Evaluation of Possible Restrictions on Short Chain Chlorinated Paraffins (SCCPs)

Final Report
Non-Confidential Version

prepared for
National Institute for Public Health and the Environment (RIVM)
The Netherlands

RPA

July 2010

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by

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1. SUMMARY OF THE SEA

1.1 Background and restriction options

This report presents an analysis of the socio-economic impacts to stakeholders within the EU-27 from a proposed restriction on the manufacture and use of SCCPs which has recently been agreed by the parties to the United Nations Economic Commission for Europe (UN ECE).

The proposed UN ECE restriction (Option 1), would prohibit the manufacture and use of SCCPs (defined as chlorinated alkanes with a carbon chain length of 10 to 13 carbon atoms) with two notable exemptions: when used as flame retardants in rubber used in conveyor belts and when used as plasticisers in dam sealants. Manufacture of SCCPs to be specifically used in these two applications would be allowed to continue.

During the discussions of the UN ECE parties, the issue of SCCPs' chlorination level arose and there have been suggestions for a limit of 48% chlorine by weight to be included in the requirements of any restriction. The implications of this approach have been considered in this SEA (under Option 1a), as have the implications of a full restriction on the manufacture and use of SCCPs without any exemption for any application (under Option 2).

1.2 Manufacture and consumption of SCCPs in the EU

Based on consultation and literature review, we have concluded that the level of **production** of SCCPs in the EU is currently at 1,500 tonnes. In recent years, a number of manufacturers have withdrawn from the market and it is possible that only one manufacturer will be left in the market by the end of this year.

In the past, **imports** of SCCPs from non-EU countries have been very small. Nevertheless, the changing landscape of chlorinated paraffins (including the scarcity of the substance and its increasing price per tonne) and the decreasing size of the relevant markets could make the role of SCCP imports much more significant. We understand that a significant amount of production takes place in India and China. According to Entao (2003), chlorinated paraffin production in China has undergone rapid development in the past dozen years. Manufacturing capacity increased sharply to 300,000 t/y by the end of 2003 and the output reached 150,000 tonnes. China has already become the biggest chlorinated paraffin producer in the world. Figures for North America estimate a production of 6,000 to 8,800 tons/year (UN ECE, 2007). Jabr & Environmental Health News (2010) confirm that chlorinated paraffin production is growing in China and possibly in India. They report that the production of chlorinated paraffins in China soared from 20,000 tonnes in 1990 to over 600,000 tonnes in 2007, according to a 2009 presentation by Jiang Gui-bin of the State Key Laboratory of Environmental Chemistry and Ecotoxicology in Beijing, China. India also may be increasing its production of SCCPs. Please note that these figures refer to chlorinated paraffins in general and not specifically to SCCPs; however, they do provide a good indication of the growing role of Asian producers in the global markets for chlorinated paraffin and, by inference, SCCPs.

In relation to **exports**, based on an EU consumption of ca. 530 tonnes/year (as explained in **Table 1.1**), exports of SCCPs to non-EU customers are calculated at 970 tonnes/year, i.e. considerably higher than EU consumption.

With regard to the **consumption** of SCCPs in the EU, the applications identified are in rubber (for underground mining conveyor belts and other rubber products), sealants and adhesives, paints and coatings and textile impregnation formulations. Information collected from Eurochlor and a series of assumptions have allowed us to conclude that the current consumption pattern in the EU is as follows:

Table 1.1: Assumed EU Consumption of SCCPs by Application - 2009

Application	Sales of SCCPs in the EU	
	Tonnes	%
Sealants & adhesives	237	45%
Paints	101	19%
Rubber	162	31%
Textiles	29	6%
Total	***530***	***100***

Note: figures have been rounded hence the aggregates may not be entirely identical to the figures shown in the last row. These sales figures will be used as consumption figures in our calculations later in this SEA

In terms of future trends, registration of the substance under REACH before the end of 2010 will be an important milestone. The discussions within the Stockholm Convention on POPs and the restriction agreed by UN ECE parties (along with the declining demand for the substance) will impact the decision of key industry stakeholders whether to register the substance (i.e. cost-benefit analysis). Similar considerations would also arise with regard to whether to apply for an authorisation under REACH.

1.3 Applications for SCCPs

The descriptions of the applications of SCCPs in the EU are provided in **Table 1.2**. It is worth noting that the majority of companies we contacted during the preparation of this report have been working on or at least are aware of alternatives. With the exception of certain manufacturers of road marking paints, no other company has suggested that SCCPs are critical to their businesses, although it was made clear that reformulation of products would entail R&D costs and potentially increased raw material costs.

Table 1.2: Overview of Current SCCPs Applications in the EU

Parameter	Rubber industry	Sealants and adhesives	Paints and coatings industry	Textiles industry
Relevant applications	Literature suggests use in underground mining conveyor belts and products such as gaskets, hoses etc. We have confirmed the use of SCCPs in conveyor belts in the EU and have indications that use in other products may still be possible. It is assumed that conveyor belts account for 75-90% of current consumption. Among the different types of conveyor belts, use of SCCPs has been confirmed in mono-ply (solid woven) conveyor belts (the most modern type). In these, a textile core is impregnated with PVC and is then covered with a rubber cover. We assume that any recycling of SCCP-containing rubber, especially conveyor belts, is unlikely to occur at appreciable quantities	Literature suggests use in polysulphide and polyurethane formulations as well as acrylic and butyl sealants. The relevant applications appear on a wide scale and include the filling of expansion and movement joints in building and general engineering, the filling of joints for protection from spillages and where resistance to water, chemicals, alkalis, solvents and biological agents is required and where low temperatures may prevail, the waterproofing of roofs and adhesives suitable for a variety of substrates. Products that could be considered to be dam sealants and contain SCCPs appear to be on the market. However, the few industry stakeholders that made an input to this SEA did not raise specific concerns with regard to a restriction on SCCPs	SCCPs are used in chlor-rubber and acrylic protective coatings as well as in intumescent paints. Typical applications include road marking paints, anti-corrosive coatings for metal surfaces, swimming pool coatings, decorative paints for internal and external surfaces, and primers for polysulphide expansion joint sealants. SCCPs may also be used in cross-linkable polyester systems with peroxides for the production of long-term road markings and it may be found in unsaturated polyester resin which is used in the production of fibre reinforced composites. SCCPs generally act as a plasticiser and they reduce the cost of the formulation by (partly) replacing primary plasticisers such as phthalates	Typical applications have potentially included furniture upholstery, seating upholstery in transport applications, and interior textiles such as blinds and curtains as well as industrial protective clothing. Consultation for this SEA suggests that use in the impregnation of commercial and military tents (to provide a flame-retardant, waterproof and rot-proof finish – 'dry proofing' of heavy textiles) is still ongoing. On the other hand, backcoating of upholstery or industrial textiles (workwear) is unlikely. The types of fibres still impregnated with SCCPs may be polyester-cotton, cotton or linen-flax
SCCPs concentration	10% for conveyor belts 10-17% for other rubber products	20-30% appears to be common	In intumescent coatings, it may range between 2.5% and 10%. In road marking paints it can be fairly low from <1% to 10% but typically towards the lower end of this scale. In anti-corrosive and protective coatings, SCCPs' concentration could be 10-15%	Literature suggests 4-15% while a UK textiles expert advises that the actual concentration is a commercial secret but it should be assumed to be quite considerable
SCCPs chlorination	Literature indicates a high chlorination of 63-71%; consultation with companies suggests 60-65% only and information from the Bulgarian authorities suggest 52-56% by weight (past use)	Information from one source only indicates that the degree of chlorination of the SCCPs used is 56% but could well be higher	Consultation suggests 50% to 54% but could be considerably higher for water repellence or fire retardancy (e.g. intumescent paints). Literature suggests up to 70%	Literature suggests chlorine contents of around 56-60% chlorine by weight for backcoating of textiles

Table 1.2: Overview of Current SCCPs Applications in the EU

Parameter	Rubber industry	Sealants and adhesives	Paints and coatings industry	Textiles industry
Number and locations of users	Two conveyor belt manufacturers seem to continue using SCCPs. Both companies are in the process of switching to alternatives (possibly MCCPs). France, Germany, Poland and the UK are countries using SCCPs (although companies located in some of these countries may have now discontinued the use of SCCPs). Use in Bulgaria and Sweden appears to have stopped. In our calculations we assume 3 conveyor belt users and 10 users for other rubber products	We have confirmed the use of SCCPs in the Czech Republic, France, Germany, the Netherlands and the UK. In our calculations we assume 20 users	Use has been confirmed in the Czech Republic, Spain and the UK. Indirect consultation with distributors has confirmed the use of SCCPs in paint manufacture in France and Slovenia. Use elsewhere in the EU is still possible. In our calculations we assume 20 users .	One major tent textile processor uses SCCPs in the UK. Another user is located in France (according to input made by a distributor). Past users in countries such as Belgium, France, Germany and the Netherlands have apparently moved on to alternatives
Importance for the wider sector	We assume SCCPs is used in 1,215-1,460 tonnes of rubber for belting and 95-400 tonnes of other rubber products. These form a very small fraction of the EU consumption of synthetic rubber of 2.4 million tonnes (in 2008). SCCPs are of limited importance to the wider rubber industry or indeed the conveyor belt industry, although it is correct that SCCP-containing rubber has been used in some niche markets with particular safety requirements, such as the underground coal mining sector	We assume SCCPs are used in 790-1,185 tonnes of finished products. This tonnage is a very small fraction of the EU consumption of sealants and adhesives of 3 million tonnes in 2009. SCCPs are of limited importance to the wider sealant and adhesive industry. We have not received any input from industry suggesting that any particular sealant or adhesive product based on SCCPs may be particularly critical	We assume that SCCPs may be contained in 675-10,000 tonnes of finished products. This tonnage is a very small fraction of the estimated EU market for paints of 7.6 million metric tonnes. SCCPs are of limited importance to the wider paints and coatings industry. However, this may not be true for all stakeholders (for instance, road marking paint manufacturers)	Given the very low consumption of SCCPs in the textiles sector, it is reasonable to assume that SCCPs are of limited importance to the wider textile finishing industry. Their potential loss could however cause problems of practicality and cost for the apparently few companies that still use them

1.4 Alternatives for SCCPs

Among the various alternatives identified, the most well known are the longer-chain chlorinated paraffins, i.e. MCCPs and LCCPs, with MCCPs appearing to be the alternative of choice for the vast majority of users. MCCPs (and LCCPs) have characteristics that resemble those of SCCPs. However, their use is not without problems: MCCPs have a lower chlorine content and higher viscosity and, as such, impart a lower water repellence and flame retardancy to formulations and products that contain them. The high viscosity makes formulation and application (for instance, use of sealants on-site) more difficult. The result of this is that MCCPs may need to be used at higher loadings than SCCPs and/or be used alongside a viscosity regulator (e.g. a solvent) or an additional flame retardant additive (for example, a brominated flame retardant).

