye contact	Stinging
Aug 2001	21, F	Inhalation	Headache, vomiting, rash, feels unwell
Aug 2001	42, M	Inhalation	Dry throat
Oct 2001	F	Multiple	Rash
Jun 2002	3, M	Skin contact	Redness

Source: ECSA, 2002a

Birmingham (England) Poison Control Centre

The Poison Control Centre supplied to ECSA detailed information on incidents relating only to DCM in paint strippers, from January 2000 to September 2002. Table E1.17 presents only the publicly available data (the rest is not provided in the ECSA report for confidentiality reasons). ECSA notes that the detailed information shows that, most cases were benign with the only two severe cases were both due to ingestion.

Table E1.17: Incidents related to DCM-based Paint Strippers from the Birmingham Poison Control Centre (UK, 2000-2002)							
Exposure route	**None (0)**	**Minor (1)**	**Moderate (2)**	**Severe (3)**	**Fatal (4)**	**Unknown**	**Total**
Ocular	6	22	2	0	0	1	31
Dermal	3	14	1	0	0	2	20
Inhalation	3	10	1	0	0	5	19
Ingestion	6	13	1	2	0	4	26
All routes	18	59	5	2	0	12	96

Source: ECSA, 2002a
Poisoning Severity Score (PSS) - IPCS/EC/EAPCCT:
None (0): No symptoms or signs related to poisoning
Minor (1): Mild, transient, and spontaneously resolving symptoms
Moderate (2): Pronounced or prolonged symptoms
Severe (3): Severe or life-threatening symptoms
Fatal (4): Death

Belfast (Northern Ireland) Poison Control Centre

A few incidents with paint strippers in general were reported in the years 2000-2002, according to the following Table E1.18.

Table E1.18: Incidents related to DCM-based Paint Strippers in Northern Ireland (UK, 2000-2002)				
Date	**Chemical**	**Symptoms**	**Adult/ child**	**Information source**
3 Aug 2001	DCM	Had been feeling dizzy but feeling better soon after	Unknown	Toxbase
10 Aug 2001	Strypit paint remover (DCM)	Unknown	Adult	Toxbase
13 Feb 2002	Dulite paint stripper (DCM 80%)**	None (caller concerned about using the product because of the warnings on the label – but had not been exposed)	Unknown	Toxbase

Source: ECSA, 2002a

Cardiff (Wales) Poison Control Centre

With regard to telephone enquiries to the Cardiff Poison Control Centres, the numbers for those related to DCM-based paint strippers are presented in Table E1.19. Symptoms were only recorded if the patient was very ill and was followed up closely by this department. This is rare and there are no such reports involving DCM (or its alternatives).

Table E1.19: Enquiries related to DCM-based Paint Strippers in Wales (UK, 1997-2002)	
Year	**Number of enquiries related to unspecified DCM-based paint strippers**
1997	26
1998	27
1999	22
2000	32
2001	20
2002	9 (part of the year)
Source: ECSA, 2002a	

E1.23.2 Data from Consultation

Consumer Accidents – HASS/LASS Database

Some information on accidents involving paint strippers in the UK has been made available through the Home and Leisure Accident Surveillance System (HASS/LASS) database. This database is sample data collected from a sample of 16-18 UK hospitals. The HASS/LASS database is not specific enough to provide details on specific types or products neither does it specify whether the product involved in the accidents had DCM in it. It also does not contain fatalities and the latest data available is for 2002[2].

A total of 183 accidents were recorded in this database between 1996 and 2002. These were related to paint strippers without necessarily relating to the actual use of paint stripping products or indeed to the use of chemical paint strippers. The accidents described in Table E1.20 are most certainly related to DCM-based paint strippers since the name of specific commercial products that contain the substance were named by the patient or their representative at the time of attending the hospital. It is likely that other accidents may well have been the result of the use of DCM-based formulations, however, we cannot be sure of their relevance.

[2] On 2nd May 2003, it was announced that the UK Department of Trade and Industry (DTI) would no longer fund the collection and publication of HASS/LASS data. Therefore, the database has not received any new information since the end of 2002.

Table E1.20: UK Accidents Involving DCM-based Paint Strippers – HASS/LASS Database – 1996-2002 (16-18 UK Hospitals Data)

Accident	Year	Mechanism	Outcome	Sex	Age	Activity	Location
Chemical burn to forearm -v- Nitromors paint stripper	1997	Corrosion, chemical burn by liquid	Referred to any outpatient clinic	F	31	Unknown activity	Unspec. home location (in/outdoor)
Stripping down a pine painted chair - Nitromors gel flicked off brush and went into eye	1998	Corrosion, chemical burn by liquid	Referred to other hospital	F	35	Walking/ moving about home/garden	Kitchen/utility room
Stripping down a pine painted chair - Nitromors gel flicked off brush and went into eye	1998	Corrosion, chemical burn by liquid	Referred to other hospital	F	35	Stripping pine chair	Kitchen/utility room
Going to clean paint brushes - no sense of smell using Nitromors and inhaled fumes	1998	Inhalation of fumes	Referred to GP (doctor)	M	52	Cleaning paint brushes	Garage
Contact with Nitromors paint remover -feeling unwell	1998	(Suspected) poisoning by liquid	Examined but no treatment given	M	30	Unknown activity	Unspec. home location (in/outdoor)
Using Nitromors paint stripper on door-it flicked off paint brush into eye	1998	Corrosion, chemical burn by liquid	Referred to any outpatient clinic	M	34	Decorating	Yard/driveway /path/hard surface
Mother picked him together with a tin of Nitromors paint stripper, which spilled on to his leg.	1999	Corrosion, chemical burn by liquid	Examined but no treatment given	M	1	Unknown activity	Unspec. home location (in/outdoor)
Stepped on paint scraper that had pointed tip - injury to foot - scraper also had Nitromors paint stripper on it and flecks of paint	2000	Skin puncture by foreign body/spike/shot	Treated; no more treatment required	M	5	Children playing (exclude sport)	Unspec. home location (in/outdoor)
Patient stripping paint off door using Nitromors, overcome by fumes - fell as a result to wooden floor	2002	(Suspected) poisoning by liquid	Treated; no more treatment required	F	53	Other DIY/carpentry/repairing/ decorating	Lounge, study, living/dining/ play area
In garden opening Nitromors tin for paint stripping. Seal still left on lid after removing cap - liquid exploded into pts face.	2002	Foreign body in eye	Treated; no more treatment required	F	40	Other DIY/carpentry/repairing/ decorating	Yard/driveway /path/hard surface

Source: ROSPA, 2006

Workplace Accidents – RIDDOR Data

The UK HSE Statistics Branch has suggested that during the years 1996/7 to 2004/05, there were 11 accidents found on the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) database. None of the accidents were fatal (UK Department of Trade and Industry, 2006)

Occupational Diseases – SWORD/OPRA Data

A search for relevant cases reported to the Surveillance of Work-related and Occupational Respiratory Disease system (SWORD) and Occupational Physicians Reporting Activity (OPRA) for the period 1998-2005[3], revealed 9 actual cases of respiratory diseases that have been attributed to DCM exposure. Chest physicians reported five of these and HSE medical inspectors reported the remaining four. More detailed information is provided in the Table E1.21.

Table E1.21: Respiratory Diseases Attributed to Workplace Exposure to DCM in the UK (SWORD/OPRA data, 1998-2002)

Diagnosis	Job	Age/sex	Year of reporting	Reporting physicians
Asthma	Coppersmith in dockyard	M /50+	1998	Chest phys. (Sample)
Asthma	Laser cutter in electronic industry	F /50+	1999	Chest phys. (Core)
Asthma, due to sensitisation	Welder	M /40+	2000	Chest phys. (Sample)
Inhalation accidents	Manager in electrical industry	F /45+	1999	Chest phys. (Core)
Inhalation accidents (death)	Paint stripping operator	M /20+	1999	HSE medical inspector
Inhalation accidents (death)	Paint stripping operator	M /40+	1999	HSE medical inspector
Inhalation accidents	Operator in paint manufacturing	M /30+	2001	HSE medical inspector
Inhalation accidents	Operator in paint manufacturing	M /20+	2001	HSE medical inspector
Other respiratory disease	Filler in glue manufacturing	F /45+	2001	Chest phys. (Core)

Source: UK Department for Environment, Food and Rural Affairs, 2006 (based on data from the UK HSE)

Five of the above cases were reported on SWORD. On the basis of this number a total of 27 estimated cases or respiratory disease has been calculated (estimated cases = (cases reported on a monthly basis) + cases reported by sample reporters during a single randomly allocated month per year x 12) (HSE, 2007a).

[3] Originally this information was provided for the years 1998-2002, however, HSE (2007) advised us that it applies to the years until 2005. It should be noted that the two inhalation accidents that appear in Table E1.21 for the year 2001, were not included in the most recent communication with the HSE (2007).

E2. FATALITIES DATA FOR DCM-BASED FORMULATIONS

We have collected information on fatalities and accidents from a number of sources. These include:

- the ETVAREAD (2004) report;
- the Internet site of the European Association for Safer Coatings Removal (http://www.eascr.org/DCMincidents.html);
- information that was submitted by the UK Formulators Group to the UK authorities (UK Department for Environment, Food and Rural Affairs, 2006);
- a publication of the Office of Environmental Health Hazard Assessment of California Environmental Protection Agency (USA) (OEHHA, 2000); and
- abstracts of relevant scientific papers downloaded from the PubMed (www.pubmed.gov) Internet site.

We have combined all this information in the table presented in Table E2.1 taking care in removing duplicate entries. However, the following need to be considered when using this Annex:

- we do not have copies of all of the original sources, therefore we rely at places on the sources mentioned in the bulletpoints above regarding the description of the circumstances of each incident;

- we had to make a judgement on whether an accident is relevant or not; occasionally our sources would provide some detail on this; in other cases we had to base a judgment on the often-limited information available. The same applies to judging whether the accident related to consumer, professional or industrial use of DCM-based paint strippers;

- occasionally, the year when the accident took place was uncertain, hence the year of publication has been used (this is indicated with the note "*DoP*" in the table);

- it is possible that there is still some duplication as more recent sources may well refer to incidents discussed in older sources; and

- it has not been possible to fully cross-check whether fatal accidents referred to above (notably in France and Germany) have been included in the table. We are in the process of clarifying this with the relevant consultees.

Notably, the EASCR Internet site presents a number of other accidents classified under "cleaning" (1 death and 17 non-fatal injuries in the EU, in total) and "other applications" (4 deaths and 33 non-fatal injuries in the EU, in total). These have not been included in Table E2.1 below.

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
1	EASCR, 2006 – (Collier, 1936)	1935	UK		**2**	?	IND	DCM industrial intoxication	Unknown
2	UK Department for Environment, Food and Rural Affairs, 2006 – (Moskowitz & Shapiro)	1951	USA	**1**	**3**	No	IND	Vegetable resin extraction process. Likely problem due to inability to condense vapour being formed and overflow occurred into plant area. 4 workers exposed to DCM, one of whom died. Unconscious for 3-6 hours after 1-3 hours exposure. Worker in plant area died those in changing room survived. Enclosed plant and no PPE available. Only control was to ask for reduced steam when odour detected	• Ventilation • PPE
3	EASCR, 2006 – (Craig S. O'Connell - 1985 / www.trainweb.org/crocon/okie.html)	1959	USA	**1**		Yes	IND	Male victim's job involved degreasing metallic raw materials and stripping paint from various pieces. Victim was overcome by fumes and succumbed to his death having fallen into a tank of chemical paint stripper	• Tank use
4	OEHHA, 2000, ETVAREAD, 2005 and EASCR, 2006 – (Gerritsen & Buschmann, 1960)	1960	Nether-lands	**1**	**1**	Yes	CON	Phosgene poisoning caused by the use of chemical paint removers containing DCM in ill-ventilated basement room heated by kerosene stoves was reported	• Ventilation • Heat
5	UK Department for Environment, Food and Rural Affairs, 2006 – (Weiss Zentral blatt fur ArbeitsMed ArbneitsSchutz 1967 17 (9) 282-285 (Translation)) (possibly earlier)	1967	Germany	**1**	**1**	No	CON/ PROF	A fatality through ingestion of 240ml DCM mixed with beer. 39 yr old chemist had intensive contact with DCM over 5 years in a room ventilated by an open door, recrystallising a product, and distilling solvent. Levels varied from 660 to 3600 ppm at floor level. Suffered from heart pains, depression, hallucinations and toxic encephalosis. Removal from exposure proved to be sufficient treatment	• Long-term exposure

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No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
6	OEHHA, 2000 – (Kuzelova et al. 1975) (DoP)	1975	?	**1**		No	IND	A 30-year-old worker in a film plate production plant inhaled DCM causing narcosis and resulting in a fall into splashed solvent. The dermal contact with concentrated DCM caused severe skin chilblains on about 40 percent of the body surface, and the worker died 28 hours after the accident	Unknown
7	OEHHA, 2000, ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 – (Stewart & Hake, 1976)	1976	USA	**1**		Yes	CON	A man stripping wooden furniture in basement room (10.7x6.1x2.7m) for 3 hours, heated with hot air from a gas furnace. Retrosternal pain developed after first exposure and admitted to hospital. Following discharge, stripping continued, symptoms returned, and readmitted to coronary care unit. 6 months later began work again, chest pain developed after 2 hours and died before hospital admission. Myocardial infarction was reported. Inadequate ventilation appeared to be the root cause of the problem. It was of concern that there was no learning from the first to the third exposure by the user	• Ventilation • Heat
8	ETVAREAD, 2004 and EASCR, 2006 - (Stewart & Hake, 1976)	1976	USA		**1**	Yes	CON	A 35-year-old male cardiologist, who was enjoying excellent health, volunteered to participate in a research project, the purpose of which was to correlate the subject's COHb level with the air pollution in his section of Milwaukee	• Experiment
9	OEHHA, 2000 and EASCR, 2006 – (Roberts & Marshall, 1976)	1976	UK		**1**	No	CON	In a suicide attempt, a 38-year-old male ingested one to two pints of paint stripper, equivalent to about 9,000 to 18,000 mg/kg of DCM. He had diverticula of the duodenal jejunal junction after six months but recovered eventually	• Suicide

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10	EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 – (US Consumer Product Safety Commission Jan 6 1978)	1976	USA	**3**		Yes	CON	The Commission learned of at least three deaths from heart attacks in 1976 after use of paint and varnish removers containing DCM. One CPSC investigation in 1976, showed a fatality apparently caused by inhaling fumes from a paint stripper with the chemical	Unknown
11	OEHHA, 2000 and EASCR, 2006 – (Langehennig *et al*, 1976).	1976	UK		**2**	Yes	CON	Furniture stripping with DCM in a large 5,425-square-feet single-room basement by two healthy athletic non-smoking females. Physicians for six hours raised the blood COHb concentration to 26 percent and 40 percent, respectively, without symptoms	• Ventilation
12	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Bonventre, Brennan, Jason, 1977)	1976	USA	**1**		Yes	CON	13 yr old boy died while cleaning paint from a bathtub. Paint remover can upright and open in bathtub. Composition was DCM / EtOH / MeOH / Toluene / NMP / TEAP / Mineral Spirit. Paint remover can upright and open in bathtub. Death occurred after short period of inhalation. No information about ventilation, although bath tub would act as a sump holding vapour at high concentrations	• Ventilation
13	ETVAREAD, 2004 - (Bonventre, Brennan, Jason, 1977)	1977	USA	**1**		No	?	Cleaning oil storage tank (1.6 m deep) from inside in basement of an apartment. Opening on top of tank only; two open solvent cans (3.7L) in the room and on top of tank; no PPE	• Ventilation • PPE
14	EASCR, 2006 – (Barrowcliff, 1978)	1978	UK		**1**	Yes	?	Chronic carbon monoxide poisoning caused by DCM paint stripper	• Long-term exposure
15	OEHHA, 2000 – (Pryor *et al*, 1978) (DoP)	1978	?	**?**	**?**	No	?	DCM was used as part of abused inhalant mixtures	• Solvent abuse
16	EASCR, 2006, UK Department for Environment, Food and Rural Affairs, 2006 – (Bakinson & Jones)	1961-1980	UK		**8**	Yes	PROF/ IND	33 cases of gassing due to DCM, 8 in paint stripping and 9 in cleaning. 14 were in confined spaces. 13 found unconscious	• Ventilation

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17	ETVAREAD, 2004 and EASCR, 2006 - (Fagin, Bradley, Williams 1980)	1980	UK		**1**	Yes	CON	A 20-year-old art student developed nausea and severe, throbbing headache while using a commercial paint remover in a poorly ventilated, unheated room for 1 hour. She was discharged from hospital on the third day	• Ventilation
18	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Winek, Collom 1981)	1981	USA	**1**		No	?	Cleaning by immersing parts in small solvent tank in small basement room ventilated by window over the tank. He was found slumped over the tank with his forehead immersed in DCM	• Ventilation • Tank use
19	OEHHA, 2000 and EASCR, 2006 – (Memon & Davidson 1981, Walker & Wyke 1981).	1981	UK		**1**	Yes	CON	Multisystem disorder including nausea, headache, vomit, and anorexia occurred in a healthy 25-year-old male accountant using Nitromors in a confined space for three to four hours. The patient developed skin rash as well as temporary diabetes and could not work for six months due to mental impairment	• Ventilation
20	OEHHA, 2000 – (Lee, 1981) (DoP)	1981	UK (?)		**1**	Yes	CON	Multisystem disorder including nausea, headache, vomit, and anorexia was reported by a male physician after a day of stripping paints using Nitromors in a well-ventilated room with the door open	• No signs of misuse
21	ETVAREAD, 2004 and EASCR, 2006 - (Tariot, 1983)	1983	USA		**1**	Yes	IND	Strip tank operator over 4 years. A case is reported of delirium resulting from exposure to DCM	• Long-term exposure
22	EASCR, 2006 – (Ott, Skory, Holder; Scand J, 1983)	1983	Scandi-navia		**1**	No	IND	The study involved one fibre production plant which used a DCM/methanol mixture and acetone as solvents and a second fibre production plant that used acetone only. The research design included a retrospective cohort mortality study and several health evaluation studies, as well as an environmental assessment of the two plants	Unknown

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No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
23	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Shinomiya, 1985)	1984	Japan	**1**	**1**	No	IND	Pulverisation of paint (diluted with DCM as solvent) in sub deck sweet water reservoir of new vessel. 39 yr old man painting inside of water tank of a ship with a paint containing 10% DCM. Inadequate ventilation and insufficient protection (mask available, but not used)	• Ventilation • Tank painting • PPE
24	EASCR, 2006 – (The Daily Telegraph - UK - March 29, 1993)	1984	UK	**1**		?	CON	Person died in 1993 after having developed a kidney disease (Goodpasture's syndrome) in 1984 due to inhaling fumes while doing DIY work at home. The deceased required dialysis three times a week and had a kidney transplant in 1990	Unclear
25	EASCR, 2006 – (Protocol of a DCM accident in Kassel-Germany 24.4.1985)	1984	Germany		**1**	?	?	?	Unknown
26	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Novak & Hain, 1990)	1985	USA	**1**		Yes	IND	Work at open furniture stripping tanks (60x30x28 inches), found semi-immersed in solvent. Probable case of solvent abuse. 86% DCM formulation	• Solvent abuse (?)
27	OEHHA, 2000 and EASCR, 2006 – (Miller *et al*, 1985)	1985	UK		**1**	?	?	Acute renal failure with tubular necrosis, myoglobinuria, hypocomplementemia, and liver enzyme elevations was reported in a person who inhaled DCM at high concentrations over an extended period of time. The product was used for the removal of tiles	• Long-term exposure
28	EASCR, 2006 – (Schiele, 1985)	1985	Germany		**1**	?	?	?	Unknown
29	EASCR, 2006 – (Protocol of a DCM accident in Fuldatal - Germany 19.4.1985)	1985	Germany		**1**	?	?	?	Unknown

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No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
30	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Buie, Pratt, May 1986)	1986	USA		**1**	Yes	CON	Male suffered adverse effects of paint stripper (DCM, Toluene, Methanol, Acetone) while stripping furniture at home for 4 days. For 3 days adequate ventilation used - on the fourth day the area was enclosed due to low temperature. Patient's condition steadily improved and was discharged after 8 days	• Ventilation
31	OEHHA, 2000 – (ACGIH 1986) (DoP)	1986	?		**2**	?	PROF	DCM poisoning in painters who suffered from headache, giddiness, stupor, irritability, numbness, and tingling in limbs	Unknown
32	UK Department for Environment, Food and Rural Affairs, 2006 – (Rioux & Myers, 1988) (pre 1987)	Pre 1987	USA	**1**	**25**	?	MIXED	Twenty-six cases of DCM poisoning, mainly through inhalation, were reported in the literature from 1936 through October 1986. Among these, 13 acute general exposure cases, 11 acute occupational exposure cases, and two chronic occupational exposure cases were reviewed to reveal that industrial and domestic use of DCM is equally widespread. Includes 1 fatality. It is likely that all of these are recorded elsewhere	Unknown

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33	ETVAREAD, 2004 and UK Department for Environment, Food and Rural Affairs, 2006 - (Hall & Rumack 1990)	1984-1988	USA	**2**	**2**	Yes	IND	21 yr old rendered unconscious on 2 occasions when stripping furniture in a dip tank - no ventilation or LEV used 53 yr old rendered unconscious when paint stripping - no respirator, but an open window - 25% body surface suffered burns 19 yr old stripping furniture in a dip tank without respirator. Found slumped over tank and dead on arrival at hospital 34 yr old man stripping furniture in dip tank found unconscious over tank. No respirator, and only ventilation was open door. 20% second degree burns from contact	• Ventilation • PPE • Tank use
34	EASCR, 2006 – (Briot, 1989)	1988	Germany		**2**	?	?	?	Unknown

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35	EASCR, 2006 – (CCOHS fatality reports, Canada ncsp.tamu.edu/reports/CCOHS/Fatality%20Reports%202112.htm)	1988	Canada	**1**	**1**	No	IND	A male chemical industry foreman fell into a vat sprayed with DCM solution and died of asphyxia. The foreman placed a wooden ladder in a mixing vat that had been sprayed with DCM the night before to clean it. He called to a labourer, who worked at the plant, but was not familiar with the equipment, to start an extract fan. The labourer inadvertently pressed the wrong switch and started the blades of the mixing vat rather than the extract fan. This started a series of disasters which resulted in the death of the foreman. The mixing blades damaged the ladder on which the foreman was standing, resulting in him falling into the vat. The labourer tried to extricate him from the vat, but he was already semiconscious and fell down to the bottom of the vat. At this time, the staff were asked for help by the labourer, who went into the vat to rescue the foreman, wearing a respirator mask. He then lost consciousness himself and another member of the staff then entered the vat to remove foreman and the labourer, using an air hose to try and combat the fumes. He became dizzy himself and was just able to climb out as the ambulance arrived. They were unable to enter the vat and had to wait some five minutes for the fire brigade to arrive with their self-contained respirator units, which enabled them to enter the vat and extricate foreman and the labourer, who were then resuscitated by the ambulance attendants. The foreman was deeply unconscious and the labourer was semi-conscious. The two men were taken to Hospital and subsequently. The labourer made an uneventful recovery, but the foreman was declared brain dead two days later	• Ventilation • Tank use

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No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
36	ETVAREAD, 2004 - (Gisbau/Wesermarsch) UK Department for Environment, Food and Rural Affairs, 2006 and EASCR, 2006 – (Kreiszeitung Wesermarsch 5/5/1989)	1989	Germany	**2**		Yes	PROF	Stripping paint from a ceiling. Insufficient protection masks; open 25L can with 9L already applied; poor ventilation (windows and door covered with plastic	• Ventilation • PPE
37	EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 – (Bohn & Telge. Commun. IX Symposium "Forensische Toxicologie" (Bad Doberan 1989) Universitat Rostock, Abl. Wiss. Publizistik 9-13 (1990))	1989	Germany	**1**		?	?	?	Unknown
38	EASCR, 2006 – (Weber *et al*, 1990)	1989	France		**1**	Yes	IND	A 31-year old man, professional paint stripper, entered a stripping vat to pick up an object that had fallen inside. When coming out of the vat, he hit his head on the lid which was partially open. The cranial trauma led to an immediate loss of consciousness so that he fell into partial immersion in the stripping solution which was at a depth of 30 cm and was consisting mainly of DCM. He was discovered by a colleague (who was also disturbed by the vapours) a few minutes later on his stomach and face submerged in the solution. The victim suffered a loss of consciousness for 36 hours and suffered from 2nd degree burns on 80% of his body.	• Tank use
39	EASCR, 2006 – (Sheffield "STAR" - 11th January 1989)	1989	UK	**1**		Yes	IND	Man of 58 collapsed in tank in furniture stripping facility. Extraction fan was in place but not operated for fear of excessive costs to the owner. Deceased had consumed a considerable amount of alcohol before the incident	• Tank use • Alcohol abuse

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40	EASCR, 2006 – (Velvart , 1989)	1989	Switzerland		**1**	?	CON	?	Unknown
41	EASCR, 2006 – (Rioux & Myers, 1989)	1989	USA		**2**	?	?	?	Unknown
42	OEHHA, 2000, ETVAREAD, 2004 and UK Department for Environment, Food and Rural Affairs – (Manno, Rugge 1992)	1989	Italy	**2**		No	IND	Burying barrels containing mixed solvents and solid waste from a chemical plant in a well (2m below ground level). The men died from inhalation of massive concentrations of DCM although toxic mechanism is unclear. In these two acute inhalation fatalities, blood levels of DCM were as high as 168,000 ppm, comparable to the levels in the inhaled air. COHb levels were 30 percent, but these levels were not enough to account for the deaths. Air analysis a few hours later showed near saturation with DCM. No PPE	• Ventilation • PPE
43	OEHHA, 2000, ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 – (Leikin, Kaufmann, Lipscomb 1990)	1990	USA	**2**	**3**	Yes	PROF	Stripping paint in a small washroom. The two workers died after being exposed to DCM used to remove paint in an enclosed space and three rescuers complained of dizziness and nausea. 1 rescuer had difficulty removing the patients and succumbed to solvent vapour, although survived. The rescuers respiratory protection was overwhelmed (cartridge respirators have a limited life when used in high concentration environments)	• Closed space • PPE
44	ETVAREAD, 2004 - (Frederick, Rudge 1990)	1990	?		**1**	No	IND	Cleaning of computer equipment over 6-8 hours without protective equipment	• PPE
45	ETVAREAD, 2004 - (Schmidt & Raudonat 1990)	1990	Germany	**1**		No	IND	Cleaning a tank of a tank truck. Poor ventilation (opening at top of tank only); no PPE; 90% DCM formulation	• Ventilation • PPE

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46	OEHHA, 2000 and EASCR, 2006 – (Shustermann *et al*, 1990)	1990	USA	**1**	**1**	Yes	IND	A 35-year-old furniture refinisher came to the occupational medicine clinic with complaints of upper respiratory irritation, fatigue, and lightheadedness occurring on a daily basis after using a methylene chloride-containing paint stripper	• Long-term exposure
47	EASCR, 2006, French Ministry of Labour, 2006b – (EPICEA, 2006) - ident/case 00117	1990	France	**1**		Yes	PROF	A 38-year old painter found dead after applying a stripping gel with hand brush inside a water tower	• Ventilation • PPE
48	OEHHA, 2000, ETVAREAD, 2004 and EASCR – (Logemann, van der Smissen 1991)	1990	Germany	**1**		Yes	PROF	Stripping paint in small overfall basin (180x150x190). Fatal exposure of a male painter using 10 kg stripper in a swimming pool in Germany showed high blood DCM concentrations of 513 to 773 µg/ml. Painter removing chlor-rubber paint from 2 swimming pools by sand-blasting. After finishing first pool painter found dead in second pool. Almost empty 10kg container of DCM based paint stripper found in his car	• Ventilation

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49	EASCR, 2006 – (Safety and Health 1991 https://portal.navfac.navy.mil/portal/page?_pageid=181,3448772&_dad=portal&_schema=PORTAL)	1991	USA	**2**	**1**	Yes	IND	On September 11, 1991, at an Antiques and Furniture Stripping establishment, the spray finisher was returning to the spray booth from the front of the shop and discovered an unconscious employee. Employee #1 was found slumped over a stripping tank containing Benco 7, which consisted of DCM and methanol. The employee had been stripping furniture. Employee #1 was taken to Lutheran Hospital and treated for cardiac arrest. A heartbeat was restored but he remained comatose and did not recover consciousness. He died approximately 8 1/2 hours after admission. The coroner's report identifies inhalation of DCM as the cause of death. No other workers were in the area of the 8 ft by 3 ft by 30 in. stripping tank at the time. The stripping fluid was approximately 6 in. in depth with approximately 24 in. of freeboard. Monitoring in the tank indicates IDLH concentrations were present within the top 1 foot of the tank. The work practices in place exposed the employee to the IDLH atmosphere. A painting company had placed paint remover (stripper-solvent) on the floor of a basement to remove old paint. The paint remover contained a high concentration of DCM. Employees #1 and #2 were upstairs in the building. Employee #1 directed employee #2 to go to the basement and turn on the sump pump. By this time the basement had filled with DCM fumes. When employee #2 got to the sump pump he passed out. Employee #1 went down a little later to check on employee #2. The fumes also overcame him. Employee #2 survived; employee #1 was killed. The basement was 30 feet long by 24 feet wide. An air sample taken in the basement revealed 1280 ppm DCM	• Ventilation • Tank use • Ventilation