Other available alternatives include substances such as phthalate plasticisers, brominated flame retardants, organophosphate flame retardants and phosphate plasticisers, inorganic flame retardants (e.g. aluminium trihydroxide) and several others. Some of these substances may perform better than SCCPs in certain ways (e.g. decaBDE is a more effective flame retardant than SCCPs and phthalates are generally better plasticisers than SCCPs); however, there is apparently no single substance (except perhaps MCCPs and to a lesser extent LCCPs) that can combine the performance characteristics of SCCPs. Several of these alternatives are several times more costly than SCCPs; indeed SCCPs may have been used in the past to ensure that the cost of formulation is kept low (for example, by partly replacing costly primary plasticisers such as phthalates).

In the course of consultation, it has been suggested by some companies that a transition to alternatives may not be necessarily smooth and re-formulation could take a considerable time. However, examples show that there are companies that have made the switch to alternatives without major implications. With particular regard to the two applications that are exempt from the UN ECE restriction, a major manufacturer of conveyor belts has indicated that transition to MCCPs was smooth and low cost and two other companies are currently working on alternatives. For dam sealants, none of the companies identified appears to offer dam sealants.

Overall, alternatives are available but, for some, their use could come at an increased price compared to SCCPs and could affect the performance of the relevant products. Importantly, concerted efforts to replace SCCPs have started well before the agreement on the UN ECE restriction and presumably will need to be completed with the REACH registration and authorisation deadlines in mind. Therefore, it is not considered that a UN ECE restriction would play a decisive role in encouraging users to switch to alternatives or indeed in selecting which alternative to switch to.

1.5 Assessed restriction options and comparison of impacts

For this study, three main policy options are considered in the context of implementing restrictions; these are:

- ***Option 0 – Do Nothing Option***;

- ***Option 1 – UN ECE restriction***: UN ECE restriction on the manufacture, marketing and use of SCCPs, with exemptions for conveyor belts and dam sealants. One sub-option is considered briefly (and qualitatively) under this:

  - ***Option 1a – UN ECE restriction with a limit on the chlorination levels***: as for Option 1 with the addition of a limit on the chlorination level of SCCPs that may still be used in the two exempted applications (conveyor belts and dam sealants); and

- ***Option 2 – UN ECE restriction without exempt applications***: total restrictions on the production, marketing and use of SCCPs (with no exemptions).

Using information collected from literature and consultation with industry, as well as by making reasonable and worst-case assumptions where information was not available, we have estimated the costs to the key stakeholder groups from the UN ECE restriction (Option 1). The key cost elements generally include:

- one-off costs of R&D work to reformulate the relevant products;
- one-off and ongoing costs of authorisations and re-approvals (for example, in accordance to relevant safety standards); and
- ongoing raw material costs (from the use of potentially more costly alternative flame retardants/plasticisers).

It should be noted that reformulation is not a simple process of replacing SCCPs with another material at the same or similar concentration. Issues of compatibility and viscosity need to be addressed. It has not been possible to provide the most accurate raw material cost estimates, however, we assume that the costs of R&D do cover to a certain extent the costs of 'fine-tuning' the new SCCPs-free formulations. The overall costs for users of SCCPs and their downstream customers for **Option 1** are summarised in **Table 1.3**.

Table 1.3: Summary of Estimated Costs/Savings to the Key Stakeholder Groups from the UN ECE Restriction on SCCPs

Cost element	SCCPs manufacturers	Rubber products	Sealants and adhesives	Paints and coatings	Textiles
Users of the substance					
One-off R&D costs	Nil	Up to €563,000 (but probably much lower)	€0.5-1 million	€205,000 – 769,000	Unknown
One-off re-approval costs	Nil	Unknown	Negligible	€418,000 – €916,000 (but probably even lower)	Unknown

Table 1.3: Summary of Estimated Costs/Savings to the Key Stakeholder Groups from the UN ECE Restriction on SCCPs					
Cost element	**SCCPs manufacturers**	**Rubber products**	**Sealants and adhesives**	**Paints and coatings**	**Textiles**
Cost of alternative substances	'Low' tonnage losses (1,300 t): €0.73 to €1.9 million	For a current SCCPs consumption of 34 tonnes: -€0.011 to €0.26 million (present value over 5 years)	-€0.44 to €1.06 million (present value over 5 years)	-€28,000 to €220,000 (present value over 5 years)	€518,000 to €2,595,000 (present value over 5 years)
	'High' tonnage losses (1,500 t): €0.84 to €2.2 million	For a current SCCPs consumption of 14 tonnes: -€0.004 to €0.105 million (present value over 5 years)			
Cost of alternative materials	Not applicable	Unknown	Unknown	Unknown	Not applicable
Users of formulations and articles					
Cost of using products with alternative substance	Not applicable	Unknown	Unknown; literature suggests 5% price increase	7% for acrylic paints (literature) 10-20% for road marking paints (consultation)	Limited
Cost of using alternative products		Unknown	Unknown	Unknown (but thermoplastic road markings could last longer than SCCP-containing road marking paints)	Unknown
Note: hereafter a negative sign (accompanied by red colour font) will indicate a saving rather than a cost					

The comparison between the impacts of **Option 1b** and those from Option 1 would suggest that the introduction of a 48% (by weight) limit on the chlorination of SCCPs would not cause significant problems for manufacturers however it would affect the functionality of their product. Fire retardancy and water repellence are directly linked to the chlorine content of SCCPs, therefore, a limit on the levels of chlorination would make the remaining users much less inclined to use SCCPs. Even in cases where use would continue, a significant re-formulation would be needed to ensure fire retardancy/water repellence is adequate (and any relevant standards are met) while ensuring sufficient compatibility of components and viscosity of the final product. Given that conveyor belt and sealant manufacturers are already looking into the development of alternatives, the most likely outcome of a limit on chlorination would be the cessation of use of SCCPs in the EU (in effect a complete restriction on the substance, i.e. Option 2).

With regard to **Option 2** and how it compares to Option 1, we note that for manufacturers of SCCPs it would be very likely that the any demand for the substance by EU manufacturers of conveyor belts and dam sealant manufacturers under Option 1 would be too small to allow for continued production of SCCPs within the EU. In any case, even if manufacture of SCCPs were to continue, the difference in turnover impacts between Option 1 and Option 2 have been calculated as being very small (as long as new sales of MCCPs/LCCPs replace a considerable amount current SCCPs sales). In any case, the assessment of impacts on the manufacturers of SCCPs from Options 1 or 2 could prove to be purely academic; the sustained regulatory pressures on SCCPs (e.g. REACH and discussions under the Stockholm Convention) have already made many of the downstream users to investigate and switch to alternatives. Therefore, impacts on manufacturer of SCCPs specifically arising from Options 1 or 2 could be very limited in the context of other developments.

With regard to the users of SCCPs, Option 2 would result in an additional R&D cost for rubber conveyor belt manufacturers (€0.038-0.13 million) and an additional cost for alternative substances of up to €0.96 million, though at the low end, some cost savings of around €0.033 million may accrue (present value over 5 years, depending on the SCCPs consumption tonnage assumed (122 or 146 tonnes)). If alternative materials such as chloroprene rubber were used, costs increases could reach 30-40%. For users of rubber conveyor belts, the cost increase from using products with alternative flame retardants has been calculated at €8.2 - €24 million (present value over 5 years). Costs may also arise as a result of the poorer longevity of PVC belts which might be used as a replacement to SCCP-containing PVG belts.

On the other hand, the costs to manufacturers of dam sealants has been calculated at up to €487,000, though at the low end, some cost savings of around €12,800 may accrue) (present value over 5 years), depending on the tonnage of SCCPs used in dam sealants (12 or 47 tonnes) and the alternative plasticiser used. No additional R&D costs (compared to Option 1) would be envisaged.

The additional costs to the manufacturers of conveyor belts and particularly the users of conveyor belts may appear significant. However, it is unlikely that they would materialise in real life. First, the manufacturers of conveyor belts appear to be already in the process of switching to alternatives (probably MCCPs) and it is reasonable to expect the switching to be completed before an UN ECE restriction is implemented across the EU. Second, manufacturers of conveyor belts currently face the task of potentially reformulating their conveyor belts for underground mining in order to meet the requirements of a new European fire safety standard (EN 14973:2006). Manufacturers would be able to undertake reformulation to replace SCCPs as part of the process of complying with the new standard. They would also be able to pass on any costs to the users of the belts so that it incorporates the cost increase resulting from the replacement of SCCPs even before the UN ECE restriction is implemented.

1.6 Conclusion on the impacts from the UN ECE restriction

A restriction on the use (and manufacture) of SCCPs in the EU would undoubtedly have an adverse impact on industry stakeholders (with the exception of the manufacturers and suppliers of alternatives, who would experience increased sales). Textile finishing, paints and coatings and sealants and adhesives would probably suffer proportionally higher impacts as opposed to the rubber industry where the main application of SCCPs, in conveyor belting, would be exempt.

In monetary terms, impacts could well be significant for a small number of users who may still face difficulties with reformulating their products in a cost-effective way. Road marking paints and textile impregnation appear to be the key applications that may face particular difficulties. Concerns over the viability of reformulated sealants have also been expressed. It is, however, the case that, even in applications where concerns are raised regarding switching to alternatives, there have been companies that have already moved to viable alternatives. Moreover, the management of risks associated with the use of SCCPs has been a very protracted process which has definitely raised awareness within the relevant industry sectors and has allowed companies time to investigate and develop alternatives (at least a significant proportion of them). It is also worth noting that the production of formulations and articles that contain SCCPs accounts for a very small proportion of the EU markets for rubber, sealants/adhesives, paints and finished textiles.

Given the pre-existing frameworks within which risks from the use of SCCPs are being addressed, namely the OSPAR Convention, the EU Risk Assessment and Risk Management, the REACH authorisation process, discussions under the Stockholm Convention on POPs and now the UN ECE decision, it is clear that the replacement of SCCPs has been an ongoing process and, as such, any costs arising cannot be wholly attributed to the recently agreed UN ECE restriction. It should also be considered that even if the UN ECE is finalised, a certain time period would intervene between finalisation and implementation. It is likely that by the time the restriction is implemented action will have been taken under other regulatory frameworks (REACH, EU POPs Regulation) or the users will simply have completed he reformulation of their products. As a result, the socio-economic impact of the UN ECE decision itself should be considered to be very small.

2. AIM OF THE SEA

In recent years, a number of restrictions have been introduced across the EU banning the use of Short-chain Chlorinated Paraffins (SCCPs, EC Number: 287-476-5, CAS Number: 83555-84-8) in certain applications (e.g. in metalworking and for fat liquoring of leather). More recently, the European Chemicals Agency (ECHA) has considered the possibility of applying the authorisation requirements under REACH to the remaining uses of SCCPs. Recent discussions at the international level have also explored the possibilities for restricting certain uses of SCCPs.

Moreover, SCCPs are classified as dangerous to the environment (N) and as being very toxic to aquatic organisms, possibly causing long-term adverse effects in the aquatic environment (R50/53). It is also concluded that SCCPs meet the criteria for being a PBT substance.

On 18 December 2009, the United Nations Economic Committee for Europe (UN ECE) decided to include SCCPs in Annex I and II of the Protocol to the 1979 Convention on Long-range Transboundary Air Pollution (LRTAP) on Persistent Organic Pollutants. This implies a total ban on the production and use of SCCPs in the near future, except for use in conveyor belts in the underground mining industry and in dam sealants. Whilst the implementation date for the ban agreed by the UN ECE is currently unknown, the relevant entry is likely to appear as follows.

<table>
<tr><th colspan="3">Table 2.1: Provisions of the UN ECE Restriction on SCCPs – Restriction Option 1</th></tr>
<tr><td colspan="3">Annex I: Substances scheduled for elimination</td></tr>
<tr><td rowspan="2">Short-chain chlorinated paraffins[1]</td><td>Production</td><td>None, except for the production for the uses specified in Annex II</td></tr>
<tr><td>Use</td><td>None, except for the uses specified in Annex II</td></tr>
<tr><td colspan="3">Annex II: Substances scheduled for restrictions on use</td></tr>
<tr><td>Substance</td><td colspan="2">Implementation requirements</td></tr>
<tr><td rowspan="2">Short-chain chlorinated paraffins[1]</td><td>Restriction to uses</td><td>Conditions</td></tr>
<tr><td>(a) Fire retardants in rubber used in conveyor belts in the mining industry
(b) Plasticisers in dam sealants</td><td>Parties should take action to eliminate these uses once suitable alternatives are available.

No later than 2015 and every four years thereafter, each Party that uses these substances shall report on progress made to eliminate them and submit information on such progress to the Executive Body. Based on these reports, these restricted uses shall be reassessed.</td></tr>
<tr><td colspan="3">[1] SCCP is defined as chlorinated alkanes with a carbon chain length of 10 to 13 carbon atoms</td></tr>
</table>

In view of the above developments at both EU and international levels (leading towards a ban on the use of SCCPS at some time in the near future), the Dutch authorities have undertaken an analysis of the socio-economic impacts as well as of the human health and environmental implications of a ban on SCCPS on the EU industry (including the manufacturers and downstream users of SCCPs). Risk & Policy Analysts Ltd (RPA) was contracted to support the Dutch National Institute for Public Health and the Environment (RIVM) in the preparation of this analysis.

This report presents a Socio-economic Assessment (SEA) of the impacts of possible restrictions on the production, marketing and use of SCCPs. According to the Specifications for this study, the SEA should be focused on possible essential uses of SCCPs. Such current uses of SCCPs, as identified in recent reports on SCCPs issued by ECHA, are in:

- rubber;
- sealants and adhesives,
- paints and coatings; and
- textile finishes.

Please note that the above restriction does not include a limit on the chlorination level of SCCPs. This will be discussed later in the report (under Option 1a).

3. MANUFACTURE AND USE (BASELINE)

3.1 Manufacture, import and exports of SCCPs

3.1.1 EU manufacture of SCCPs

EU production locations

Our research identified four EU-based companies associated with the production of SCCPs in the EU. These are located in the UK, the Slovak Republic, Italy and Romania. The leading manufacturer is the company based in the UK. Our research has revealed the following recent or ongoing developments:

- the Italian company is currently in administration. Consultation suggests that the company has not manufactured SCCPs for over 18 months, but it does produce products based on longer-chain chlorinated paraffins. The company indicated that it does not sell old SCCPs stock;

- the Slovakian company is also currently undergoing a bankruptcy process and does not intend to produce SCCPs beyond 2010. The company indicated that in the past it did not produce significant quantities of SCCPs; and

- the Romanian company indicated that their manufacture of SCCPs ceased in 2006. It is noted, however, that the product is still being advertised on their Internet site.

Two companies in Spain and Germany, which were contacted in the course of this SEA, confirmed that they are only producing longer-chain chlorinated paraffins and, indeed, have never manufactured SCCPs.

EU production tonnage

In the mid-1990s, there were four manufacturing locations in France, Germany, Italy and the UK producing more than 32,000 tonnes per year (ECHA, 2008). These figures have gradually decreased and indeed production in France and Germany stopped, as shown above. On the other hand, with the expansion of the EU, the Slovak plant added its production tonnage to the overall EU production. The amounts of SCCPs produced in Slovakia have been reported to be ca. 560, 350, 480 and 410 tonnes/year for 2004, 2005, 2006 and 2007 respectively, although different sources provide slightly different tonnages (ECHA, 2008).

The following table summarises some information on past and present manufacture, imports and exports in selected EU Member States that has been collected by RIVM through consultation with Member State Competent Authorities.

Table 3.1: Information Provided by Member State Authorities on the Manufacture, Imports and Exports of SCCPs

Historic tonnages							
Country	**Manufacture**		**Imports**		**Exports**		**Notes**
	Tons	**Year**	**Tons**	**Year**	**Tons**	**Year**	
Bulgaria	0	1996-2008	0-414	1996-2008	0-4,229	1996-2008	Maximum imports in 1996 Maximum exports in 1997
Denmark	ND		ND		ND		
Germany	19,300	1994			9,300	1994-1995	Unknown destinations for imports
Italy	1,000-2,000	1994-1995	ND		ND		Data from ECHA (2008)
Norway	ND		ND		ND		SCCPs were used as plasticisers, rust-removers, coolants, and lubricants in 1995
Slovakia	100-500	2005	0	2005	2,994	2001	Maximum production of 584 tonnes in 2000 Maximum exports in 2001
Sweden	ND		ND		ND		
UK	8,000-11,000	1994-1995	ND		D		Data from ECHA (2008)
Present tonnages							
Country	**Manufacture**		**Imports**		**Exports**		**Notes**
	Tons	**Year**	**Tons**	**Tons**	**Year**	**Tons**	
Bulgaria	0	2009	0.004	2009	22	2009	
Cyprus	0	2010	0	2010	0	2010	
Denmark	0	2010					
Finland	0	2009			0	2009	One product containing SCCPs imported in 2009 for metalworking
Germany	0	2010			0	2010	
Italy	0	2010			0	2010	Information from consultation
Norway	0	2010	0	2010	0	2010	Production/ import/export of SCCP was forbidden in 2000
Slovakia	ND		ND		ND		
Sweden	0	2010					The total reported use of SCCP (CAS no 85535-84-8) in Sweden was 14.3 t in 2008, use and import as part of articles is not known.

ND: no data
Source: Bulgarian Ministry of Environment and Water, Cypriot Department of Labour Inspection, Danish Environmental Protection Agency, Germany Institute for Occupational Safety and Health, Norwegian Climate and Pollution Agency, Slovak Centre for Chemical Substances and Preparations, Swedish Chemicals Agency

More detailed and reliable information on the current levels of production is available from industry. However, due to the presence of only one key player in the EU, for reasons of confidentiality, we cannot provide specific production tonnage figures.

ECHA recently published a background document (ECHA, 2009) in which it is suggested that the volume of SCCPs currently manufactured in the EU is in the range of 1,000 – 4,000 t/y with a most probable volume around 1,500 tonnes/year. Information that has been received from Eurochlor on the sales of SCCPs in the EU confirms that the SCCPs market is in decline – this might suggest that production has been declining accordingly.

3.1.2 EU imports of SCCPs

Consultation with stakeholders suggests that imports of SCCPs into the EU from non-EU countries have traditionally been very limited. This has been confirmed by two non-EU companies that have been consulted in the course of this SEA; the first, a Turkish company indicated that it does not sell chlorinated paraffins to EU-based customers. The second, a US company confirmed that it manufactures chlorinated paraffins (in the USA) but does not export them to the EU. The US company ceased the manufacture of SCCPs as of 31 December 2009 and had, specifically, ceased selling SCCPs in the EU in 2008. In any case, the company clarified that it had only ever sold a few drums at most.

Also, from a business perspective, chlorine manufacturers tend to make a profit on the caustic product and generally not on the chlorine. The price of SCCPs is determined by a relationship to phthalates as they are used as an alternative in PVC plasticisation, and the prices are very low. Because SCCPs are easily made by bubbling chlorine through liquid paraffin, a company that does not make chlorine cannot cross-subsidise chlorinated paraffin manufacture, and this could make importation and sale of SCCPs from overseas uncompetitive. As a result, it has traditionally been difficult for non-EU manufacturers to compete with EU-based manufacturers of SCCPs.