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50	French Ministry of Labour, 2006 – EPICEA database - ident/case 02971	1992	France	**1**		Yes	PROF	A 55-year old man in charge of applying water-tightness product inside an indoor swimming pool	• Ventilation
51	OEHHA, 2000 and EASCR, 2006 – (Snyder *et al*, 1992a, 1992b)	1992	USA		**1**	Yes	CON	Non-cardiogenic pulmonary oedema and subsequent hyperreactive airways following exposure to DCM and its combustion product, phosgene in a 37-year-old male non-smoker male using a paint remover with a heat source	• Heat
52	EASCR, 2006 – (Protocol of a DCM fatality in Minden -Germany 31.7.1992)	1992	Germany	**1**		?	?	?	Unknown
53	OEHHA, 2000 and EASCR, 2006 – (Hughes & Tracey 1993).	1993	UK	**1**		No	CON	A 56-year-old female ingested about 300 ml of a paint stripper (Nitromors) containing predominantly DCM. Paresthesias, somnolence, altered sleep patterns, convulsions, euphoria, and changes in cardiac rate developed after DCM ingestion. Extensive gastrointestinal ulceration and bleeding occurred after ingestion. She regained consciousness after about 14 hours but died after 25 days. Her COHb level rose to a peak of 12.1 percent at about 36 hours following ingestion. It was considered that the corrosive properties of the formulation rather than the formation of COHb were responsible for the lethal outcome	• Suicide
54	EASCR, 2006 – (US Department of Health and Human Services, 1993)	1993	USA		**1**	?	CON	?	Unknown
55	EASCR, 2006 – (EPICEA, 2006)-ident/case 04416	1993	France	**1**	**1**	Yes	CON	?	Unknown
56	OEHHA, 2000 – (Frenia and Schauben 1993) (DoP)	1993	?	**1**	**6**	No	?	Inhalation of a carburetor cleaner containing 43.8 percent toluene, 23.3 percent methanol, 20.5 percent DCM and 12.5 percent propane. Each exhibited CNS impairment, nausea, vomiting, shortness of breath, and visual symptoms	Unknown

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57	OEHHA, 2000 – (Anundi *et al*, 1993) (DoP)	1993	Sweden		**12**	Yes	PROF	High exposure to organic solvents, mainly DCM, among twelve 18- to 36-year-old graffiti removers with a median age of 23 years working during daytime in underground stations in Sweden. The observed effects consisted primarily of irritative effects in the upper respiratory tract and the eyes. Of the 12 subjects, six exceeded the Swedish Permissible Exposure Limit (PEL) of 120 mg/m^3 (about 35 ppm)	• Ventilation
58	OEHHA, 2000, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 – (Tay *et al*, 1995)	1994	Singa-pore	**1**		Yes	IND	Man died when internal cleaning of ISO latex tank with DCM containing MeOH, HF & oDB. Ventilation operating but hose not in place. No respiratory protection used. Not authorised practice. CNS depression was implicated	• Ventilation • PPE • Tank cleaning
59	EASCR, 2006 – (EPICEA, 2006) - ident/case 06270	1995	France		**1**	Yes	PROF	The victim, aged 37, was a specialised painter for a temping agency. While she was using a DCM-based paint stripper, she suffered from a fit of dizziness and fell off the scaffolding (height: 3.5m). She suffered several fractures to her spinal cord	Unknown
60	OEHHA, 2000 and EASCR, 2006 – (Kim *et al*, 1996b)	1995	South Korea	**1**		No	IND	Accidental poisoning with DCM. A man (CEO in painting factory) discovered in underground TCE tank where DCM used for rust removal from iron sheets	• Ventilation
61	OEHHA, 2000 – (Horovitz & Zecler 1995) (DoP)	1995	Israel		**1**	?	?	A man had acute renal failure and hepatocellular damage two days after he was exposed to DCM mainly through inhalation by working in a closed room. He recovered after treatment with haemodialysis	• Ventilation
62	EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 – (Quarterly Review http://www.hrva.com/pgcasualty/96sprqr#product)	1996	USA	**1**		No	IND	Woman died of DCM intoxication after using a paint stripper while helping her husband to clean ink barrels at his place of work	• PPE • Tank use

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63	OEHHA, 2000 – (Fairfax *et al*, 1996) (DoP)	1996	?	**2**		Yes	PROF	Died while removing the surface finish of wood floors of a squash court using a stripper containing 80 percent DCM with paraffin and toluene. Their exposure to DCM was estimated to be about 9,500 to 19,000 ppm	• Ventilation (?)
64	OEHHA, 2000 – Mahmud & Kales (1999)	1996	USA		**1**	No	IND	Intermittent headaches in a male cabinet worker who had a COHb saturation of 21 percent approximately 35 minutes after leaving his work site. The lacquer thinner he used at work contained 70 percent DCM and the work area air samples had DCM levels of 300 to 500 ppm. In addition, a propane-powered forklift inside the plant was considered a potential source of CO and the work area air samples had CO levels of 28 ppm. This case of DCM poisoning is complicated by the simultaneous exposure to ambient CO. The patient recovered once the source was removed	Unknown

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
65	SUVA, 2006b – (Dichloromethane (DCM), Paint strippers, Accidents) and SUVA, 2007	1996	Switzer-land	**1**	**?**	Yes	PROF	In the period 1993-2003, SUVA's Chemistry section dealt with 15 cases caused by "halogenated organic compounds". In five cases, DCM was the cause of the accidents (four cases involving paint stripping in the painting and decorating industry, one case in the metal processing industry). One of these accidents was fatal A painting and decorating firm was contracted to carry out renovations in bathrooms and kitchens in flats. This included removing all old coatings down to the plaster with paint strippers and wiping down the surface afterwards. The bathrooms measured 9 cubic metres (2.2 x 1.7 x 2.5 m). The size of the window is 1.3 m^2 (1.15 x 1.2 m), the window sill was 0.95m above floor level. The tiled wall on the wet area reached 1.5m high, this means the area to be paint stripped was approx 5m^2. The complete removal of old paint was carried out using a product that contained mainly DCM and up to 8% methanol as a coagulant. The insured person had already renovated 7 such bathrooms before the accident. The victim, an experienced male painter and decorator, started work in the bathroom in the morning. At approx 1pm, his boss found him lying dead in the bath tub. The following relevant conditions were observed and later documented: (a) the door to the bathroom was closed; (b) the window was only half open; (c) all the walls had been treated with DCM-based formulation; (d) respiratory protection mask with active carbon filter was lying unopened and unused in the hall; (e) the day of the accident was an unusually hot summer's day.	• Ventilation • PPE

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
66	EASCR, 2006 – (Gouillou *et al*, 1999)	1997	France		**2**	Yes	IND/ PROF	Two men were taken to the Accident and Emergency Department of a hospital suffering from severe intoxication (after a 20 minute exposure). The first patient, aged 43, fell into a coma and did not show sighs of clinical anomaly. The second patient, aged 53 and a smoker, did not show signs of initial neurological disorder	Unknown
67	EASCR, 2006 – (EPICEA, 2006)- ident/case 08613 - ident/case 09208	1997	France	**1**	**1**	Yes	IND	A 35-year-old paint stripper lying near an open stripping fluid storage (200 litres container	• Tank use
68	EASCR, 2006 – (OSHA-report / http://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=170740005)	1997	USA		**1**	Yes	IND	A male employee was in an almond hopper located over the hand sorting area inside a building. He was stripping the paint from the hopper using Lifteeze paint and varnish remover, which contained DCM, methanol, acetone, toluene, and wax. He was overcome by the fumes in the small space and fell unconscious. He was found by co-workers, who removed him from the hopper. Medical aid was sought, and he was airlifted to hospital	• Ventilation
69	OEHHA, 2000 and UK Department for Environment, Food and Rural Affairs, 2006 – (Goulle *et al*, 1999) Rouen	1997	France	**1**		No	IND	A 47-year-old man was found dead in a factory where DCM tanks were stocked. He was making an inventory of the annual stock of DCM contained in several tanks (5,000- to 8,000L capacity) by transferring the solvent into an additional tank with the help of compressed air. During this operation, one of the tanks overflowed and the man, who was not wearing any protection, was intoxicated. Autopsy showed digestive, suprarenal, and liver bleeding. Blood was also found in the trachea	• PPE • Tank use

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
70	EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Protocol of a DCM fatality in Oldenburg)	1998	Germany	**1**		?	?	?	Unknown
71	OEHHA, 2000 – (Nager & O'Connor, 1998) (DoP)	1998	?		**1**	No	CON	CO poisoning generated from spray paint inhalation in a 52-year-old woman. The paint contained 31 percent DCM. Her COHb level was 11.7 percent four days after using the paint, and was reduced to 3.1 percent after treatment to relieve her symptoms	Unknown
72	ETVAREAD, 2004 - (O'Neill, Rory 2003), and EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Croner Small business briefing 31, 1999) Also information from HSE, 2006	1999	UK	**2**		Yes	IND	Immersing alloy wheels in DCM, hydrofluoric acid and methanol containing tanks. Reaction of aluminium and HF heated the solution to the boiling point of DCM. There were no arrangements, e.g. forced ventilation and/or Local Exhaust Ventilation, for removal of solvent vapours released from the tanks, apart from natural ventilation created by opening the roller shutters and doors leading to the process area. During the night shift operations, however, the roller shutters and external doors were often closed	• Ventilation • Tank use • Heat
73	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Reinecke 1999)	1999	Germany	**1**		Yes	PROF	Stripping of paint in small bathroom (1.45x2.80x2.64) with 80-90% DCM. No PPE; window (0.53x1.26m) was opened, door was closed	• Ventilation • PPE
74	ETVAREAD, 2004 and EASCR, 2006 - (Reinecke 1999)	1999	Germany		**1**	Yes	PROF	Welding in basement rooms, while stripping in the open staircase. Phosgene poisoning (DCM and open flame). No PPE	• Ventilation • PPE
75	ETVAREAD, 2004 and EASCR, 2006 - (Reinecke 1999)	1999	Germany		**1**	Yes	PROF	Stripping of paint from a balcony floor (3.5 m²). Kneeling over paint stripper; open working space; unknown PPE	Unknown

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
76	EASCR, 2006 – (The Mirror, 21/12/1999)	1999	UK		**6**	Yes	CON	Family of six found semi-unconscious by pizza delivery man. DIY work in the house was considered to be the cause of exposure to paint stripper fumes	• Ventilation
77	EASCR, 2006 – (Protocol of a DCM accident in Frankfurt - Germany 8.11.1999)	1999	Germany		**1**	?	?	?	Unknown
78	OEHHA, 2000 –(Chang *et al*, 1999).	1999	Taiwan	**1**		No	CON	DCM paint stripper taken orally either accidentally or as a suicide attempt. An elevated COHb level was documented as 35 eight hours after ingestion of 300 ml DCM, or an estimated dose of 4,286 mg/kg. Renal and liver failure with prolonged tissue hypoperfusion as well as acute pancreatitis occurred and eventually he died on day nine in the hospital	• Suicide
79	OEHHA, 2000 –(Chang *et al*, 1999). (DoP)	1999	Taiwan		**6**	No	CON	DCM paint stripper taken orally either accidentally or as a suicide attempt. COHb was 8.4 percent 10 hours after ingestion of about 25 ml of DCM	• Accident/suicide
80	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Fechner, Ortmann, Du Chesne 2000)	2000	Germany	**1**		Yes	IND	Found dead in car lacquering company following paint removal with DCM without using a gas mask. Window was partly open and electric fan switched off. Working in a room (3x4x2.5 m) with an open submersion bath (150x70x40m) filled with DCM and two filled open buckets and 1 closed 150L barrel of solvent present. 85% DCM in formulation	• Ventilation • PPE • Tank use

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
81	EASCR, 2006 – (Occupational hazards-10.10.2002 http://occupationalhazards.com/articles/2491)	2000	USA		**8**	Yes	IND	Several employees were overcome by vapours after using a mixture containing 70 percent DCM and 30 percent perchlorethylene to remove paint from the floor. As a result of the exposure, eight employees were taken to local hospitals for treatment. The company employs about 100 workers at the facility, which is engaged in silk-screen printing of designs on garments. The company did not provide safety equipment, facilities to allow employees to remove any paint stripper contamination or training on the use of DCM	• PPE
82	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Zarrabeitia, 2001)	2000	Spain	**1**		Yes	IND	Work at open dipping tank (400x100x100); concentration over solvent surface 89,474->140,000 mg/m³ DCM in a small room with no ventilation except the door. Found slumped over tank, arms in the solvent, head & trunk in tank. One glove and half mask with organic vapour cartridge found later in tank	• Ventilation • PPE (?) • Tank use
83	ETVAREAD, 2004 and EASCR, 2006 - (OHN 2002) 514,15 May, 2002	2002	Australia	**1**	**3**	Yes	IND	Work at open dipping tank (3.7m x 0.9 m); concentrations over the tank at control up to 420,000 ppm	• Ventilation • Tank use • PPE
84	ETVAREAD, 2004 and EASCR, 2006 – (OHN, 2002a)-515,29 May, 2002	2002	Australia	**1**		Yes	IND	Work with open dipping tank	• Ventilation • Tank use • PPE
85	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006- (OHN, 2002) 529, 11 Dec 2002	2002	Australia	**1**		Yes	?	?	Unknown
86	ETVAREAD, 2004 - (Hahn & Michalak, 2002)	2002	Germany	**1**		Yes	PROF	Stripping paint in unventilated room for more than 3 hours per day over several days; masks only partially worn; 91% DCM formulation	• Ventilation • PPE

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
87	EASCR, 2006 – (BBC-April 5, 2002)	2002	UK	**1**	**12**	Yes	PROF	Spilled paint stripper was believed to have killed a 34-year old man who was renovating a house in south-west London. Another 12 people, including police and ambulance staff, were taken to hospital following the chemical spillage. A bucket containing five litres of DCM-based paint stripper had overturned and spread across the basement floor. Operator capability of doing work questioned at inquest (claim of UK formulators)	• Ventilation
88	ETVAREAD, 2004, EASCR, 2006 and UK Department for Environment, Food and Rural Affairs, 2006 - (Testud, Martin, Charreton, 2002) (Lyon)	2002	France	**1**		Yes	IND	Work at open dipping tank (120x320x90). The 44-year old furniture restorer was found in apparent lifelessness, lying over a tank of liquid containing 80% DCM, forearms and top of head immersed. Despite initially effective resuscitation, he soon died following refractory collapse and multiorgan failure. Post-mortem examination revealed non specific lesions of diffuse visceral congestion and no other cause e.g. trauma, pre-existing disease to explain death. Levels measured at 15,000 ppm above the tank. No respiratory protection was used	• Tank use • PPE
89	EASCR, 2006 – (NICNAS, 2004)	2003	Australia	**2**		Yes	IND	Two workplace deaths in Victoria and New South Wales occurred in 2003 when DCM was used in open tanks for stripping paint from furniture. Very high levels of DCM vapour were found in the air immediately above the open tanks	• Tank use
90	EASCR, 2006 – (LA, Fire Department, 2004, http://www.lacofd.org/HealthHazMat/PDFs/Web.Aug2004.pdf)	2003	USA		**1**	No	IND	Incident involving the discharge of furniture stripping solution containing DCM to the city sewer in Santa Monica, LA. The discharge of DCM chloride nearly resulted in the death of a sewer maintenance employee who was working in the sewer. The worker suffered third degree burns over 60% of his body from exposure to DCM	• Pollution