Nevertheless, the changing landscape in the chlorinated paraffins market (mainly due to regulatory pressures) and the decreasing size of the relevant markets could make the role of SCCP imports much more significant (assuming no restriction were to be introduced). For instance, a stakeholder in the rubber industry has indicated that the SCCPs used in their products are imported from non-EU countries. The reason for this was cited as the scarcity of the substance and its increasing per tonne price. We understand that in India and China there are a large number of producers. According to Entao (2003), chlorinated paraffin production in China has undergone rapid development in the past dozen years. The capacity increased sharply to 300,000 t/y by the end of 2003 and the output reached 150,000 tonnes. China has already become the biggest chlorinated paraffin producer in the world. Figures for North America estimated a production of 6,000 to 8,800 tons/year (UN ECE, 2007). Jabr & Environmental Health News (2010) confirm that chlorinated paraffin production is growing in China and possibly in India. They report that the production of chlorinated paraffins in China soared from 20,000 tonnes in 1990 to over 600,000 tonnes in 2007, according to a 2009 presentation by Jiang Gui-bin of the State Key Laboratory of Environmental Chemistry and Ecotoxicology in Beijing, China. India also may be increasing its production of SCCPs. Please note that these figures refer to chlorinated paraffins in general and not specifically to SCCPs; however, they do provide a good indication of the growing role of Asian producers in the global markets for chlorinated paraffin and, by inference, SCCPs.

It should also be noted that non-EU manufacturers of the substance may offer SCCPs of a slightly different chain length to that specified by the known EC/CAS numbers this SEA focuses on. The reason for this is that these companies may use different feedstock. It has been suggested by an industry consultee that different EC/CAS numbers will result in different requirements (registration, authorisation) under REACH.

3.1.3 EU exports of SCCPs

Some information on the destinations of exports has been provided by the main EU producer but has been excluded from this report due to reasons of confidentiality. No specific information has been provided on the quantity of imports. However, assuming that any EU production of SCCPs (estimated at 1,500 tonnes/year) which is not consumed within the EU (where EU consumption is estimated at 530 tonnes) is effectively exported, the value of exports has been calculated as being around 970 tonnes/year[1].

Likely developments under REACH

Registration of the substance under REACH before the end of 2010 will be an important milestone. The discussions within the Stockholm Convention on POPs and the restriction agreed by UN ECE parties will have to be taken into consideration along with the declining demand for the substance in the calculations of key industry stakeholders as regards the cost-benefits of registration and later authorisation (unless a restriction pre-empts such action). We do not have specific information on companies' plans with regard to whether to register the substance or not.

3.1.4 EU distribution of SCCPs

In the course of this SEA, we contacted 26 companies which may be acting as distributors of SCCPs in the EU. These were located in Belgium, the Czech Republic, Germany, Spain, Finland, France, Hungary, Italy, Netherlands, Slovenia and the UK. Of these only two companies, located in France and Slovenia confirmed that they indeed distribute SCCPs to EU customers. It should be noted however that some of the companies we contacted advertise SCCPs on their Internet sites and literature.

For the two companies that confirmed the sales of SCCPs, the following information was provided:

- **Distributor Company 1** distributed seven tonnes of SCCPs in 2009 to a total of eight domestic customers. Tonnage data for 2007 and 2008 indicate small changes compared to the latest 2009 data. Customers purchased SCCPs for use in:
    - rubber manufacture – four companies;

1 Information on the consumption of SCCPs in the EU is provided in Section 3.2. Therein it is explained that of the estimated 620 tonnes of SCCPs sold to EU-based downstream users, it is assumed that 90 tonnes are sold to non-EU customers by EU-based distributors. EU Consumption of SCCPs is therefore estimated at 530 tonnes/year (620 – 90). Exports to non-EU users is therefore 970 tonnes/year (1,500 – 530).

- manufacture of pliolite, façade paints and industrial paints – one company;
- manufacture of adhesive ribbons and fire retarded acrylic adhesives – two companies; and
- finishing of flame-retarded textiles – one company.

The company has indicated that SCCPs are in the process of being replaced with longer-chain chlorinated paraffins (though the replacement process seems to be slower than expected). The company declined to provide details of their customers or even notify them of the study. According to the company "…*this is requesting too much time and involving too many people for something which is almost no longer an issue*"; and

- **Distributor Company 2** has indicated that its customers have been informed already of the issue of restrictions on SCCPs. Most of them are outside EU and they generally plan to use these products for as long as is possible. Fewer than five customers can be found in the company's domestic market, all of which are paint manufacturers, with a total SCCPs consumption volume of less than 5 tonnes per year. The company advised that all these customers are aware of current developments they are taking necessary steps for the replacement of SCCPs in due time.

3.1.5 Presence of lower chain impurities in MCCPs

According to HSE (2010), the levels of chlorinated paraffins of chain lengths other than C_{14-17} present in the current commercial MCCPs products are <1%. The producers of MCCPs (represented by Eurochlor) have, since 1991, used paraffin feedstocks in the production process with a C_{10-13} content of <1% (the actual levels are often much lower than this), and a >C_{18} content of <1%. However, it should be noted that a manufacturer of SCCPs and MCCPs has given a somewhat different interpretation of these figures.

As explained in Section 6.3.1, it is not correct to refer to "SCCPs impurities" in MCCPs commercial products. EU manufacturers purchase a C_{14-17} paraffin feedstock for MCCPs production and a C_{10-13} feedstock for SCCPs production. The feedstocks and products remain separate throughout the manufacturing process. Manufacturers do not mix these feedstocks, nor do they mix the resultant SCCPs and MCCPs products. Therefore manufactures distinct commercial grades of SCCP and MCCP (the same is true for LCCPs). It is more accurate to say that lower chain molecules (or indeed longer chain molecules) may find their way into the C_{14-17} paraffin fraction purchased. The paraffin fractions purchased are collected using molecular filters. However, this method will never give 100% certainty that the final product will fall 100% within the range requested and it can be accepted that up to 1% of the paraffins could fall outside the requested distribution. The C_{13} molecule could be the one most likely to be present in MCCPs.

A worst-case percentage of 1% impurities consisting of shorter chain paraffin molecules would mean that around 637 tonnes of shorter chain molecules may be found in commercial grades of MCCPs used in the EU (data for 2006 – HSE, 2010).

HSE (2010) notes that "it is possible that MCCPs is a source of SCCPs in the environment" however it recognises that this refers to C_{10-13} components and "*the identity and actual concentration of the individual components is not known*". It is worth noting that these 637 tonnes (a worst-case estimate) is a higher tonnage than the total intentional consumption of SCCPs in 2009 which has been calculated in Section 3.2 at 530 tonnes per year.

3.1.6 Summary

In summary, this SEA assumes that there are currently two manufacturers of SCCPs in the EU at present, in the UK and the Slovak Republic. This number is expected to reduce to one by the end of 2010. In terms of tonnages, the UK company appears to dominate the EU market.

The most recently published (2009) publicly available information suggests an EU **production** tonnage of SCCPs of 1,500 t/y; it is, however, possible the this figure may somewhat overestimate the current situation for the year 2010. **Imports** of SCCPs have traditionally been of limited significance. However, as the size of the overall SCCPs market decreases, imports of SCCPs from non-EU countries may account for an increasing percentage of SCCPs sales in the EU. **Exports** of SCCPs are estimated at around 970 tonnes/year; this is apparently very significant compared to sales and consumption of the substance within the EU.

Chlorinated paraffins of chain lengths lower than C14 may also be present as **impurities** in commercial MCCPs products. When a conservative impurity level of 1% is considered this would mean that 637 tonnes of such impurities may also be present in the MCCPs products used in the EU (based on 2006 tonnage data).

3.2 EU consumption of SCCPs

Historic consumption

In the past, the availability of feedstock has been driving product development. Initially, waxes were available and they led to the production of long-chain chlorinated paraffins (LCCPs). Customer demand for medium-chain chlorinated paraffins (MCCPs) developed due to the demand for the product for PVC manufacture. MCCPs replaced waxes due to their better compatibility with PVC. Later on, the expansion of the metalworking fluid market led to an increased demand for SCCPs due to their higher chlorine content and their lower viscosity. In 1994, the overall consumption of SCCPs in the EU was around 13,000 t/y, as shown in the following table.

Table 3.2: EU Consumption of SCCPs in Different Applications in 1994	
Application	**Tonnage per year**
Metal working lubricants	9,380
Rubber	1,310
Paints	1,150
Sealants	695
Leather fat liquors	390
Textiles	183
Other*	100
Total	***13,208***
Source: Environment Agency for England and Wales (2007) ** this reflects mainly sales to distributors who then supply for the above uses*	

Trends in Usage

Tonnage data for later years are not directly comparable to the data for 1994 due to the different groupings of some applications (for instance, some sources group flame retardant applications together). An overview of the different tonnages over the years has been provided by Eurochlor in graphs that were made available to RPA for the purposes of this study. This is presented as Figure 3.1 and Figure 3.2.

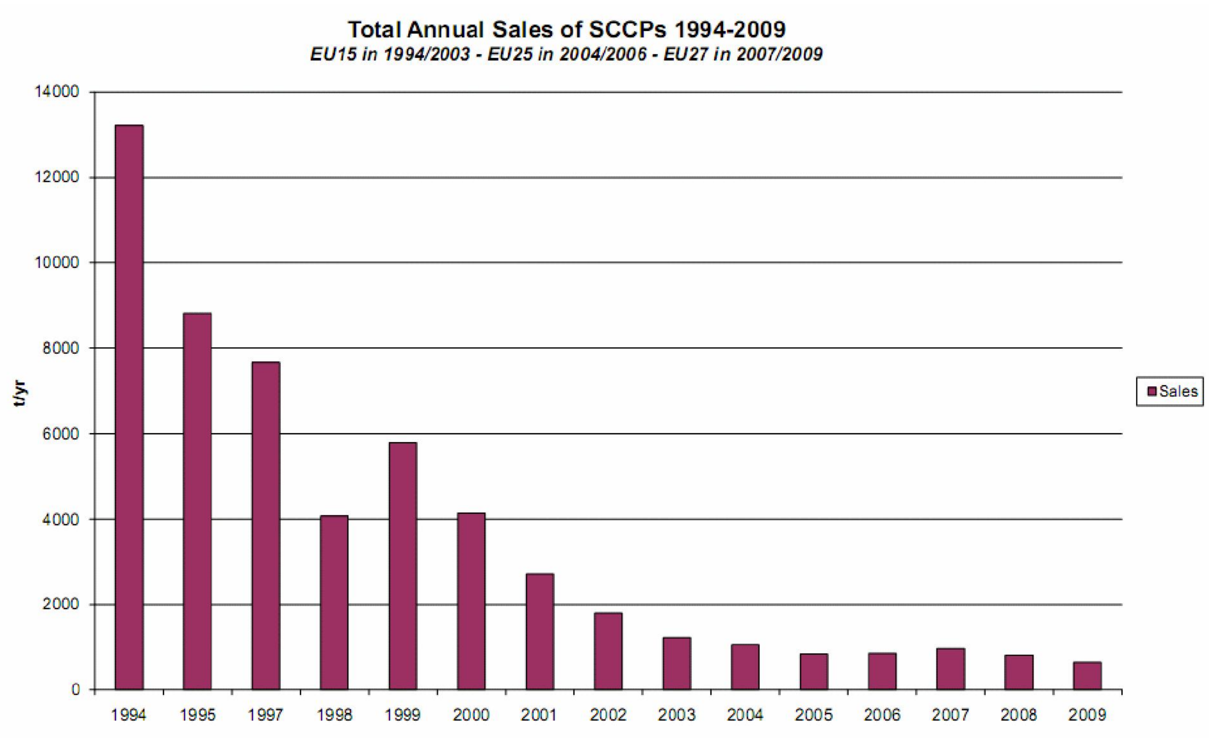

Figure 3.1: Total Annual Sales of SCCPs in the EU in 1994-2009 (provided by Eurochlor)

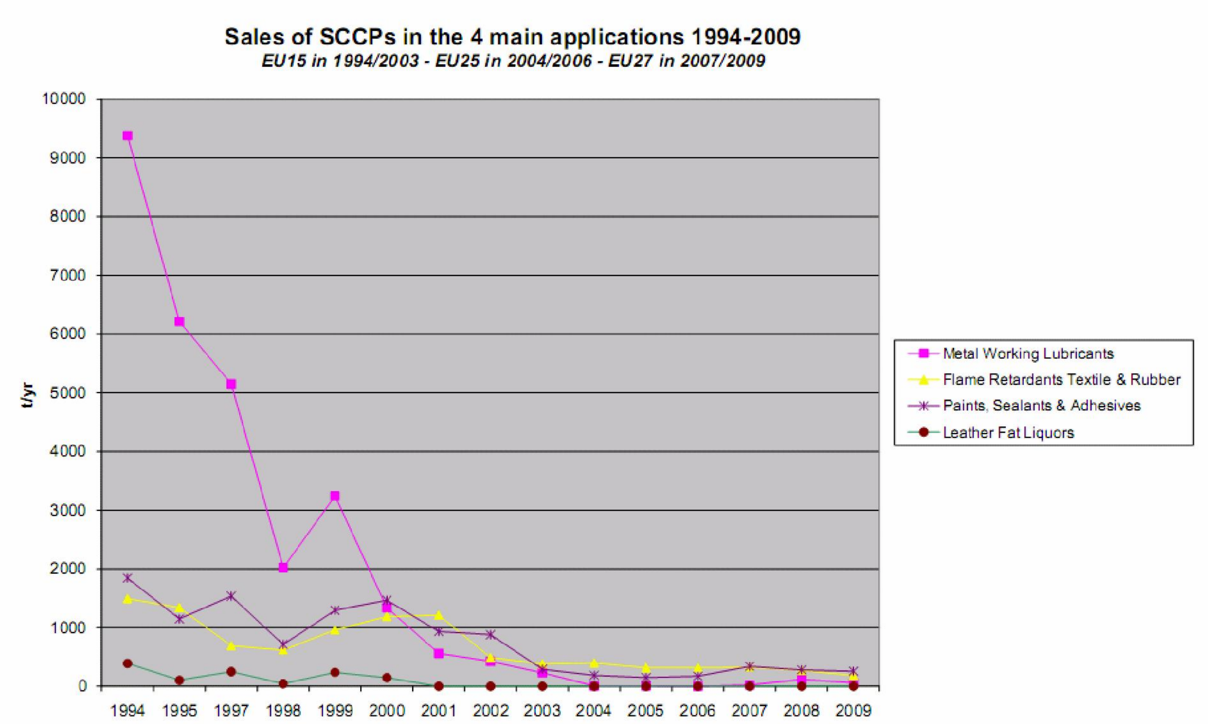

Figure 3.2: Annual EU Consumption of SCCPs per Application in 1994-2009 (provided by Eurochlor)

Please note that more detailed information or specific tonnages for particular industry sectors is not available; it is understood that Eurochlor needs to aggregate data to prevent competing companies from deducing the tonnages sold by others.

The key drivers behind these changes have been:

- the classification of the substance in the early 1990s as a carcinogen and dangerous to the aquatic environment (N; R50/53). Especially in the metalworking fluids sector, downstream users wanted safer materials and manufacturers started focusing on longer-chain chlorinated paraffins; and

- the results of the EU risk assessment under the Existing Substances Regulation (ESR) which resulted in an EU-wide restriction on the use of SCCPs in metalworking fluids and leather fat liquors. Use in metalworking fluids (theoretically) ceased in the EU in 2004 while use in leather fat liquors effectively ceased in 2001.

While in products such as PVC the classification of SCCPs does not result in the classification of the final product/article, this is not the case in sealants, adhesives and paints. Many downstream users were unwilling to place products that had a classification as carcinogens or dangerous to the environment on the market.

Information from key industry associations presented by ECHA (2009b) suggests that sales of SCCPs have been decreasing due to substitution mainly by MCCPs; it would be expected that the change to MCCPs may have already occurred for the majority of uses for which this is possible. The classification of SCCPs as a Persistent Organic Pollutant by UN ECE and its inclusion in the candidate list of substances for authorisation under REACH would be expected to add further to the pressure to substitute SCCPs with alternatives where possible and further reinforce the current downward trend in use. .

While use of SCCPs in the EU may be declining markedly, emissions to the environment will still occur as articles containing SCCPs will be present in use in the EU for several years and so SCCPs applied to articles in the past (e.g. sealants in buildings, rubber articles, painted articles and treated textile articles) will still have the potential for emission to the environment. These articles are expected to be widely distributed throughout the EU and act as diffuse sources of emission (ECHA, 2008).

With regard to the concentration of SCCPs in the different products, the following concentrations have been suggested in the EU Risk Assessment Report. These concentrations are broadly consistent with newer information regarding the concentration of SCCPs in different products obtained for this study and discussed later in this SEA.

Table 3.3: SCCPs Concentration in Different Formulations and Articles

Application	SCCPs concentration (%)
Sealants & adhesives	5-14
Paints & coatings	1-10
Rubber	10-17
Textiles	4-15
Metalworking lubricants	15 (in emulsions diluted with water to 5%)

Source: Environment Agency for England and Wales (2008)

Current consumption patterns

As shown in Figures 3.1 and 3.2, in 2009, the most prominent use of SCCPs in the EU was in paints, sealants and adhesives with a total of ca. 230 tonnes consumed. The next most important application was as a flame retardant in textiles and rubber with a total consumption of ca. 130 tonnes. Surprisingly, there was still a certain usage of SCCPs in metalworking lubricant formulations of around 70 tonnes (please note that the exact tonnages have not been provided by Eurochlor, therefore, these estimates have been read off Figures 3.1 and 3.2 presented earlier). We have discussed this with Eurochlor and we were advised that this must be a case of mistaken reporting, especially given that in the years 2004-2007 the consumption of SCCPs in metalworking lubricants was, as expected, nil. We therefore opted for ‘distributing’ these 70 tonnes to the remaining four main applications of SCCPs.

The grouping of applications does not help in identifying specific tonnages for specific industry sectors. We therefore need to make some assumptions that would allow us to allocate specific tonnages to specific industry sectors. The assumptions made can be summarised as follows:

- we have information on the uses of 230+130 tonnes of SCCPs used in the four key applications (sealants, paints, rubber, textiles) while another 70 tonnes are assumed to have been mis-reported and need to be allocated among the four key applications. We started by identifying the consumption percentages of each application within the 'known' 360 tonnes;

- while in 1994 consumption in paints was much wider than in sealants and adhesives, the situation appears to have changed in recent years. BiPRO (2007) suggests that sealants and adhesives have become a more important area of application (with 75-100 tonnes of consumption in the EU compared to 50-75 tonnes for paints in 2005). In light of our discussions with consultees and in the absence of more detailed information, we will assume that among the group of "paints, sealants and adhesives", paints represent 30% of the consumption tonnage with sealants and adhesives representing the remaining 70%. If we have assumed a 75-25% split, the resulting consumption tonnage for paints could be too low to accommodate the significant tonnages of specific companies that we have consulted with in the preparation of this SEA;

- between use in rubber and use in textiles, the former has traditionally been much more important. Indeed, as will be discussed later in this report, use in textiles appears to be very limited at present. In ECHA (2008), rubber applications appear to account for a consumption tonnage potentially six times higher than the consumption tonnage for textiles. Also, the ESR Risk Assessment Report suggests a rubber-related consumption 7 times higher than textiles-related consumption. Considering the relative tonnages for rubber and textiles in 2004 and assuming that a similar relationship still applies, we make the assumption that use as a flame retardant in rubber represents 85% of the total in this category and the remainder (15% of this category) is used in textiles;

- the above splits (70%-30% and 85%-15%) result in the following tonnages and percentages within the 'known' consumption of 360 tonnes:
  - **sealants/adhesives**: 161 tonnes or 45% of the 'known' 360 tonnes consumed;
  - **paints**: 69 tonnes or 19% of the 'known' 360 tonnes consumed;
  - **rubber**: 110 tonnes or 31% of the 'known' 360 tonnes consumed;
  - **textiles**: 20 tonnes or 6% of the 'known' 360 tonnes consumed;

- to distribute the 70 mis-reported tonnes, we assume that the four percentages shown above would apply;

- the total sales of SCCPs in the EU in 2009 are shown in Figure 3.1 to have been around 620 tonnes. The total tonnage for the three categories named above, (a) paints, sealants and adhesives, and (b) rubber and textiles, and (c) mis-reported metalworking lubricants) is 430 tonnes (again these figures are based on visual interpretation of the figures, rather than the exact tonnages behind the figures). The tonnage difference (620-430) suggests that an additional 190 tonnes are allocated to distributors (what in older statistics may often appear as 'other uses'). As we do not know what the outlets for this material really are, we make the following assumptions[2]:

- around half of this quantity is sold to non-EU customers; and
- the remainder (assumed to be 100 tonnes) is apportioned proportionately among the key four applications.