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
91	EASCR, 2006 – (Accidents report industry insurance Rheinland Westfalen 2.6.2004)	2004	Germany		**2**	?	PROF	?	Unknown
92	EASCR, 2006 – (Accident report Industry insurance Hamburg 8.3.2004)	2004	Germany		**1**	?	PROF	?	Unknown
93	EASCR, 2006 – (Protocol of a DCM accident in Berlin -Germany 19.5.2005)	2005	Germany		**1**	?	PROF	?	Unknown
94	EASCR, 2006 – (Jacubovich *RM et al* (2005): Facial nerve palsy after acute exposure to DCM, Am J Ind Med., 2005 Nov; 48(5):389-92.)	2005	Israel		**1**	Yes	PROF	The patient was part of a paint removing crew who have worked without proper protecting measures and were thus exposed to high levels of DCM. The patient was involved in paint stripping with DCM, and developed facial nerve palsy	• PPE
95	EASCR, 2006 - (Protocol of a DCM accident at a dip tank in Hessonia, Geramyn - April 2006)	2006	Germany		**1**	?	IND	?	Unknown
96	Express & Star, 2006 ("*Paint Stripper Tragedy*") Eco Solutions, 2007	2006	UK	**1**		?	IND	A 21-year-old died after apparently inhaling deadly fumes while working at a Wolverhampton paint-stripping firm. The man passed out and stopped breathing. He was rushed to hospital but resuscitation attempts failed. Communication with a UK formulator of alternative paint strippers suggests that the Coroner's Office at Wolverhampton has confirmed the involvement of DCM-based formulations to the accident and that, at the time of writing this Final Report, the fatality was subject to a police investigation with the possibility of a prosecution, and the inquest was pending. The above have **not** been confirmed by the authorities.	Unknown

Table E2.1: Overview of Available Information from Literature on Fatalities Involving Use of DCM-based Products (1930s-2007)									
No	**Reference**	**Year**	**Location**	**Fata-lities**	**Non-fatal**	**Rele-vant?**	**Use type**	**Description**	**Key issue for fatality/injury**
97	EASCR, 2006 - (Guardian Unlimited - 27.10.2006 / www.safetynews.co.uk - restorator dip tank)	2006	UK	**1**	**4**	Yes	IND	Death of a man in High Wycombe, UK. The deceased may have been overcome by exposure to DCM contained in a tank (for furniture stripping), 4 other persons required to attend hospital.	• Tank use
98	French Ministry of Ecology, 2007 (based on information from Institut national de la recherche scientifique – INRS)	2007	France	**1**		Yes	IND	An industrial worker was killed in January 2007 of intoxication with DCM. The deceased worked for a small company stripping wood and metal: parts to be stripped (shutters, gates, etc.) are placed in large tanks which contain a mixture of DCM and of pickling solution. This workman, who had more than 10 years experience, was accustomed to using hooks to handle the part in the tank, in order not to approach the bath of pickling solution, not to breathe the vapours. This employee was found in a state of apparent death on the edge of the tank. Resuscitation efforts were fruitless.	• Tank use
			Totals	***64***	***151***				

Sources: ETVAREAD, 2004, UK Department for Environment, Food and Rural Affairs and EASCR (2006) Internet site (http://www.eascr.org/DCMincidents.html), SUVA, 2006b
"Year": The year of the accident; occasionally this is not available and the year of publication is used. This is indicated in the reference as "DoP".
"Non-fatal": Injuries associated with each incident
"Relevant": This shows whether the incident was related to the use of DCM-based paint strippers in applications relevant to this study
"Use type": Allocation of the incident to consumer, professional or industrial use of the DCM-based products
"Key issue": Possible key reason for which the accident occurred
Please note that all information on accidents and fatalities discussed in this Table has been provided by third parties; this information has not necessarily been verified independently during the course of this study. We are, therefore, not in a position to vouch for the accuracy and interpretations provided therein.

E3. ACCIDENTS ASSOCIATED WITH ALTERNATIVE PAINT STRIPPING FORMULATIONS

E3.1 Introduction

The information below is taken from the ECSA (2002a) report on the European Poison Control Centre survey they undertook. The ECSA report suggests that, in the few Poison Control Centres where data had been reported for other paint strippers, there are usually no more incidents with DCM than with the alternatives. In these countries, incidents with alternatives have been shown to be more severe than with DCM

Adequate ventilation is the best protection against high exposure. Furthermore, many incidents could have been avoided by the use of appropriate protection devices recommended by the manufacturers for all paint strippers (gloves, spectacles, mask).

On the basis of the data in its report, ECSA argues that no risk management measures are required with regard to the use of DCM adhesives, aerosols and paint strippers (ECSA, 2002a).

E3.2 Accident Data from Austria

Ten accidents with alternatives have been recorded at the Austrian Poisons Information Centre from 1 January 2000 through 30 September 2002. The respective products and their active ingredients were:

- "Lackstrip 90" (dimethylformamide, formic acid, chloroacetic acid): 2 instances;
- "Abbeizer Rote Krähe" (mixture of halogen-free non-aromatic solvents): 1 instance;
- "Abbeizer spezial" (ethylethoxypropionate, NMP, butyldiglycol): 1 instance

In 6 cases, the product was unspecified.

Reported symptoms included: burns or irritation of the epidermis or mucous membrane in 3 cases (1 "Abbeizer spezial", 2 unspecified paint removers).

E3.3 Accident Data from Belgium

As shown earlier in this report, DCM-based products account for 60% of accidents related to the use of paint strippers. The majority of the remaining accidents related to products of unknown composition (i.e. possibly DCM as well). Only dimethylformamide is specifically mentioned as being related to slightly more than 5% of incidents (ECSA, 2002a).

E3.4 Accident Data from the Czech Republic

As discussed previously, only 3 inquiries on paint strippers had been recorded at the time of the ECSA survey, none of which relating to solvents. They contained mostly alkalis.

As a conclusion, in the Czech Republic, DCM, glycol ethers, NMP, DBEs, dimethylsulphoxide, n-propyl bromide, d-limonene and paint strippers containing these substances alone or with accelerators (such as acetone, methyl ethyl ketone, toluene, anisole) do not represent a serious problem (ECSA, 2002a).

E3.5 Accident Data from Germany

E3.5.1 Bonn Poison Control Centre

Only two cases were reported in 2002:

- a man complained about headache and nausea after using a product containing N-methyl-2-pyrrolidone and another product ("Anti-Teer" - no further information available). ECSA suggests that it is difficult to link symptoms to the use of the paint stripper; and

- a man, working with a graffiti-remover containing butyl acetate, methoxy-propanol, isobutanol and xylene showed burns (erythema, burning and bullae) after dermal contact with the substance.

There were no other case reports on paint strippers reported to this Poison Control Centre during the last 4 or 5 years (ECSA, 2002a).

E3.6 Accident Data from the United Kingdom

E3.6.1 Belfast (Northern Ireland) Poison Control Centre

Table E3.1 presents the available data for accidents involving DCM-free paint strippers in Northern Ireland (UK) for the years 2000-2002. ECSA notes that the number of recorded accidents in larger than the number of incidents involving DCM-based paint strippers.

Table E3.1: Incidents related to DCM-based Paint Strippers in Northern Ireland (UK, 2000-2002)				
Date	**Chemical**	**Symptoms**	**Adult/child**	**Information source**
14 Apr 2000	Acetone	Inhaled about 3 days ago. Had nausea and vomiting, but nothing now	Child - 5 years	Toxbase
06 Oct 2000	Acetone	None	Child - 1 yr	Toxbase
12 Jan 2001	Methyl ethyl ketone peroxide	Patient has chest/breathing problems – possible occupational exposure to methyl ethyl ketone	Adult	Poisindex Tomes
22 May 2001	Methyl ethyl ketone peroxide	Unknown	Adult	Poisindex
Source: ECSA, 2002a				

E3.6.2 Cardiff (Wales) Poison Control Centre

With regard to telephone enquiries to the Cardiff Poison Control Centres, the numbers for those related to paint strippers of unspecified composition are presented in Table E3.2.

Table E3.2: Enquiries related to Paint Strippers of Unspecified Composition in Wales (UK, 1997-2002)	
Year	**Number of enquiries related to unspecified DCM-based paint strippers**
1997	17
1998	17
1999	15
2000	13
2001	15
2002	14 (part of the year)
Source: ECSA, 2002a	

The enquiries are normally on UK named products, not on the ingredients/agents, for example, acetone. This chemical is used in the UK to remove nail polish so there are many enquiries on this agent, both as a product and as a chemical in its own name.

ANNEX F:

INFORMATION ON VOLATILE SUBSTANCE ABUSE

F1. INTRODUCTION TO SUBSTANCE ABUSE

F1.1 What is Volatile Substance Abuse?

The practice of solvent abuse is not a modern phenomenon. The deliberate inhalation of substances to produce an intoxicated state dates back at least to the ancient Greek and other civilisations, where it was an adjunct to religious practice. Volatile substance abuse, as we understand it today, involves the inhalation of vapours from a number of substances, which then enter the body via the large surface of the lungs, providing easy access to the body and the rapid onset of effects (Re-Solv, 2007a).

F1.2 Relevance of Volatile Substance Abuse to this Study

We have looked into the issue of volatile substance abuse following the receipt of comments from a number of consultees. More specifically, some manufacturers of DCM and DCM-based paint strippers have suggested that any restriction on the marketing and use of DCM-based paint strippers could result in increased sales of alternative paint stripping formulations that contain substances such as methanol, xylene, toluene, ethyl acetate, methyl ethyl ketone (MEK) and dimethyl ether which have a "sweeter smell" and are more widely abused that DCM. In relation to this, ECSA also argues on the Euro Chlor Internet site (ECSA, 2002b) "(DCM-based paint stripper) *formulators are concerned that minimal risks to the consumer from use of DCM will be significantly increased through volatile substance abuse incidents from replacement paint removers…encouraging further products onto the consumer shelves is felt to be unacceptable against this background, and not what a responsible industry wishes to see*". A small number of Competent Authorities in Member States where solvent abuse is an important social issue have also raised these concerns.

F1.3 Who Abuses Volatile Substances?

According to the Society for the Prevention of Solvent & Volatile Substance Abuse (Re-Solv, 2007b), there is a common misconception that those who become involved in volatile substance abuse are deviant young people who use volatile chemicals for the sole purpose of getting 'high'. This generalisation makes no allowance for the complex motivations behind the actions of many young people, for whom the sensation of being 'high' is neither pleasurable nor acceptable, but rather a means to an end (Re-Solv, 2007b).

Motivations behind volatile substance abuse may include (Re-Solv, 2007b):

- ***experimentation***: volatile substance abuse can satisfy a youthful need to experiment. The 'buzz' created by volatile substances, and the hallucinations which may accompany this, can provide new sensations in a culture which strives for ever greater thrills;

- ***peer pressure***: the power of peer pressure can often be underestimated during the teenage years, which are a time of self-discovery and personal growth. The pressure to be popular can make it difficult to resist friends' persuasion, even when there are dangers, and taking risks can seem an easy way to impress friends;

- ***medical or psychological factors***: sniffing may arise as a symptom of another problem, rather than the cause. It can be a means of avoidance. When dealing with volatile substance abuse, teachers are advised to be aware of the effects of bereavement and divorce on young people, any mental or physical stresses associated with school or adolescence, or other emotional pressures, and how they may cope with these, and address the need for professional help for young people who use volatile substance abuse as a coping mechanism;

- ***accessibility***: volatile substances can appear an attractive alternative to drugs as they are cheap and easy to buy or steal, and many are freely available in the home;

- ***boredom***: sniffing can satisfy a need for new, exciting and cheap social activities;

- ***to shock***: the power to shock adults can be a means of asserting one's individuality during a typical period of conflict between parent and child; and

- ***social activity***: young people may see sniffing as comparable to their parents having a social drink at the pub.

The following is a list of reasons for the choice to abuse volatile substances (Orr & Shewan, 2006):

- ***readily and legally available***: products that can be used are readily available in the home and the school. Many can also be purchased legally, some by young people;

- ***relatively low cost***: the cost of volatile substance containing products is very often less than the cost of alcohol, cigarettes or other substances;

- ***considered easy to conceal abuse***: volatile substance containing household products are not readily recognisable as substances for abuse. Volatile substance abuse often has a short term outwardly visible effect on participants; and

- ***not considered addictive***: unlike other substances, many of the products used are non-addictive and there is a low risk of dependency.

The current literature tends to describe young people who use inhalants as a homogeneous group, with little attention paid to differences in the chemical composition or toxic profile of the substances they inhale. The actual rate of inhalant misuse among young people is likely to be somewhat higher, as population or school-based surveys typically exclude young people at high risk of becoming regular users (e.g. those not attending school, and the homeless) (Lubman *et al*, 2006).

F1.4 Which Substances are Abused?

To be abused by inhalation, products must contain a suitably volatile compound (or compounds) which are accessible in sufficient quantity and are free from overtly toxic components. Solvents from contact adhesives, notably toluene, typewriter correcting fluids and thinners (until recently, commonly 1,1,1-trichloroethane), other halogenated solvents, volatile hydrocarbons, such as those found in cigarette lighter refills (often liquefied petroleum gas (LPG), largely butane), aerosol propellants, halocarbon fire extinguishers, and inhalational anaesthetics, such as enflurane and nitrous oxide are among the compounds or products which may be abused in this way. Petrol (gasoline) is still often abused, especially in remote rural communities (Flanagan & Ives, 1994). Table F1.1 presents an overview of the key volatile substances that may be abused by inhalation. Notably, DCM is among them.