Table 3.4 summarises the tonnages that result from these assumptions.

Table 3.4: Assumed EU Consumption of SCCPs by Application - 2009

Application	Direct sales of SCCPs in the EU		Mis-reported sales ('metalworking lubricants')		Distributor sales of SCCPs in the EU		Total sales of SCCPs in the EU	
	t	**%**	**t**	**%**	**t**	**%**	**t**	**%**
Sealants & adhesives	161	45%	31	45%	45	45%	237	45%
Paints	69	19%	13	19%	19	19%	101	19%
Rubber	110	31%	21	31%	31	31%	162	31%
Textiles	20	6%	4	6%	5	6%	29	6%
Total	***360***	***100***	***70***	***100***	***100***	***100***	***530***	***100***

Note: figures have been rounded hence the aggregates may not be entirely identical to the figures shown in the last row. These sales figures will be used as consumption figures in our calculations later in this SEA

The figures shown in the above table will be used as the basis for the assessment of impacts to different stakeholders.

Summary: in terms of tonnage, the most important use of SCCPs in the EU appears to be in sealants and adhesives (237 tonnes) followed by rubber (162 tonnes), paints (101 tonnes) and textiles (29 tonnes). We have also assumed that tonnages allocated to metalworking lubricants have been the result of mis-reporting and have consequently been redistributed among the four key applications.

Please note that these figures are based on assumptions and have only been generated with the aim of facilitating the assessment of impacts from the potential UN ECE restrictions.

2 This assumption is based on discussions with some EU distributors of SCCPs who may sell this substance to non-EU customers.

3.3 Use of SCCPs in rubber

3.3.1 Use of chlorinated paraffin flame retardant in elastomers

Overview

There are many types of elastomers and ranges of sources indicate different types of rubbers that may contain SCCPs. It is reasonable to expect that elastomers that do not have good flame resistance would be the prime candidates to be protected with SCCPs. According to the Conveyor Belt Guide (2005), rubbers such as natural rubber (NR), styrene and butadiene rubber (SBR), polybutadiene rubber (BR), acrylonitrile and butadiene rubber (NBR), butadiene or isoprene rubber (IIR) and EDPM elastomer (a terpolymer of ethylene, propylene and a di- or polyene) have very poor flame resistance. On the other hand, poly-β-chlorobutadiene rubber (e.g. chloroprene, also known as neoprene or CR) and PVC have inherent flame resistance. Notably, flame and heat resistance should not be confused. PVC for instance has poor heat resistance despite its good fire/flame resistance; on the other hand, IIR and EDPM have very good heat resistance.

According to Dick (2001), chloroprene rubber may be used for mining conveyor belt compounding alongside chlorinated paraffins for both the cover compound and the skim compound. Dick indicates that the chlorinated paraffin may be used at 15 parts by weight in a cover per hundred chloroprene and at 30 parts by weight per hundred chloroprene in a skim coat. The compound may also contain phosphate plasticiser, antimony trioxide, zinc borate and aluminium hydroxide[3].

SBR-based conveyor belts which exhibit good strength, flexibility and ability to tolerate high filler loadings may also be flame retarded with chlorinated paraffins. Dick (2001) reports formulations containing 20-25 parts chlorinated paraffin with a 70% chlorine content per hundred SBR/NR. Antimony trioxide, zinc borate and aluminium hydroxide may also be used, the latter in concentrations as high as 60 parts per hundred rubber. Phosphate and other plasticisers may also be added.

Nitrile rubber may also be flame retarded with SCCPs. Dick (2001) refers to mixtures of NBR and PVC foam that may contain 20 parts of chlorinated paraffin per hundred rubber by weight. Antimony trioxide, zinc borate and significant concentrations of aluminium hydroxide are also added to the formulation. Blends of nitrile elastomer and PVC are known to combine the oil, chemical and ozone resistance of PVC with the solvent resistance and elastic properties of nitrile elastomer. In addition, PVC can provide some degrees of flame retardancy to NBR. Nitrile/PVC blends with different flame retardants are used in applications such as fire hose, roll cover, electrical connector parts, automotive components and foam insulation (Dick, 2001).

[3] According to Dick (2001), antimony trioxide acts as a synergist but suffers from the disadvantage of generating large amounts of smoke during combustion. Efforts to reduce smoke generation, ensure cost-effectiveness and avoidance of the toxic effects of antimony have resulted in substitutes such as zinc borate to find increasing use.

Finally, EPDM elastomer may also be flame retarded with chlorinated paraffins. Dick (2001) reports typical EPDM formulations with chlorinated paraffin content of 50 parts per hundred EPDM. The paraffin appears to be SCCP as it is suggested to have a very high chlorine content at 71.5%. Antimony trioxide and zinc borate are also added at low concentrations. EPDM formulations are used in building applications, transportation applications and electrical and electronic applications.

Key applications of SCCPs-containing rubber

Information from literature and past studies

A key use of the rubber flame retarded with SCCPs is in conveyor belts for use in underground mines where specific safety requirements need to be met. Other uses are also possible. A survey undertaken in the UK by the British Rubber Manufacturers' Association in 2001 indicated the use of SCCPs in conveyor belts only with a concentration of 10-17%. Chlorinated paraffins of unknown chain length (but possibly SCCPs) were also used in shoe soles (concentration 6.5%) and industrial sheeting (concentration 13%). In terms of tonnages, conveyor belt use was far more important than the other two in the UK at the time (Environment Agency for England and Wales, 2007).

Uses of SCCPs in rubber may also include gaskets and hoses. According to the German Federal Environment Agency (2007), SCCPs have also been used, as PCB-substitute, in gaskets, e.g. of splices, in buildings. Information from non-EU countries, such as the Brazilian Ministry of Environment (2007), suggests that SCCPs may also be used in the fabrication of rubber car carpets and other accessories of vehicles, except tyres.

Information from consultation

The following table displays the numbers of companies contacted within the wider rubber manufacture sector in the EU. A further eleven companies (two in Belgium, three in Germany, one in Denmark, one in the Netherlands and four in the UK) potentially involved in the recycling of rubber (conveyor belts) are not included in this table.

Table 3.5: Numbers and Locations of Companies Contacted in the EU Rubber Manufacture Sector

Country	Number of companies	Country	Number of companies	Country	Number of companies
Austria	1	Finland	1	Romania	9
Belgium	3	France	16	Sweden	4
Bulgaria	1	Hungary	1	Slovenia	2
Germany	15	Italy	11	Slovakia	4
Denmark	11	Netherlands	9	UK	21
Greece	5	Norway	1		
Spain	10	Poland	14		

We also contacted the relevant European trade association, the European Tyre & Rubber Manufacturers' Association (ETRMA). ETRMA did not make a specific input to our work; however, it forwarded some information from a "*big international company*". At corporate level, the company verified the use of SCCPs and stated "*we used short chain chloroparaffins in the past, but it is no longer the case since the automotive industry prohibits the use of these substances in the compounds supplied to them. The historical use was as a flame retardant*". The company indicated to ETRMA that it is the company's strategy that restrictions in the automotive sectors are applied by default and when feasible also to products developed for different sectors. The company did not wish to disclose its name or engage in direct communication with RPA.

A total of 23 companies responded to our requests for information. We confirmed the use of SCCPs by only two companies in the conveyor belt sector; such use is possible if these articles are intended to be used in underground mines where fire safety requirements need to be met (this is further discussed later in this report). A further three companies may also be using SCCPs, according to information collected from manufacturers and distributors of SCCPs (see discussion on the location of relevant companies below). It is worth noting that a small number of other companies in the conveyor belt sector indicated that SCCPs had been replaced either in the distant past or very recently.

The information collected on conveyor belt manufacture has been incorporated in the separate sub-section on conveyor belts immediately below; unfortunately, a similar level of detail has not been obtain for applications of SCCPs other than in conveyor belts. This however provides some indication of the importance of the role of SCCPs in different areas of the EU rubber industry.

3.3.2 Use of SCCPs in rubber conveyor belts

Underground mining

Conveyor belts are widely used for transporting minerals in mines as well as in many other industrial situations. They have a carcass of woven polymeric material or steel cords to provide strength, and covers of rubber or other polymeric materials to give wear resistance and appropriate frictional properties. Because they contain large amounts of polymeric materials their use in certain environments, especially coal mines, but also in steel works, power stations and other enclosed areas must be controlled to minimise the fire risk. It is understood that in the period 1995-2001, there had been 60 fires in underground mines in the UK alone and that of these, half were associated with conveyors (Cerberus, 2002).

The key application for rubber conveyor belts that are fire retarded with SCCPs is in underground coal mining. This type of coal mining apparently accounts for an important proportion of all coal mining undertaken globally. In 2004, it was estimated that the share of underground coal mining would reach 70% of all mined coal by 2006. In the two biggest coal-producing countries, China and the USA, the share of underground mining was already above this figure (Küsel, 2004).

Areas of rubber use

According to Metso Minerals (2001), rubber may be used in the form of a skim coat and in the form of a cover. A skim coat is a layer of rubber scaled to provide appropriate adhesion with reinforcement, transmit and distribute tension between plies of reinforcement, and absorb and distribute stress generated by impact.

Use as a cover is apparently most important and is the one that has been confirmed through consultation for this SEA. The polymer used for the cover varies with the properties required for example styrene-butadiene or natural rubber are used for abrasion resistance, styrene-butadiene, butyl or ethylene/propylene rubber for heat resistance, chloroprene or styrene-butadiene rubber for flame resistance, chloroprene or nitrile rubber for oil resistance (Metso Minerals, 2001).

Overview of conveyor belt types and construction

Conveyor belt covers consist of 10 to 20 different ingredients. The main components are one or more elastomers such as those referred to earlier in this report, i.e. SBR, NR, NBR, IR, IIR, EPDM, copolymer of ethylene and propylene (EPM), CR, BR and PVC. Other components are carbon black, sulphur, accelerators, fire retardants, antioxidants, fillers, oils, plasticisers, stabilisers etc. (Küsel, 2007).

There are two big families of conveyor belts: those made with a steel carcass and those made with a textile carcass. Steel carcass belts tend to have rubber covers while textile carcass belts may have a rubber or a PVC cover.

Among the textile carcass belts, one may distinguish the following (Küsel, 2007):

- multi-ply conveyor belts;
- two-ply conveyor belts (more modern type); and
- mono-ply (solid woven) conveyor belts (the most modern type).

Consultation has confirmed the use of SCCPs in solid woven conveyor belts. The carcass of these belts utilises warp yarns interlocked and tied into one single mass. Nylon or polyester load bearing warp yarns and nylon or nylon/cotton weft yarns are used. Various combinations of these synthetic and natural fibres ensure that the requirements for impact resistance, belt elongation, flexibility (for troughing and wrapping round small diameter pulleys), load support and fastener retention are met. Where there is a specific need, cotton pile warp yarns may be included to further improve impact resistance. Additional edge reinforcement is included where required. The solid-woven fabric is impregnated with PVC to make the finished carcass (Fenner Dunlop, 2006).

Following the impregnation process, covers need to be applied to the top (carrying) and bottom (drive) surfaces of the belt to protect the carcass and extend service life. Cover type, quality and thickness are matched to specific customer requirements. For use above and below ground and where a higher coefficient of friction is required, rubber covers are vulcanised to the parent belt. These can be fire-resistant if required. Rubber covers are recommended for short-centre, high trip rate, high tonnage installations such as coal preparation plants, coke works and for hard rock conveying applications. On the other hand, where a higher coefficient of friction is not a priority, PVC covers can be formulated to meet any worldwide fire resistance specification and to offer resistance to other hazards, such as oils and chemicals. Special compounds can also be used to give improved abrasion resistance or a higher coefficient of friction (Fenner Dunlop, 2006).

Safety standards and use of SCCPs in solid woven conveyor belts

Since chloroprene rubber is highly fire resistant by nature, only a little amount or no addition of fire retardants is necessary. In case of a fire, due to the high content of halogens (chlorides, bromides), endothermal processes are initiated which withdraw energy and extinguish the fire. PVC shows a similar behaviour. On the other hand, in the case of SBR, a large amount of fire retardants has to be added, which deteriorate the physical properties of the compound. Even by addition of big amounts of fire retardants the safety features of chloroprene rubber cannot be achieved. Literature suggests that, some 30 years ago, the flame retarded conveyor belts (grade DIN-K or ISO 340) based on SBR had to be replaced by self-extinguishing conveyor belts based on chloroprene rubber in European underground coal mining. Since then the use of flame retarded conveyor belts (as opposed to self-extinguishing ones based on chloroprene rubber or PVC) was only allowed above ground (Küsel, 2007).

However, this statement that chloroprene rubber has replaced SBR may not uniformly apply across the EU. It appears that until now different countries have different fire safety requirements for conveyor belts. This has allowed different types of rubber to be used in different countries; we have been advised that nitrile rubber may also be used, for instance in countries such as Poland, when flame retarded with SCCPs. It has also been suggested that lower grade solid woven belts with SBR may also be flame retarded with SCCPs, but our understanding is that such belts do not find use in the EU.

Efforts have been made to harmonise standards across the EU. The European Standardization Organisation CEN TC/188 committee was formed in late 1989 with the aim of preventing barriers to trade within Europe by the harmonization of conflicting national standards. Five working groups were formed of which WG 3 focused on safety test methods and requirements. The working group realised that while the national standards on surface resistance were the same and laboratory ignition tests were only slightly different, the drum friction tests were different and the fire propagation tests were very different (Fenner Dunlop, 2007).

Any standard for underground belting in Europe has to satisfy and support the requirements of the ATEX Directive (Directive 94/9/EC on electrical and mechanical equipment for use in explosive atmospheres) as well as the Machinery Directive 2006/42/EC (formerly 98/37/EC). The risk assessment approach demanded by these Directives has provided a way out of the 'stalemate' situation for underground belting. The work of the CEN Committee has resulted in a new standard, EN 14973:2006 which contains five classes for belting, intended to provide safety in particular situations (Fenner Dunlop, 2007):

- Class A, general use, the only hazard being limited access and means of escape;
- Class B, as above plus a potentially explosive atmosphere:
  - B1 - no secondary safety devices;
  - B2 - with secondary safety devices;
- Class C, as Class B plus flammable dust or material conveyed:
  - C1 - no secondary safety devices; and
  - C2 - with secondary safety devices

EN 14973:2006+A1:2008 is now applicable to EU countries, however, consultation with industry indicates that Member State authorities may still have not implemented it and amended their national standards accordingly. This standard reportedly makes the safety requirements more stringent, therefore, the use of SBR belts will not be possible and the use of flame retardants such as SCCPs will play a key role. It is also worth noting that the US Mine Safety and Health Administration (MSHA) has recently issued a new safety standard for the testing of fire resistance of underground conveyor belts which is much stronger than the previous one (USA has been reported in literature as the country with perhaps the less stringent requirements in the past). The new US standard came into force in January 2010. A manufacturer of conveyor belts has noted that their standard formulations may not be able to meet this.

Overall, the change in safety standards in the EU means that SBR rubber will not be able to be used and potentially the most appropriate materials would be either PVC-covered belts or, when better friction coefficients are required (which is typically the case in underground coal mining), chloroprene rubber covers might be the only solution. We do not have sufficient information to establish whether nitrile rubber covers which are indeed used with SCCPs at present would be able to continue to be used after reformulation.

<u>Information from EU manufacturers of underground mining conveyor belts</u>

It appears that a small number of companies may have been involved in the use of SCCPs in the manufacture of conveyor belts for underground mining. The information collected from them is summarised (in an anonymous fashion, for confidentiality reasons) below:

- **Rubber Company 1** has advised that until recently they had one product with SCCPs as an ingredient. The formulation was changed around six months ago and the company now uses MCCPs. The product in question was used for underground mining only. The company did not face any cost or technical implications from the switch to alternatives and has indicated that there will be no problem meeting the relevant safety standards;

- **Rubber Company 2** has confirmed use of SCCPs and that they are in the process of changing to longer-chain chlorinated paraffins and they see "*no need for protest*";

- **Rubber Company 3** noted that the business group it belongs to, as a whole, does not use SCCPs and "*respects the rules of OSPAR since the beginning*" (this is a reference to the relevant PARCOM Decision 95/1). Use of SCCPs stopped in 1995. The company has opted for longer-chain chlorinated paraffins (mainly the solid types, i.e. LCCPs), aluminium hydroxide ($Al(OH)_3$), and brominated products (in small quantities); and

- **Rubber Company 4** has confirmed the ongoing use of SCCPs in solid woven conveyor belts (in one product only) used for underground mining in the coal industry. The relevant products are textile conveyor belts with PVC impregnation and rubber covers which are made of nitrile rubber. The degree of chlorination of the SCCPs used is 60% and its presence in the rubber is below 10%. The rubber cover may account for up to one third of the total weight of the conveyor belt, depending on its thickness. The belts are designed to last for 15 years. SCCPs are used with synergists such as antimony trioxide and aluminium hydroxide. The company is in the process of identifying a suitable alternative that will ensure acceptable mechanical properties and flame retardancy while keeping the price increase at reasonable levels. It has been two years since the efforts to replace SCCPs begun.

3.3.3 Locations of use of SCCPs

Until recently, SCCPs have been used by a relatively small number of companies that manufacture conveyor belts for underground coal mining. These appear to be located in France, Germany, Poland and the UK. Communication with these and other companies (which generally are large international companies) indicates that some, but not all, have abandoned SCCPs. For confidentiality reasons, we cannot indicate the locations of those companies which still use SCCPs; however we can confirm that the remaining users are in the process of switching to alternative formulations.

With regard to the manufacture of rubber products other than conveyor belts, there is some evidence of supply of SCCPs to German companies as well as some French companies which may be linked to the production of rubber products other than conveyor belts. We have also been advised that Italian companies have a leading role in the hydraulic rubber goods sector (gaskets, hoses, etc.) and may in theory be using the substance but there is no concrete evidence on this.

Past use of SCCPs in rubber manufacture has been confirmed through consultation with Member State authorities in:

- Bulgaria – in 1990-1996 SCCPs with 52%wt. Cl were used as plasticisers in the production of plastic articles (ca. 400 tonnes) and SCCPs with 52-56% by weight Cl were used in conveyor belts for underground mining;

- UK – in 2005, an estimated 105 tonnes were used in rubber manufacture; and

- Sweden – some information is available but refers to chlorinated paraffins as a whole and is not certain that SCCPs were imported and used.

Recycling of SCCP-containing rubber

According to ECHA (2008), the lifetime of such belts is around 10 years (though a belt manufacturer suggests a lifetime of 15 years) and the belts are increasingly being recycled by reduction to powder and subsequent formation of belts, mats and building materials. ECHA suggests that it is possible that articles other than conveyor belts could be made (for example mats, building materials, paving materials) and so this could result in an additional source of widespread use of, and hence diffuse exposure from, SCCPs.

However, the above assertions are not corroborated by information provided by consultees contacted during the preparation of this SEA, as follows:

- **Rubber Company 3** has advised us that flame resistant belts are not recycled and others are recycled only in small quantities;

- **Rubber Company 4** suggested that conveyor belts of the type that contains SCCPs are not recycled and are typically buried in the mines;

- **Rubber Company 5** has indicated that solid woven belts (those approved for underground mining by, for instance, the UK Coal Authority) are not recycled. The conveyor belts which are recycled tend to be SBR belts which do not contain paraffins. The recycling process needs to turn the belt into granulate and this is not possible with the solid woven belts;

- **Rubber Company 6** confirmed that it recycles end-of-life tyre material, whole tyres and inner tubes in the Netherlands and Belgium. Generally, the recycling activities encompass tyres and all kind of rubber products based on NR and/or SBR or BR. To the company's best knowledge, recycling of rubber in the EU is mainly based on recycling of tyre material. One of the main reasons for this is the consistency of the material. All tyres have more or less the same ingredients and are based on the same kind of recipes. Only a few polymers are used, like natural rubber, SBR and BR. Only for the inner liner recipe a butyl polymer is used, but this is only in a very small amount when compared to the entire tyre.