Table F1.1: Selected Volatile Substances which may be Abused by Inhalation

Group	Substance
Aliphatic	Acetylene
	Butane *
	Isobutane (2-methylpropane) *
	Hexane **
	Propane *
Alicyclic/aromatic	Cyclopropane (trimethylene)
	Toluene (toluol, methylbenzene, phenylmethane)
	Xylene (dimethylbenzene) ***
Mixed	Petrol (gasoline) ****
	Petroleum ethers *****
Halogenated	Bromochlorodifluoromethane (BCF, FC 12B1)
	Carbon tetrachloride
	Chlorodifluoromethane (FC 22, Freon 22)
	Chloroform
	Dichlorodifluoromethane (FC 12, Freon 12)
	DCM
	1,2-Dichloropropane
	Ethyl chloride (monochloroethane)
	Halothane (2-bromo-2-chloro-1,1,1-trifluoroethane)
	Tetrachloroethylene (perchloroethylene)
	1,1,1-Trichloroethane
	1,1,2-Trichlorotrifluoroethane (FC 113)
	Trichloroethylene
	Trichlorofluoromethane (FC 11, Freon 11)
Oxygenated compounds	Acetone (dimethyl ketone, propanone)
	Butanone (2-butanone, methyl ethyl ketone, MEK)
	Butyl nitrite ******

Table F1.1: Selected Volatile Substances which may be Abused by Inhalation	
Group	**Substance**
	Enflurane (2-chloro-1,1,2-trifluoroethyl difluoromethyl ether)
	Ethyl acetate
	Diethyl ether (ethoxyethane)
	Dimethyl ether (DME, methoxymethane)
	Isobutyl nitrite ("butyl nitrite") *******
	Isoflurane (1-chloro-2,2,2-trifluaroethyl difluoromethyl ether)
	Isopentyl nitrite (3-methyl-l-butanol, isoamyl nitrite, "amyl nitrite") ******/*******
	Methyl acetate
	Methyl isobutyl ketone (MIBK, isopropyl acetone)
	Methyl tert-butyl ether (UTBE)
	Nitrous oxide (dinitrogen monoxide, "laughing gas")
	Sevoflurane (fluoromethyl 2,2,2-trifluoro-l-(trifluoromethyl)ethyl ether)

Source: Flanagan & Ives, 1994
* Principal components of LPG
** Commercial "hexane" mixture of hexane and heptane with small amounts of higher aliphatic hydrocarbons.
*** Mainly meta-xylene (1,3-dimethylbenz4ene)
**** Mixture of aliphatic and aromatic hydrocarbons with boiling range from 40° to 200°C
***** Mixtures of pentanes, hexanes etc. with specified boiling ranges (e.g. 40° to 60°C)
****** Abused primarily for its vasodilator properties
******* Commercial amyl nitrite is mainly isopentyl nitrite, but other nitrites are also present

The first category of abusable products includes most aerosols and all forms of liquefied petroleum gas (gas lighter fuel, fuel for picnic stoves, etc.), which are "sniffable" and will carry warnings such as "flammable", "do not puncture or incinerate", "do not use near fire or flame", etc. Aerosols producing foam, paste, mousse or gels are not usually "sniffed" (Re-Solv, 2007c).

The second category of abusable products come under the heading of highly flammable liquids. These products are usually in the form of liquids in metal containers or bottles. All will bear the words "Highly-Flammable" or similar wording, and display a black flame on a square orange background. In addition, the outer case of multiple retail packs will be marked either with the same symbol or with a diamond symbol (Re-Solv, 2007c).

The third category of abusable products are not in themselves flammable, but hints can be gained from reading the appropriate text on the packaging. Relevant products included non-flammable paints, fire extinguishers, adhesives and cleaning fluids which contain substances such as (Re-Solv, 2007c):

- trichloroethylene;
- DCM; and
- tetrachloroethylene.

Table F1.2 outlines the main commercial products in which the aforementioned abusable solvents may be contained.

Table F1.2: Selected Products which may be Abused by Inhalation		
Product type		**Relevant volatile substances**
Adhesives	Balsa wood cement	Ethyl acetate
	Contact adhesives	Butanone, hexane, toluene and esters
	Cycle tyre repair cement	Toluene and xylenes
	Polyvinylchloride cement	Acetone, butanone, cyclohexanone, trichloro-ethylene
	Woodworking adhesives	Xylenes
Aerosols	Air freshener	LPG, DME and/or fluorocarbons
	Deodorants, antiperspirants	LPG, DME and/or fluorocarbons
	Fly spray	LPG, DME and/or fluorocarbons
	Hair lacquer	LPG, DME and/or fluorocarbons
	Paint sprayers	LPG, DME and/or fluorocarbons and esters
Anaesthetics and analgesics	Inhalational	Nitrous oxide, cyclopropane
		Diethyl ether, halothane, enflurane, isoflurane
	Topical	FC 11, FC 12, monochloroethane
Dust removers ("air brushes")		DME, FC 22
Commercial dry cleaning and degreasing agents		DCM, FC 113, methanol, 1,1,1-tri-chloroethane, tetrachloroethylene, toluene, trichloroethylene (now rarely carbon tetrachloride, 1,2-dichloropropane)
Domestic spot removers and dry cleaners		DCM, 1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene
Fire extinguishers		Bromochlorodifluoromethane, FC 11, FC 12
Fuel gases	Cigarette lighter refills	LPG
	Butane	LPG
	Propane	Propane and butanes
Nail varnish and nail-varnish remover		Acetone and esters
Paints and paint thinners		Acetone, butanone, esters, hexane, toluene, trichloroethylene, xylenes
Paint stripper		DCM, methanol, toluene
Room odouriser		Isobutyl nitrite
Surgical plaster and chewing-gum remover		1,1,1-Trichloroethane, trichloroethylene
Typewriter correction fluids and thinners		1,1,1-Trichloroethane
Whipped cream dispensers		Nitrous oxide
Source: Flanagan & Ives, 1994		

F1.5 Current Legislative Measures against Volatile Substance Abuse

The following legislative measures apply in countries around the world (CCSA, 2006; Re-Solv, 2007d):

- England and Wales: Cigarette Lighter Refill (Safety) Regulations 1999 - these regulations make it an offence to supply any cigarette lighter refill canister containing butane or a substance with butane as a constituent part to any person under the age of 18 years. Intoxicating Substances (Supply) Act 1985 - under this act it is illegal for a person to sell or supply a substance to anyone believed to be under the age of 18 or anyone acting on behalf of someone under that age, if he or she has reasonable cause to believe that the substance may be inhaled for the purpose of intoxication. The Act is applicable in England, Wales and Northern Ireland. The statute does not make it an offence, however, to purchase and subsequently abuse solvents and other volatile substances. There have been few prosecutions since the Act was passed, with only 53 out of 90 prosecutions leading to a conviction, the other 29 resulting in a fine;

- under Scottish Common Law, the supply or sale of solvents or volatile substances to any person, knowing that these substances will be abused has been held to constitute criminal conduct, which culpably endangers life and health. In Scotland, the Social Work (Scotland) Act 1968 took over the responsibility for children who were in need of care and protection and children who committed a variety of offences. The purpose of the Act was to decriminalise the activities of children. The Solvent Abuse (Scotland) Act of 1983 was an amendment to this Act and made volatile substance abuse in itself a specific ground for referral to the Children's Panel. It is important to note that the reason for referral i.e. solvent abuse, was not seen as a criminal act;

- approximately 40 US States have outlawed the inhalation of toxic substances. Treatment options are available in some but not all of the states;

- in Australia, the Queensland Government Safe Places Legislation restricts the selling of volatile solvents in cases where the seller suspects the purchaser is going to misuse the substance; and

- the possession and use of volatile solvents are not prohibited under Canadian federal law, and provincial and municipal laws are rare.

F2. EXTENT OF VOLATILE SUBSTANCE ABUSE IN THE EU AND LINKS TO PAINT STRIPPERS

F2.1 Data on Volatile Substance Abuse in EU Member States

Table F2.1 summarises the available information on the current status regarding volatile substance abuse in selected EU Member States.

The information in the table is taken from the European School Survey Project on Alcohol and Other Drugs. The same source provides an indication of the lifetime prevalence (%) of inhalant abuse by Member State and a comparison of prevalence (%) for the years 1995 and 1999. It appears that the countries with highest prevalence include Ireland, Malta, the UK, Slovenia, Greece and Estonia. At the other end of the spectrum are Romania, Bulgaria, Portugal, Hungary and Finland.

Table F2.1: A European Perspective – A Summary of Volatile Substance Abuse Evidence within the ESPAD Database			
Country	**Date**	**Title of paper**	**Information**
Belgium	2000	Reitox report-Scientific Institute of Public Health, Unit of Epidemiology	From 15-16 years of age onwards, cannabis derivatives are the products most used; ecstasy is the second product most used; among younger students, solvents or hypnotics or sedatives are the products most used
Bulgaria	2000	Bulgarian National Report	Solvents: small decrease (no further detail)
Czech Republic	2000	Czech Republic National Report on drug situation	The following specifics apply to the Czech Republic in the long-term horizon: • significantly high share of drug addicts misusing volatile solvents. The most often abused drugs by pupils and students are solvents, cannabinoids and hallucinogens. There was a significant drop in the number of solvent users in all Czech regions compared to 1998 but on the other hand the increase in Moravian regions. EPIDEMIOLOGICAL SITUATION The use of solvents is relatively widespread in the Czech Republic and it reports several specifics: • users are mostly from the youngest age groups; • users are predominantly boys from secondary apprentice training centres; • regionally different distribution supported by differences in social and economical situation in regions with higher unemployment rate is significant; • it is higher in regions with higher a concentration of the Romany population; and • it is often linked to non-fatal emergencies. While the number of problematic solvent users has slightly gone down recently, they registered a small increase in the number youths experimenting with solvents. The reasons of continuously increasing numbers of drug users undoubtedly include the ease by which these substances can be obtained (over-the-counter drugs, solvents).

Table F2.1: A European Perspective – A Summary of Volatile Substance Abuse Evidence within the ESPAD Database			
Country	**Date**	**Title of paper**	**Information**
Denmark	2000	Reitox report- National Board of Health	In 1995, as many as 6.3% of the 15-16-year-olds had tried sniffing solvents; in 1999 this figure is 7.5%. There is thus a small rise between 1995 and 1999 with an approximately equal distribution between boys and girls in 1999. The number of persons admitted for psychiatric treatment after use of centrally stimulating substances, hallucinogens and solvents during the past few years seems to have stabilised. Since the first school surveys were conducted at the beginning of the 1990s, it has been seen that a considerable number of young people experiment with sniffing solvents. The prevalence of sniffing among the very young in Denmark is high in relation to other illegal substances, even though on average it is lower than in most other European countries. The proportion of young people reporting having experimented with sniffing in Denmark has been between 5-7.5% during the past 10 years. From the regional hearings held in 1999, it is reported by the police and addiction consultants throughout the country that "poppers" in some periods are popular among the very young people aged between 13-14 years.
Finland	2000	Reitox report-Stakes, sosiaali- ja teveysalan tutkimus-ja kehittamiskeskus	Based on 1998 information, 2.6% of men and 1.4% of women had inhaled solvents for intoxication purposes during lifetime, while the 1992 data showed that 1.0% of men and 0.2% of women had done so. Some 2.0% of the Finnish population had experimented with inhaling solvents or glues during lifetime, but only 0.2% had done so during the previous year.
France	2000	Reitox report- l'Observatoire français des drogues et des toxicomanies	The most recent data is that obtained from a school environment, ESPAD (European School Survey on Alcohol and Other Drugs), performed in 1999 by INSERM, in partnership with OFDT and the national education ministry. The results are set out here in respect of 14 –18 year olds. For the other illicit products mentioned in the questionnaire, the levels of experimentation are low: they are still less than 5% apart from inhaled products (glues, solvents...) experimentation in these substances tend to take place more before the age of 14 years, such that its prevalence hardly develops any further during one's lifetime. For girls and for boys, three quarters of experimental users took an inhaled product for the first time before the age of 15. No of deaths by overdose as follows: 1990=12, 1991=6, 1992=6, 1993=1, 1994=6, 1995=4, 1996-1998=1, 1999=0.
Germany	2000	Reitox report- Institut for Therapieforschung	In Germany volatile inhalants are not used very frequently. The representative population survey of 1997 (Kraus & Bauernfeind 1998) shows, that 0.7% of the West German adult population used volatile inhalants at least once in their life; during 1999 only 0.2% did so. Most experiences with volatile inhalants are reported by the group of 21-24 years old persons. Among this group 2.4% used the substances at least once in their life, 1.1% did so during the last 12 months. In outpatient counselling or treatment centres solvents do nearly not exist as main diagnosis as single diagnosis they are prevalent among 0.3% of all treated men and women (Türk & Welsch, 2000a).
Greece	2000	Reitox report- University of Mental Health Research Institute	The ESPAD study in Greece was conducted by the University Mental Health Research Institute (UMHRI) in Autumn 1999. The ESPAD protocol was used and the Greek version of the ESPAD questionnaire. Main trends: the increasing trend in overall illicit drug use obvious in 1993, compared to 1984, resulted in a sharp increase after 1993, where the percentage of students reporting drug experimentation or use doubled (from 6% in 1993 to 13.7% in 1998). Cannabis and solvents presented the highest prevalence.

Table F2.1: A European Perspective – A Summary of Volatile Substance Abuse Evidence within the ESPAD Database			
Country	**Date**	**Title of paper**	**Information**
Ireland	2000	National Report on Drug Issues	Among young people in general (ages 9-18) after cannabis, solvents are the most widely used substance. Lifetime use of solvents (13%); and recent use of solvents (7%) – are somewhat higher than results from HBSS (Health Behaviours in Schools Survey).
Italy	2000	Reitox report- OIDT	Multiple use (including alcohol, pharmaceutical products, solvents) There is relatively little information available about multiple drug use at the national level. However, some data from different sources suggests that this is a developing issue.
Latvia	2000	Phare project- Centre of Drug Abuse Prevention and Treatment (Narcology)	The use of solvents has decreased considerably according to all sources of information. According to the data of narcological institutions, the proportion of solvent users was about 4 – 5% of the total number. Upon the evaluation of the data provided by the ESPAD 1999 survey, the decline in the use of inhalants could be explained by the following; 1. a larger offer of other drugs, in particular heroin, a well-organised market and the decrease in the price; 2. the improvement of the material situation. Results of the analyses show that inhalants are used mostly by the youth who come from poor families and who cannot afford buying more expensive drugs. It can also be concluded from the data that the number of inhalant users is higher in rural areas than in cities/towns. Illicit drugs are more often used by those young people who come from affluent families. Children of low-income families have smoked more and have sniffed inhalants at least once in their life.
Lithuania	2000	National Report on the drug situation in Lithuania 2000	According to ESPAD data, usage of inhalants increased in Klaipeda City among schoolchildren of grade 9 (for boys by 20%). The rates of use frequency of inhalants decreased from 15.7% in 1995 to 7.5% in 1999 (country level). The use of inhalants has been observed as very early intoxication among children. Two deaths from intoxication of solvents were registered in the early age (12 years) in Klaipeda in 1996. In 1999, among registered drug addicts, solvent use accounted for 5.2% (161persons), in 1998; 148 persons were registered. The most popular substance to abuse is glue "Moment", which according to regulations cannot be sold to children.
Luxembourg	2000	Report to the EMCCDA by the Reitox national focal point of Luxembourg, Direction de la Sante Luxembourg drug situation 2000	Data from school and youth surveys suggest solvents use show fairly stable figures since 1992. The HBSC (2000) and Matheis (1992) survey reveal low lifetime prevalence of solvent use in youngsters (16-20 years), which has slightly increased over the last 8 years (1999: 3.8% – 1992: 3.5%). Last 12 months prevalence (HBSC, 2000) figures show 1.6 per cent abuse in 12 – 20 year old students. Differences in solvent use according to gender are not significant. A possible explanation of these low figures might be seen in the whole socio-economic situation of the country. Youngsters with the financial means prefer to acquire more expensive or more powerful drugs such as ecstasy, amphetamines or cocaine.
Netherlands	2000	Reitox report-Trimbos- institut	Only mention is from ICD- 10 code from 1996 to present is F 11 -F 16 and F 18-F1 9 for Mental and behavioural disorders – cannabis, sedatives and hypnotics, cocaine, other stimulants, hallucinogens, volatile solvents, multiple drugs, other psychoactive substances

Table F2.1: A European Perspective – A Summary of Volatile Substance Abuse Evidence within the ESPAD Database			
Country	**Date**	**Title of paper**	**Information**
Romania	2000	National Report on drugs problem	The inhaling of the solvents from many unrestricted products (paints, varnishes) is a serious problem in Romania, such users are mostly underage. These volatile solvents (the major component is toluene) induce, after inhalation, a reversible psychic addiction. The number of users is increasing but the extent is not known. The highest risk is considered to be from a progression towards other drugs that may produce irreversible forms of addiction.
Slovakia	2000	Phare project-National Central Node of Drug Information System	Volatile inhalants and solvents were the most widely abused substances by youngsters before 1990. Then, as it has been already shown, the shift from these substances to heroin took place and in around 90% in 1992 but this figure had fallen to around 20% in 1994, and then stabilisation at approximately somewhat above 10% among treated drug dependent patients.
Spain	1987	The epidemiology of the illicit drug trade in Spain	In 1984, it was estimated that approximately 3% of the population, less than 18 years old, had tried inhalants, while the results of the 1985 national survey showed that 2% of the population older than 12 years had used these products at some time in their lives, with 0.7% in the six months before the survey and 0.4% in the month before the survey. A small percentage (0.07%) of the population were regular users. The average age of inhalant users at first use was 16.3 years. The proportion of high school students in Valencia having ever tried inhalants was 5.3%. A survey conducted at several universities revealed that 1.5% of the students had used inhalants at some time. In general, inhalant users are mainly males between 10 and 20 years of age, although it is not unusual to find eight-year-old users. The users usually come from lower socio-economic strata of the population who live in poor settlements outside big cities. Their home environment is often unstable. The users of inhalants usually present difficulties for adaptation at school resulting in major learning problems.
Sweden	2000	Reitox report-Folkhalsoinstitutet	Solvent use is not normally a component of multiple use among severe users. In the 1992 case finding study, the frequency of sniffing was less than 1% among the severe users. Approximately one percent of all persons undergoing compulsory treatment had volatile solvents as at least one component in their drug use leading to treatment. Solvents sniffing are more related to younger teenagers.
N Ireland (UK)	?	Drug Strategy for Northern Ireland	The findings in the surveys conducted during 1995-98 indicated that the most popular drugs used were cannabis, LSD and Ecstasy. Solvents tended to be used by more young people than heroin and cocaine. When asked to select which drug they had used, 10-13 year olds indicated that 93% had never used any drug. For 14-17 year olds the figure was 62%. The two most commonly used drugs were poppers and cannabis. The use of solvents also featured prominently.
Source: ESPAD, 2002			

F2.2 Data on Mortality from Volatile Substance Abuse in the UK

F2.2.1 Overview of Available Data

Volatile substance abuse is an issue of significant social profile in the UK. As such the UK is a country that collects very detailed data on deaths from volatile substance abuse. St. George's Hospital in London is responsible for collecting data for the UK and has recently (in 2006) released a report with data for the year 2004 (Field-Smith *et al*, 2006). The key points of this most recent report are:

- there were **47 deaths** associated with volatile substance abuse in the UK in 2004, the lowest annual total recorded since data collection methods were stabilised in 1983. The number of deaths in 2003 now stands at 53, bringing the total number of **volatile substance abuse deaths in the UK since 1971 to 2,152**;
- **since 1992 there has been a significant fall in deaths**, from an average of 77 per year in 1993-1998, to an average of 62 per year in 1999-2004;
- **gas fuels continue to be associated with the majority of deaths**. In 2004, butane from all sources, including aerosol propellants, accounted for **79% of volatile substance abuse deaths** (37 of the 47 deaths);
- **volatile substance abuse deaths in under-18 year olds have risen from nine in 2003 to thirteen in 2004**. Eight of these thirteen deaths were associated with butane cigarette lighter refills, the sale of which to under-18s is prohibited by legislation;
- **volatile substance abuse deaths continue to be more common among males than females**. In 2004 there were over four times as many male as female deaths overall, but in the under-18 year olds, this ratio fell to just over two to one; and
- in 2004 for the UK, **among those aged 10-15 years there were eight deaths associated with volatile substance abuse compared with three deaths from drug misuse**.

F2.2.2 Volatile Substances Abused in the UK in 2004

The researchers classify separately butane intended for fuel use, and butane used as a propellant in aerosols. Almost all deaths were associated with only one volatile substance. In 6% of deaths, two or more volatile substances were known to be involved.

Over the period 1995 to 2004, there was no significant change in the proportions of the substances abused. The absolute number of deaths associated with gas fuels in 2004 was lower (at 33) than in any of the previous nine years. The overall decline in gas fuel related deaths over the ten-year period was statistically significant. Similarly, the frequency of glue-related deaths declined over time (although this finding appeared to be

due to a high number of deaths in 1995). There was no significant trend in aerosol-related deaths post 1994 (Field-Smith *et al*, 2006).

Within the broad substance categories, a wide variety of products have been abused. Table F2.2 shows products abused by substance for 1971 to 2004. This also gives the type of products linked to deaths, showing them as percentages of substances used, rather than as percentages of the total number of deaths. Thus deaths can appear more than once in this table. Since 1971, butane gas lighter fuel has been associated with 83% of fatal abuses of gas fuel (38% of all substances fatally abused), deodorants and anti-perspirants with 45% of fatal abuses of aerosols (8% of all substances fatally abused) and contact adhesives with 47% of fatal abuses of glue (7% of all substances fatally abused) (Field-Smith *et al*, 2006).

Table F2.2 also gives the same information for 2004 alone. Butane gas lighter fuel was associated with 52% of all substances fatally abused, considerably more than the long-term average of 38% shown in the same table. In addition, butane fuel cans, some of which may have been lighter refills, accounted for another 6% of all substances (long term average of 1%) (Field-Smith *et al*, 2006).

Since 1995, there have been two deaths involving nail varnish, one in 1994 and one in 1995, and two involving nail varnish remover (acetone), one in 1995 and one in 2003 (Field-Smith *et al*, 2006).

From Table F2.2, **paint thinners and strippers account for only 0.7% of the products used for volatile abuse resulting in death in the UK between 1971 and 2004. This figure fell to zero for the year 2004, a fact that might indicate a fall in the use of paint thinners and strippers as products used for volatile substance abuse**. It is important to note that the majority of paint strippers in the UK consumer market is based on DCM, however, it is likely that any deaths under the 'paint thinners and strippers' category could be resulting from exposure to paint thinners rather than strippers. Thinners may contain solvents such as toluene and xylene which are known to be substances of abuse.

Overall, the presence of paint strippers among the abusable products (on the basis of recorded deaths from abuse) is very modest and cannot be considered as a priority in addressing the social issue of volatile substance abuse.

Notably, the United Nations' Bulletin "Volatile Substance Abuse" suggests that the prevalence of volatile substance abuse in the United Kingdom is broadly similar to that throughout Europe (Flannegan & Ives, 1994).

Table F2.2: Product Abused by Substance: 1971 – 2004 (n = 2258) and 2004 alone (n = 48)							
Product	**1971-2004**			**2004**			**% change**
	No. of cases	**% of substance group**	**% of all substances**	**No. of cases**	**% of substance group**	**% of all substances**	
Gas fuels							
Lighter fuel	863	82.5	38.2	25	75.8	52.1	
Butane gas cans	29	2.8	1.3	3	9.1	6.3	
Domestic gas (bottled)	103	9.8	4.6				
Propane gas cylinder	25	2.4	1.1	4	12.1	8.3	
Acetylene	3	0.3	0.1				
Unspecified butane	23	2.2	1.0	1	3.0	2.1	
Total for gas fuels	***1046***	***100.0***	***46.3***	***33***	***100.0***	***68.8***	***+22.2***
Aerosols							
Deodorant / Antiperspirant	180	44.9	8.0	3	60.0	6.3	
Pain relief spray	63	15.7	2.8				
Air freshener	51	12.7	2.3	2	40.0	4.2	
Hair spray	29	7.2	1.3				
Cleaning fluids	17	4.2	0.8				
Insect spray	7	1.7	0.3				
Paint spray	8	2.0	0.4				
Aerosol glue	2	0.5	0.1				
Other aerosols	44	11.0	1.9				
Total for aerosols	***401***	***100.0***	***17.8***	***5***	***100.0***	***10.4***	***-7.4***
Glues							
Contact adhesives	166	47.4	7.4	1	20.0	2.1	
Bicycle tyre repair glue	10	2.9	0.4				
Model glue	3	0.9	0.1				
Other glues	171	48.9	7.6	4	80.0	8.3	
Total for glues	***350***	***100.0***	***15.5***	***5***	***100.0***	***10.4***	***-5.1***
Other							
Typewriter correction fluid	113	29.0	5.0				
Chloroform	32	8.2	1.4				
Dry cleaning fluids	21	5.4	0.9				
Petrol	34	8.7	1.5				
Plaster remover	17	4.4	0.8				

Table F2.2: Product Abused by Substance: 1971 – 2004 (n = 2258) and 2004 alone (n = 48)							
Product	**1971-2004**			**2004**			**% change**
	No. of cases	**% of substance group**	**% of all substances**	**No. of cases**	**% of substance group**	**% of all substances**	
Domestic cleaning fluids	16	4.1	0.7				
Industrial solvents / degreasers	18	4.6	0.8	3	60.0	6.3	
Anaesthetic agents	35	9.0	1.6				
Carbon tetrachloride	11	2.8	0.5				
Paint thinners and strippers	16	4.1	0.7				
Alkyl nitrites	11	2.8	0.5	1	20.0	2.1	
Refrigerant gases	5	1.3	0.2				
Brake cleaner	3	0.8	0.1				
Ether	5	1.3	0.2				
Benzene	1	0.3	0.0				
Petroleum spirits (excl. petrol)	1	0.3	0.0	1	20.0	2.1	
Miscellaneous products	51	13.1	2.3				
Total for other	***390***	***100.0***	***17.3***	***5***	***100.0***	***10.4***	***-6.9***
Fire Extinguishers	58	100.0	2.6				-2.6
Substance not known	13	100.0	0.6	0	0.0	0.0	-0.6
Source: Field-Smith et al, 2006							

F3. EVIDENCE OF ABUSE OF DCM

Literature suggests that abuse of dichloromethane by inhalation indeed occurs. For example, ATSDR (2000) notes "*...older children and adolescents may be exposed to methylene chloride in their jobs or hobbies, or through deliberate solvent abuse by "sniffing. Human epidemiological studies and case reports discussing reproductive and/or developmental toxicity of methylene chloride in humans have been reviewed. Exposure routes included occupational duties and sniffing of paint removers…Solvent abuse of methylene chloride for euphoric effects results in exposure levels that equal or exceed those producing adverse effects in animals*". OEHHA (2000) also suggests that DCM has also been used as part of abused inhalant mixtures (see Pryor *et al*, 1978). Also, entry 26 in Table E2.1 in Annex E refers to another case in the USA (in 1985) where an incident may have been the result of substance abuse.

In summary, DCM is already linked to volatile substance abuse to some extent but evidently is not one of the most widely abused volatile compounds. This is also the suggestion in IPCS (1996).

Furthermore, a Safety Data Sheet by Fisher Scientific (US company - Fisher, 2006) suggests that in at least one case, DCM has led to death; a reference is given (Harbison, 1998) but no additional detail. Notably, Safety Data Sheets from other manufacturers generally do not refer to abuse.

ANNEX G:

LIST OF CONSULTEES

G1. GENERAL DESCRIPTION

For the purposes of this study, we have attempted to conduct a consultation exercise as wide and inclusive as possible. We have sent emails to more than 470 private companies. This figure includes:

- companies that RPA has sent emails to (either including attached questionnaires or with the Internet link to the European Commission Internet site (see below details on the questionnaires) or with simpler lists of questions – especially after October 2006);

- companies that were notified by other companies as they belong in the same supply chain (for example, a supplier of DCM-based paint strippers has sent letters to 150 of his customers) as well as companies that were notified indirectly about this study and have contacted RPA (either through their national associations/European federations or their national Chambers of Commerce and Industry).

The organisations that have been contacted:

- six EU manufacturers of DCM (members of the European Chlorinated Solvents Association – note that after the enlargement of the EU with Bulgarian and Romania at the start of 2007, we sent an email to a DCM manufacturer that is located in Romania but we have not receive an input);
- a considerable number of manufacturers of DCM-based paint strippers in several countries;
- manufacturers of alternative paint strippers, including the members of the European Association of Safer Coatings Removal;
- more than seventy contact points at DIY retail chains across the EU;
- a number of companies involved in paint manufacture and paint removal for aircraft, rail vehicles, and buildings maintenance (for example, graffiti removal);
- a number of companies manufacturing 'active' ingredients for alternative DCM-free paint strippers;
- a number of companies involved in the recycling of solvents across Europe; and
- a small number of pharmaceuticals companies who recycle their spent DCM.

With regard to trade associations, a total of 64 trade associations at European and Member State levels have been contacted, where this includes Chambers of Industry and Commerce in European countries. For certain European trade associations, emails were sent both to the European association and the member national associations; taking into account all the national associations contacted, the total number of associations exceeded 180. Also, two meetings were held at RPA's offices: the first with a UK manufacturer of alternative (DCM-free) formulations who is a member of the European Association for Safer Coatings Removal (EASCR), the second with a UK formulator of DCM-based paint strippers and three of his customers (all of whom are involved in professional uses). The meetings were held on 19 September 2006 and 9 February 2007 respectively at the companies' request.

The list of consultees - which includes companies, trade associations, national chambers of commerce, consumer protection agencies and Government departments in European countries, solvent abuse experts and other consultees - is provided in Section G4 of this Annex. The following should be noted:

- these lists include all companies that have been contacted mainly by email. No guarantee can be given that our original emails (and any reminder emails that followed) indeed reached the intended recipient. Only a fraction of the total number of companies have contacted RPA and have provided information for this study; and

- the names of a small number companies have been omitted from the list on grounds of confidentiality at the companies' request.

G2. USE OF QUESTIONNAIRES

For the purposes of this study, RPA prepared in collaboration with DG Enterprise a total of eight main questionnaires addressed to:

- manufacturers of DCM;
- manufacturers of DCM-based paint strippers;
- manufacturers of alternative paint strippers;
- companies involved in industrial uses of paint strippers;
- retailers of paint strippers (DIY outlets);
- companies involved in professional uses (associations) of paint strippers;
- national authorities; and
- other stakeholders.

DG Enterprise uploaded copies of the eight questionnaires as Microsoft Word documents on its Internet site (http://ec.europa.eu/enterprise/chemicals/studies_en.htm).

The questionnaires were made available in English only and were either sent to consultees or a description of them plus the above link to the Commission's Internet site was provided in email messages sent to the Competent Authorities, industry consultees and other stakeholders.

Overall, a total of 62 completed questionnaires were collected in the course of the study. Information has also been received from companies in other forms without a completed questionnaire being submitted to RPA.

Table E2.1: Overview of Completed Questionnaires collected	
DCM manufacturers	6 questionnaires (plus a questionnaire from a supplier)
DCM-based paint stripper manufacturers/suppliers	23 questionnaires
DCM-free paint stripper manufacturers	12 questionnaires
Industrial users of paint strippers	2 questionnaires
Professional users of paint strippers	4 questionnaires
DIY retailers	2 questionnaires (plus another DIY questionnaire completed by a supplier)
Solvent recycling companies	4 questionnaires
Pharmaceuticals companies	3 questionnaires
Others	4 ('stakeholders') questionnaires
Source: Consultation	

G3. CONSULTATION WITH COMPETENT AUTHORITIES

With regard to the consultation with competent authorities in European countries, we have been in contact with a variety of Departments and Agencies in 29 countries (EU-25 plus EEA countries plus Switzerland). Overall, completed questionnaires were submitted by 18 countries (some of them provided additional information) and a further 7 countries provided information but not in the form of a submitted questionnaire.

G4. LIST OF CONSULTEES

Name of Company	Country
1st Airblast	UK
3G Cleaning Ltd	UK
aatiprint S.p.A.	IT
Abbey Masonry & Restoration Ltd	UK
ACC Beku	DE
Ackros	UK
ACOL Ltd	IE
Action Products Limited	UK
Adept Restorative Cleaning	UK
AD International BV	NL
Adolf Würth GmbH & Co. KG	DE
Advanced Stone Cleaning	UK
AEA Technology Rail	UK
Aerotechnic Vertriebs– und Service GmbH	DE
Aerotek Aviation Engineering Ltd	UK
Agri Retail	NL
Air Atlanta	IE

Name of Company	Country
Air Management Systems Ltd	UK
Airbus	FR
AirFrance	FR
Albert E. Olsen AS	NO
Alfa Aesar	UK
Alfa Engineer Support srl	IT
Alfred Clouth	DE
Always Under Pressure	UK
Amik Italia	IT
Ansperger GmbH	DE
Anstrich & Sanierungstechnik Robert Kauderer GmbH	DE
Anti-Graffiti Services Limited	UK
Anton Geiselhart GmbH & Co. KGMalerbetriebe	DE
Antwerp Shiprepair	BE
APPH Aviation Services	UK
Aquablast	UK
Aragonesas Energia e Industrias S.A.	ES
Arkema	FR
Artington Manor Restoration	UK
Ashfield Land Ltd	UK
Aspokem	FI
ATB (Asociacion de Tiendas de Bricolaje)	ES
Atlantic Homecare	IE
ATOC	UK
AtoFina S.A.	FR
Atofina Nederland BV	NL
Attica Group	EL
Auto Finishes Ltd	MT
AVKO Limited	UK
B&Q	UK
BacktoBase UK	UK
Bakers of Danbury Ltd	UK
Baldini Vernici SpA	IT
Banverket	SE
BARO Bautenschutz-Rostschutz und Verwaltungs GmbH & Co. KG	DE
BASF AG Intermediates	DE
BASF Portuguesa, Lda	PT
Bauhaus	ES
BauMax	AT
Bayer AG	DE
BCA	UK
Becker & Baaß G.m.b.H.	DE
Bedec Products Ltd.	UK
Beeck'sche Farbwerke GmbH	DE
Beisterfeld	NL

Name of Company	Country
BETEC Beschichtungstechnik GmbH	DE
BITOLEA S.p.A. Chimica Ecologica	IT
Blankhout Nederland Franchising bv	NL
Bodensee-Schiffsbetriebe Gmbh	DE
Bombardier MÁV Kft.	HU
Bonjean Maler und Lackierer GmbH	DE
Bornit-Werk Aschenborn GmbH	DE
Borregaard Ind Ltd	NO
Borsodchem Co. Ltd.	HU
Boss Paints NV	BE
Bostik Findlay (Evode)	IE
Brico Group	ES
Brico Io	IT
Bricofer	IT
Bricomarché	PL
Brocolor Lackfabrik GmbH	DE
Buefa Chemikalien GmbH & Co. KG	DE
Bunnik-Advies	NL
Burnaby Stone Care Ltd	UK
Byggmakker	NO
Byko	IS
C Ginn Building Restoration	UK
C. Brewer and Sons Ltd	UK
Caminhos de Ferro Portugueses, E.P.	PT
Capital Stone Works Ltd	UK
Carlo Erba Reagenti S.r.l.	IT
Castorama	FR
Cecchi Gustavo & C.	IT
Ceetek Chemicals Ltd	UK
Celanese GmbH	DE
Cellande Ltd (t/a Go Green)	UK
Cellulose Attisholz AG	CH
Centre for Alternative Technology	UK
Centrum Naukowo-Techniczne Kolejnictwa	PL
Ceské Dráhy	CZ
Chadwicks	IE
Charpail	FR
CH Quimica	ES
Chem-Plus-Produtos Químicos e Equipamentos par a Indústria, Lda	PT
Chemetall UK plc	UK
Chemical Company Dwory S.A.	PL
Chemicals Ltd	UK
Chemimpo BV (now Epenhuysen Chemie N.V.)	NL
Chemproha	NL
Chimcomplex	RO

Name of Company	Country
Christ + Wagenseil GmbH	DE
CIN	PT
Ciresa	IT
Cisalpino AG	CH
Clas Ohlson	NO
CLC Group PLC	UK
Cleanaway	UK
Cleancoat Services	UK
Clearing Central Office BCC	BE
Cliveden Conservation	UK
CMS High Tech	FR
Cofac	ES
Cogal	FR
Color	SI
Compania Trasmediterranea	ES
Conlac	DE
Conservation Chemicals Consultants Ltd	UK
Consumentenbond	NL
Contamination Control Services	UK
Coop bau + hobby	CH
Cosmos Lac S.A.	EL
CSG	UK
Danish railway BDK	DK
Danske Statsbaner	DK
Danske Traelast	DK
DARA Fixed Wing	UK
Dasic International	UK
David Ball Restoration Ltd	UK
De Neef Chemical Recycling S.A.	BE
DEC - Spólka z ograniczona odpowiedzialnoscia	PL
Decorating Direct Ltd.	UK
Degussa-Protectosil	DE
DERPINSA (Derivados de Pinturas, S.A.)	ES
Deschamboux	FR
Deterquímica-Especialidades Químicas, Lda	PT
Deutsche Amphibolin-Werke von Robert Murjahn Stiftung & Co KG	DE
Diamond Decorators	UK
Dipter SARL	FR
Distiler, S.A.	ES
Distillerie de l'Aube	FR
Distillex	UK
Ditas	DK
Donau Chemie AG	AT
Dosmar	ES
Dow	CH

Name of Company	**Country**
Dr. Spiess GmbH & Co.	DE
DSM Fine Chemicals GmbH	AT
Duston Oils	UK
Dyrup SAS	FR
Eco - Strip Services Ltd.	UK
Eco Solutions	UK
Eco-Energy Srl	IT
Ecologia Quimica	ES
Ecologic Systems Limited	UK
Ecosocer - Recuperação de Solventes e Resíduos, Lda.	PT
Ehserchemie GmbH	DE
Eli-Lilly	IE
Elizabeth Pride Limited	UK
Elso Vegyi Industrial Zrt.	HU
Enorm	NL
Ercros	ES
Estrochem	EL
ETRAS	DE
Eura Conservation Ltd.	UK
Eurostar (UK) Limited	UK
F.W. Metcalfe & Sons	UK
Fábrica de Tintas Kar Lda	PT
Fecali-Produtos Químicos Industriais e Comerciais, Lda	PT
Feidal Lacke + Farben GmbH	DE
Ferrocarriles de Via Estrecha	ES
Ferrocarrils de la Generalitat de Catalunya	ES
FIME Srl	IT
Flügger A/S	DK
Focus DIY	UK
Fortom Chimica S.r.l.	IT
Fritz Schucker GmbH	DE
Galdes & Mamo (Trading) Ltd	MT
Gauci-Borda & Co Ltd	MT
GBF Masonry Cleaning Services Ltd	UK
GEBOtherm GmbH	DE
Geiger	DE
Givaudan Roure	FR
Globus Blaumarkt	CZ
GR Chemie GmbH	DE
Graffiti Doctor	UK
Grafitix	FR
Graz-Köflacher Bahn und Busbetrieb GmbH	AT
Green Building Store	UK
Green Cargo AB	SE
Green Dot Guides	UK

Name of Company	Country
Group Chimiderouil Technochim International SA	FR
Habekost GmbH	DE
Hagebau	AT
Harald Nyborg	DK
HaringDie Maler und Stuckateure GmbH	DE
Hasco Lakfabrieken BV	NL
Haug-Chemie GmbH	DE
Hebau GmbH	DE
Helios	SI
Hempel	ES
Henkel	UK
Hereford Blast Cleaning	UK
Herm. Hohmann GmbH	DE
Hohmann GmbH & Co. KG	DE
Homebase	UK
Hornbach	DE
Hornbach-Baumarkt	SE
Howe	DE
HSS Hire	UK
Hubo	BE
Huetzen Industrieanstrich GmbH & Co. KG	DE
Husasmidjan	IS
ICI Paints	UK
IJP Building Conservation	UK
Ikab	NL
Industrias Quimicas Kimsa	ES
Industrie Chimiche Caffaro S.p.A.	IT
INEOS Chlor	UK
Intercontainer-Interfrigo	CH
Intergamma	BE
International Rail Catering Group	CZ
Internationale Gesellschaft für Eisenbahnverkehr	DE
Interpares	SE
Invista	DE
J. C. Kröger & Sohn GmbH & Co.	DE
J.+ K. Moseler GmbHMalerbetrieb	DE
J&W Renovations	UK
Jabersa	ES
Jakob Lauer GmbH Malerbetrieb	DE
Järnia	SE
Jem & Fix	DK
John Fields Antiques	UK
John Lewien Malereibetrieb GmbH	DE
Jumbo	CH
JW Ostendorf GmbH & Co. KG	DE

Name of Company	**Country**
Kallfass Bautenschutz GmbH	DE
Kalon Ltd	UK
Kalon S.A. Pinturas y Productos Químicos	ES
Karl Röttgers GmbH	DE
Keber u. Dickert GmbH	DE
Keimfarben GmbH & CO KG	DE
Kemet RV	EE
KEMIS	SI
Ken Negus Limited	UK
Ki'Raviv	FR
Kimbolton Restoration	UK
Kingfisher	FR
Kluthe	DE
Kornmayer Farbe + Design GmbH	DE
Krahn Chemie	DE
Lackfabrik Union Aeckerle & Co (einzA Lackfabrik GmbH)	DE
Lambiotte & Cie S.A.	BE
Lanstar	UK
LDZ	LV
Leroy Merlin	FR
LJ KEM AB	SE
LLI Europe	DE
Low-Impact Living Initiative	UK
Maar	DE
MacDermid	UK
Machinery Oy	FI
Magyar Allamvasutak	HU
Magyar Allamvasutak Cargo	HU
Malcolm Smith – Power Cleaning	UK
Maler Poppe GmbH	DE
Maler- u.Lackiererunnungsverband	DE
Maler- und Lackiererinnung Hamburg	DE
Malerbetrieb Hoffmeister GmbH & Co. KG	DE
Malermeister Ahle GmbH	DE
Malermeister Gerhard Hopp GmbH & Co. KG	DE
Malning	IS
Manuquímica-Produtos Químicos de Manutenção Industrial, Lda	PT
Marco Zywicki GmbH	DE
Marktkauf	DE
MÁV Északi JÁrmujavító Kft.	HU
Mavom	NL
MÁV Szolnoki Jármujavító Kft.	HU
MÁV Tiszavas Miskolc Kft.	HU
Max Mat (Sonae)	PT
Max Wiget GmbH	DE

Name of Company	Country
Maxbo	NO
McGean UK	UK
Mensinger GmbH	DE
Merck KGaA	DE
Merkur	SI
Meyer-Chemie	DE
Misol GmbHMalereibetrieb	DE
Molto GmbH	DE
Montér (Optimera Group)	NO
Mr Bricolage	FR
Muessmann Umweltsutz GmbH	DE
Multichimica Spa	IT
Naisurfas-Processos Químicos e Ambientais, SA	PT
Nelf Lakfabrieken BV	NL
Newleaf Integrate	UK
Nietiedt GmbH Oberflächentechnik- und Malerbetriebe	DE
Nitrol Chimica S.r.l.	IT
Nordek	NO
NorDen Olje A/S	NO
Norsk Hydro A.S.	NO
Nortech GmbH	DE
Northover Restoration	UK
Novartis Agro S.A. (Formally Ciba-Geigy Agro)	FR
OBI	DE
Orga	BE
Overlack GmbH	DE
P. Brabant	FR
P.A. Jansen GmbH and Co	DE
Pai-Kor S.r.l.	IT
Palace Chemicals	UK
PenChemie	NL
Peterborough Blasting Ltd	UK
Pfannen Schmidt	DE
Pinturas Dyrup S.A.	ES
Pinturas Isaval	ES
Pinturas Palcanarias	ES
Plasticraft	UK
Plus	CZ
Polyvine Ltd	UK
PPM SA	FR
Praktiker	DE
Preptec	UK
Priest Restoration Ltd	UK
Primalab SAS	FR
Priovolos Paint Factory S.A.	EL

Name of Company	Country
Proderma-Comércio e Indústria de Produtos Químicos, Lda	PT
Produits Chimiques Du Mont Blanc	FR
Produtos Sarcol, SA	PT
Przedsiebiorstwo Transportu Kolejowego	PL
PSS INTERSERVICE AG Switzerland	CH
Pufas Werk GmbH	DE
Punto Brico	IT
Quadron Services Ltd	UK
Quaron	BE
Quimilongra-Especialidades Químicas, Lda	PT
Quimitécnica. Com-Comércio e Indústria Química, SA	PT
Quimxel	ES
Raadvad Centeret	DK
Rabochem AG	CH
Rail Capacity Allocating Office	HU
Rail Procurement Agency	IE
Rail Traction Company S.p.A.	IT
Rail Transport Service GmbH	AT
Rautakesko (K-Rauta)	LV
Ray Munn Ltd	UK
RCN	DE
Regelsolve	FR
reinhardt + hey MalerbetriebGmbH & Co. KG	DE
Reinhold Knoll GmbH Malereibetrieb	DE
Remmers Bauchemie GmbH	DE
Renofors	IE
Rette Ferroviaria Italiana	IT
Rhoba-Chemie GmbH	DE
Rhodia Ltd.	UK
Richard Geiss	DE
RĪGAS LAKU UN KRĀSU RŪPNĪCA	LV
RJ Stokes & Co. Ltd	UK
Roche Carolina Inc.	US
Rodway & Taylor	UK
Romil	UK
Ronseal	UK
Roseville (Projects) Ltd	UK
Rösler Oberflächentechnik GmbH	DE
Rounded Developments Enterprises Ltd & Rounded Developments Ltd	UK
Roxel Rocket Motors	UK
RP Adam Ltd	UK
RTV	FI
Rudanol-Sociedade de Representações, Lda	PT
Rusta	SE
Rustin's	UK

Name of Company	Country
Rutolan	FR
RWA Raiffeisen Ware Austria AG	AT
S & R (Handaq) Ltd	MT
S.J. Dixon & Son Ltd	UK
S+G GmbH	DE
Sadolin Paints	CY
Safety-Kleen Belgium S.A.	BE
Salters Powerwashers	UK
Sameca-Productos Quimicos SA	PT
SARP INDUSTRIES	FR
Satecma	ES
SCANDINAVIAN PRODUCTS LIMITED AS	NO
Schweizerhall Lohn	CH
Screwfix	UK
SDS	FR
Senigrup S.L.	ES
Senukai	LT
Servizi Ferroviari Srl	IT
Shanks	UK
Shannon Aerospace	IE
Sika Portugal-Produtos Construção e Indústria, SA	PT
Silco-Tec	DE
Silvan Kaeden	DK
Sisas S.p.A.	IT
Slippfelagid	IS
SNBI	FR
Sociedade Magalhães & Magalhães, Lda	PT
Societe Des Produits Chemiques D'Harbonnieres – Heavy Chemicals	FR
Société européenne pour le financement de matériel	CH
Société Nationale des Chemins de Fer Luxembourg	LU
Socomor	FR
Sogelub SA	BE
Solvadis polska sp. z o.o.	PL
Solvay	BE
Solveko Spa	IT
Somaster Oy	FI
SPE International Limited	UK
Specialist Stripping Services	UK
SpeedheaterSystem AB	SE
Spektrum	SE
Sperling Reinigungstechnik GmbH	DE
SPR	FR
Sprava zeleznicni dopravni cesti	CZ
Stark	DK
Sto AG	DE

Name of Company	**Country**
Strahl-u. Entsorgungs-GmbH	DE
Stripp Chemicals AB	SE
Strippers of Rochester	UK
Strippers Paint Removers Ltd	UK
STS	NO
Suffolk Brick and Stone Cleaning Company Limited	UK
Superóleo, Lda	PT
Svensk Reningsindustri AB	SE
Symblast.com	UK
T C Seamarks (Shot & Sand Blasting Specialists) Ltd	UK
Tecnochimital S.a.s.	IT
Tegee-Chemie Bremen GmbH	DE
Tessenderlo Chemie S.A.	BE
TEW Engineering	UK
TFN Proprete	FR
The Green Shop	UK
Thommen	CH
Tikkurila OY	FI
Toom	DE
Tosoh Europe	NL
Transportgesellschaft mbH	DE
Trimite	UK
Trimite Malta Ltd	MT
Turco	ES
União Indústrial Têxtil e Química (UNITECA)	PT
Unidete-Detergentes e Equipamentos Industriais, Lda	PT
Union des Transports Publics	CH
Uquifa	ES
Urban Hygiene	UK
V.G. Stokes & Son	UK
Vallier S.A.	FR
Valls Quimica, S.A.	ES
Väritukku	FI
Vecom NV	BE
Vedlikeholdsnett	NO
Vendex KBB	NL
Veolia Transport	IT
Vernilac	EL
Viochrom	CY
Vivechrom	EL
Vliegenthart	NL
Vopelius Chemie AG	DE
Wabtec Rail Limited	UK
Wacker-Chemie GmbH	DE
Watco Ecoservice Saint-Nicolas (ex- Recyper) S.A. - SITA	BE

Name of Company	**Country**
Weka-Solvent-Vertriebs GmbH	DE
Wickes	UK
Wiener Lokalbahnen AG	AT
William Birch & Son Ltd	UK
Wistema Chemiehandel und Recycling GmbH	DE
Wittenberger Destillationsgesellschaft mbH	DE
Wolfgang Hansen GmbH & Co.Malerei - Bodenbeläge	DE
Woodies DIY	IE
WOS Genk S.A.	BE
Zaklady Azotowe w Tarnowie-Moscicach S.A.	PL
ZEP Belgium SA/NV	BE
Zep Italia Srl	IT
Zeus	DE

Trade Associations	**Country**
AeroSpace and Defence Industries Association of Europe, ASD	EU
ANSPI, National Federation of Painter Contractors	ES
Apeal - The Association of European Producers of Steel for packaging-Electrolytic Chromium oxide coated steel	EU
Association Internationale des Réparateurs en Carrosserie (*plus 11 national trade associations*)	INTL
British Coatings Federation	UK
British Galvanisers Association	UK
Building Confederation- Belgian Painters	BE
CECRA (Comité Européen du Commerce et de la Réparation Automobile) - European Council for Motor Trades and Repairs (*plus 22 national trade associations*)	EU
Community of European Shipyards Association (*plus 12 national trade associations*)	EU
Construction Industry Federation	IE
Council of European Producers of Materials for Construction	EU
Danish Painters Occupational Health Service	DK
Danish Paintmakers' Association	DK
Enterprise Ireland	IE
Euro-Inox	EU
Eurofer	EU
European Aluminium Association	EU
European Association of Automotive Suppliers	EU
European Automobile Manufacturers Association	EU
European Builders Confederation - EBC	EU
European Chemical Industry Council (CEFIC) (*plus 24 national trade associations*)	EU
European Chlorinated Solvents Association	EU

Trade Associations	**Country**
European Coil Coating Association	EU
European Committee for Surface Treatment - CETS	EU
European Construction Industry Federation	EU
European Construction Wood Federation	EU
European Council of the Paint, Printing Ink and Artists' Colours Industry (CEPE) (*plus 15 national trade associations*)	EU
European Federation of Building and Woodworkers (EFBWW)	EU
European Federation of Pharmaceutical Industries and Associations	EU
European Furniture Manufacturers Association	EU
European General Galvanisers Association	EU
European Power Tool Association - EPTA	EU
Federation of Painters and Glaziers of Luxembourg	LU
IBEC	IE
ICTU	IE
Irish Chemicals Marketers Association	IE
Irish Decorative Surface Coatings Association	IE
Irish Hardware and Building Materials Association	IE
Irish National Painters & Decorators Trade Group	IE
ISME	IE
Main Association for Paint, Design and Building Protection in Germany	DE
Master Painters & Decorators of Ireland	IE
Master Painters & Decorators of Ireland	IE
Master painters association in Finland	FI
Metal Packaging Manufacturers Association	UK
Painting & Decorating Association	UK
Railway Industry Association	UK
Royal Dutch Association of Painters and Decorators (FOSAG)	NL
SA-Confederation of Icelandic Employers	IS
SFA	IE
Society for the Protection of Ancient Buildings	UK
Swiss Association of Painters and Plasterer Contractors	CH
Syndicat des Halogenes et Derives	FR
The Aluminium Federation	UK
The Austrian Federal Guild of Painters, Varnishers and Plasterers	AT
The Danish Federation of Masterpainters	DK
The European Association of Chemical Distributors (*plus 13 national trade associations*)	EU
The Norwegian Association of Painting Contractors	NO
The Society of Motor Manufacturers and Traders Limited	UK
The Swedish Association of Painting Contractors	SE
UK Surface Engineering Association	UK
Unife	EU
Union Internationale des Enterpreneurs de Peinture	INTL
Wood Protection Association	UK

National Chambers of Commerce	Country
Austrian Federal Economic Chamber (Wirtschaftskammern Osterreichs)	AT
Federation Nationale des Chambres de Commerce et dIndustrie de Belgique	BE
Alliance des Chambers de Commerce Suisses	CH
Cyprus Chamber of Commerce and Industry	CY
Economic Chamber of Czech Republic (Hospodarska Komora Ceske Republiky)	CZ
Association of German Chambers of Commerce and Industry (DIHK) (Deutscher Industrie-und Handelstag)	DE
Danish Chamber of Commerce (Det Danske Handelskammer)	DK
Estonian Chamber of Commerce and Industry (Eesti Kaubandus-Tööstuskoda)	EE
Consejo Superior de Camara de Comercio, Industria y Navegacisn de Espana	ES
Central Chamber of Commerce of Finland (Kauppakamarin Liikeyhteyspalvelu)	FI
Chambres de commerce et d'industrie de France	FR
The Athens Chamber of Commerce and Industry	EL
Hungarian Chamber of Commerce and Industry (Magyar Kereskedelmi és Iparkamara)	HU
Iceland Chamber of Commerce (Viðskiptaráð Íslands)	IS
Association of Italian Chambers of Commerce (Unioncamere - Union Italiana delle Camere di Commercio Industria Artigianato e Agricoltura)	IT
Association of Lithuanian Chamber of Commerce, Industry and Crafts (Lietuvos prekybos pramones ir amatu rumu asociacijoje)	LT
Chambres de Commerce - Luxembourg	LU
Malta Chamber of Commerce and Enterprise	MT
Netherlands Chamber of Commerce (kamer van koophandel en Fabrieken voor Amsterdam-Harlem)	NL
Oslo Chamber of Commerce (Oslo Handelskammer)	NO
Polish Chamber of Commerce	PL
Chamber of Commerce and Industry (Camara de Comercio e Industria Portuguesa)	PT
Stockholm Chambers of Commerce (Stockholms Handelskammare)	SE
Chamber of Economy of Slovenia (Gospodarska Zbornica Slovenije)	SI
Slovak Chamber of Commerce And Industry	SK
The British Chambers of Commerce	UK

Consumer Protection Agencies and Government Departments	Country
Kuratorium für Verkehrssicherheit	AT
Ministry of Justice, Unit VI/2 Bureau of Consumer Affairs	AT
Ministere des Affaires Economiques Administration de la Qualité et de la	BE

Consumer Protection Agencies and Government Departments	Country
Securitè	
Bureau Federal de la Consommation	CH
Bureau Federal de la Consommation	CH
Ministry of Health	CY
Consumers Defence Association of the Czech Republic	CZ
Czech Trade Inspection	CZ
Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft	DE
Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft	DE
Bayerisches Staatsministerium fûr Umwelt, Gesundheit und Verbraucherschutz	DE
Federal Institute for Occupational Safety and Health	DE
Kompan	DK
National Institute of Public Health	DK
Forbrugerstyrelsen	DK
Consumer Protection Board of Estonia	EE
Consumer Protection Board of Estonia	EE
Agència Catalana del Consum	ES
Ministry of Development, General Secretariat of Consumer Protection	EL
Directorate of Technical Inspection and Consumer Protection	EL
Instituto Nacional de Consumo (M° Sanidad y Consumo)	ES
Instituto Nacional de Consumo	ES
Finnish Consumer Agency	FI
Safety Technology Authority Product Safety Enforcement	FI
Safety Technology Authority Product Safety Enforcement	FI
Finnish Consumer Agency	FI
Civil Sous-Directeur de la sous-direction C Protection des consommateurs DGCCRF	FR
Commission de la Sécurité des Consommateurs	FR
General Inspectorate for Consumer Protection	HU
Fogyasztóvédelmi Főfelügyelőség	HU
Fogyasztóvédelmi Főfelügyelőség	HU
Office of the Director of Consumer Affairs	IE
Consumer Association of Ireland	IE
National Product Safety Authority	IS
Legal Department Head IMQ	IT
Klaipeda College	LT
Ministere de l'Economie	LU
Consumer Rights Protection Centre	LV
Health Statistics and Medical Technology Agency	LV
Ministry for Economic Services	MT
Ministry for Economic Services	MT
Stichting Consument en Veiligheid	NL
Food and Consumer Product Safety Authority	NL
General Inspectorate for Health Protection and Veterinary Public Health	NL
Work Research Institute	NO

Consumer Protection Agencies and Government Departments	Country
Direktoratet for samfunnssikkerhet og beredskap	NO
Norwegian Safety Forum	NO
Ministry of Health	PL
Instituto do Consumidor	PT
Konsumentverket (Swedish Consumer Agency)	SE
Konsumentverket (Swedish Consumer Agency)	SE
Konsumentverket (Swedish Consumer Agency)	SE
Konsumentverket/KO	SE
Konsumentverket (Swedish Consumer Agency)	SE
Market Inspectorate of Republic of Slovenia	SI
Consumer Safety and Strategy Department of Trade and Industry	UK
English Heritage	UK
Royal Society for the Prevention of Accidents, RoSPA	UK
Trading Standards Institute	UK

Solvent Abuse Experts	Country
Inst for Social and Health psych. (ISG)	AT
Ludwig-Boltzmann-Institut für Suchtforschung	AT
PROMES - Université Libre de Bruxelles	BE
Vrije Universiteit Brussels	BE
PROMES - Université Libre de Bruxelles	BE
National Centre for Public Health	BG
Center of Education about Drugs	CY
Center of Education about Drugs	CY
Prague Psychiatric Center	CZ
Czech Nat. Focal Point, Gov. Office Czech Rep	CZ
Dept. Epidem. Social Medicine	DK
Institute of International and Social Studies	EE
STAKES	FI
STAKES	FI
INSERM unité 472	FR
OFDT	FR
IFT Institut für Therapieforschung	DE
IFT Institut für Therapieforschung	DE
University Mental Health Research Inst.	EL
University Mental Health Research Inst	EL
University Mental Health Research Inst	EL
Budapest Univ of Economics	HU
University of Akureyri	IS
St Patricks College	IE

Solvent Abuse Experts	**Country**
CNR, Epidemiologia - IFC	IT
Istituto di Fisioloia Clinica	IT
Istituto di Fisioloia Clinica, Sez. Epidemiologia e Ricerca sui Servici Sanitari	IT
State Addiction Agency	LV
Education Development Centre	LT
Sedqa, Agency Against Drug and Alcohol Abuse	MT
University of Malta	MT
Trimbos, National Institute of Mental health and Addiction	NL
Trimbos, National Institute of Mental health and Addiction	NL
National Institute for Alcohol and Drug Research	NO
National Institute for Alcohol and Drug Research	NO
Institute of Psychiatry and Neurology - Dept. Of Studies on Alcoholism and other dependencies	PL
Núcleo de Investigaçao, IPDT	PT
National Institute for Research and Development in Health (INCDS)	RO
Research Institute for Child Psychology and Patopsychology	SK
Clinical Institute of Occupation, Traffic and Sports Medicine	SI
Swedish Council for Information on Alcohol and Other Drugs, CAN	SE
Swedish Council for Information on Alcohol and Other Drugs, CAN	SE
ISPA	CH
Alcohol & Health Research Centre, University of the West of England	UK
Alcohol & Health Research Centre, University of the West of England	UK
Homefield	UK
St George's Medical School	UK
Scottish Drugs Forum	UK
Re-Solv	UK

Other Consultees	**Country**
IVAM	NL
BiPRO	DE
European Trade Union Confederation	EU
Friends of the Earth	INTL
Greenpeace European Unit	INTL
Irish Hardware Magazine	IE
PRA Coatings Technology Centre	UK
The European Consumers' Organisation (BEUC)	EU
WWF European Policy Office	INTL