  For other applications (conveyor belts, gasket, hoses, etc.) all kind of recipes/formulations are possible, based on all different kind of polymers, like NBR, EPDM or CR. Choice of raw materials is based on the applications of, for example, the hoses, i.e. what kind of fluids or gases has the hose to be resistant to, what environmental circumstances is the hose used in (high pressure, etc.). Besides that, the amount of reinforcing materials might be a problem for trying to recycle conveyor belts or hoses. Most conveyor belts or hoses contain a lot of reinforcing fibres or steel, much more than is used in a tyre. Although fibres and steel can be separated during the recycling process, the high amount present could cause problems.

  Also, fillers are much more variable. In tyres it is mainly carbon black and silica. For other products also other white fillers and flame retardant fillers are used.

With the current processing technology it is not possible to recycle different kind of polymers together. And even if this were possible, customers would still need a consistent recycled product. Nevertheless, the company has tested its reclaimed material for SCCPs. BR reclaim and NR reclaim have both a SCCP content of <10 mg/kg. The source of the low percentage of SCCPs could be some kind of plasticiser that has been used in the product but it is not a typical ingredient for a tyre. However, the company recycles tyre materials from all over the world, and it does not know exactly what compounders in other countries do; and

- **Rubber Company 7** recycles rubber but does not handle conveyor belting due to the presence of contamination such as textile, steel and whatever the belt was used to transport. The only probable outlet for such a product is as a fuel source for a cement kiln but it would have to be granulated and the owner would have to pay for it to be taken. Most rubber recyclers do not handle products such as conveyor belting and hoses because of the fibre and metal reinforcing. SCCPs have yet to cause any problems to the company's recycling operations but they are aware of their presence.

3.3.4 Size of the EU Rubber Industry

The global natural rubber production in 2008 was 10 million tonnes (apparently no production of natural rubber takes place in Europe). The production of synthetic rubber was 12.8 million tonnes of which the EU accounted for 2.55 million. In terms of consumption, in 2008, the EU consumed 1.2 million tonnes of natural rubber and 2.4 million tonnes of synthetic rubber. The value of SBR produced in France for export was around €1,500 per tonne in 2009 (International Rubber Study Group, 2010). According to the European Tyre & Rubber Manufacturers Association Internet site (ETRMA, 2010), the EU rubber industry encompasses 4,200 companies with a total direct employment of 360,000 workers. The annual turnover of the industry is €47 billion with €27 billion associated with ETRMA tyre members.

Statistics on the production of conveyor belts in the EU are presented in ECHA (2008) (under the code 25.13.40.50 in the Prodcom database – rubber conveyor belts). In 2007 the total sold volume in the EU was 237,880 tonnes, with the highest production of such belts occurring in Germany (approximately 22.4%), Poland (16.4%), Greece (10.1%) and Romania (8.6%)[4]. Later in this report we present our assumption that conveyor belts account for 75-90% of the total EU consumption of SCCPs in the rubber sector. With an assumed SCCP concentration of 10% in conveyor belts, the estimated consumption of 122-146 tonnes of SCCPs would correspond to a conveyor belt tonnage of 1,215-1,460 tonnes. This is less than 1% of the production volume for conveyor belts in the EU in 2007. However, it should be noted that the rubber is only used as (mainly) a cover while the conveyor belts is essentially made of textile impregnated with PVC. Consultation with a conveyor belt manufacturer indicates that the percentage of rubber in the conveyor belt depends on the thickness of the rubber, 33% is typically the maximum for solid woven

[4] According to the Prodcom database the production figures for Belgium, Czech Republic, Ireland, Latvia, Austria, Portugal, Slovenia and Slovakia are confidential and data were not given for the Netherlands or the United Kingdom (ECHA, 2008).

belts. Therefore, the tonnage of conveyor belt that contains SCCP-retarded rubber is larger than the maximum of 1,460 tonnes estimated above (ca. 3,700-7,300 tonnes of belting). We cannot, however, compare any such higher figure to the Prodcom figure as we do not know whether it refers only to the rubber element or the entirety of conveyor belts that may contain tuber components.

For other rubber products, as shown later in this SEA (**Table 6.3**), we assume a concentration of SCCPs in rubber products of 10-17% and this results in an assumed 95-400 tonnes of final rubber products. This is an evidently insignificant amount in the context of the wider EU rubber industry.

3.3.5 Summary

Relevant applications: past reports claim that SCCPs has been used mainly in underground mining conveyor belts and products such as gaskets, hoses etc. We have confirmed the use of SCCPs in conveyor belts in the EU and have indications that use in other products may still be possible. On the basis of the information collected to date, we will assume that the vast majority of SCCPs used in the rubber industry is consumed by the manufacturers of rubber conveyor belts (later in the report, we assume the relevant percentage going to conveyor belts to be 75-90% of the total of 162 tonnes consumed in the rubber sector).

Concentration and chlorination: with regard to the concentration of SCCPs in rubber, literature suggests a concentration of 10-17% but recent consultation indicates a concentration of <10% in rubber for conveyor belts (rubber may constitute up to a third of the entire conveyor belt product). Literature indicates a high chlorination of 63-71% but consultation with companies suggests a lower level of around 60-65%. Information from the Bulgarian authorities suggests that SCCPs with 52-56% by weight Cl were used in conveyor belts for underground mining in the past.

Use of SCCPs in conveyor belts: SCCPs may in theory be used in several types of rubber, however, for underground mining conveyor belts high levels of flame retardancy are required and rubbers such as SBR are not used. Chloroprene rubber, which is inherently fire resistant, may contain SCCPs; SCCPs use in nitrile rubber in the EU has also been confirmed. A new European standard (as well as a new US standard) has recently been introduced (EN 14973:2006+A1:2008) and this will eventually result in higher levels of flame retardancy across the EU.

Among the different types of conveyor belts, use of SCCPs has been confirmed in mono-ply (solid woven) conveyor belts (the most modern type). In these, a textile core is impregnated with PVC and is then covered with a rubber cover.

Numbers and locations of users: the number of manufacturers of conveyor belts for underground mining is small and currently only two companies seem to continue using SCCPs. Both companies are in the process of switching to alternatives (possibly MCCPs). France, Germany, Poland and the UK are countries were use of SCCPs has been taking place (although companies located in some of these countries may have now discontinued the use of SCCPs). Use in Bulgaria and Sweden appears to have stopped.

Recycling of SCCP-containing rubber: the nature of the products that might contain SCCPs and their likely composition make them poor candidates for recycling. In this SEA we will have to assume that any recycling of SCCP-containing rubber, especially conveyor belts, is unlikely to occur at appreciable quantities.

Importance of SCCPs in the wider rubber industry: assuming an SCCPs consumption of 162 tonnes per year (see **Table 3.4**) and that conveyor belts account for 75-90% of SCCPs consumption, we calculated above the tonnages of rubber that may contain SCCPs (1,215-1,460 tonnes of rubber for belting and 95-400 tonnes of other rubber products). These form a very small fraction of the EU consumption of synthetic rubber of 2.4 million tonnes (in 2008). Therefore, SCCPs are of limited importance to the wider rubber industry or indeed the conveyor belt industry, although it is correct that SCCP-containing rubber has been used in some niche markets with particular safety requirements, such as the underground coal mining sector.

3.4 Use of SCCPs in sealants and adhesives

3.4.1 Uses of SCCPs in sealants and adhesives

Information from past studies and literature

According to literature, chlorinated paraffins, including short-chain ones, are used as plasticisers/flame retardants in adhesives and sealants. Examples include polysulphide, polyurethane, acrylic and butyl sealants used in building and construction and in sealants for double and triple glazed windows. The chlorinated paraffins are typically added at amounts of 5-14% by weight of the final sealant but could be added at amounts up to 20% by weight in exceptional cases (Environment Agency for England and Wales, 2007).

The difference between an adhesive and sealant can be fairly blurred in that some sealants are used as adhesives and vice versa. Generally, sealants are considered to be materials that are installed into a gap or joint to prevent water, wind, dirt or other contaminants from passing through the joint or crack. Adhesives, on the other hand, are used to transfer loads and are typically designed with much higher tensile and shear strength than sealants. The main use of SCCPs in this area is in sealants (Environment Agency for England and Wales, 2007). SCCPs have been used in both 1-part and 2-part sealants (ECHA, 2008).

<u>Information from publicly available Safety Data Sheets</u>

In the course of this SEA we investigated the presence of SCCPs in sealant and adhesive formulations by researching publicly available Safety Data Sheets (SDSs) of relevant products. Those found on the Internet are presented in **Table 3.6**. We contacted the companies named as manufacturers/suppliers of these products and any information collected has been incorporated in the table. This communication has confirmed that some products have now been discontinued. The information in the table confirms that:

- formulations that contain SCCPs include polysulphide-, polyurethane- and acrylic-based products which come in one- or two-parts (among the products shown below, two-part products appear to be more common);

- SCCPs may be present in both sealants and adhesives. For the latter, applications identified include adhesives for road marking tapes, military uses and artificial grass. For sealants, there is a wide range of applications with the most prominent being:
    - the filling of expansion and movement joints (either horizontal or vertical, depending on the product);
    - the filling of gaps around doors, windows, dorm windows, arches;
    - sealants for water storage applications (reservoirs) but also for protecting areas from oil and fuel spillages, areas around petrol stations, sewage treatment works;
    - sealants for underground facilities such as basements and subways but also for the waterproofing of constructions where water flow occurs such as bridges and culverts; but also
    - sealants for automotive windows and sealants that may act as intumescent (fire protection coatings);

- another use of sealants that appears to be quite common is the use as a waterproof roof coating which typically can be applied on many substrates even in damp weather conditions;

- the concentration of SCCPs may vary widely and can be as low as 2% (in the adhesive for road marking strips) up to 95% in accelerators for two-part sealants. The most common concentrations shown in Safety Data Sheets are generally 10-30% (but note that the concentrations shown may (but not always) only reflect the presence of SCCPs in one of the two parts of the sealant); and

- we have identified products which could fall under the description of 'dam sealants'. These are products which may be used for spillways[5] and sea defences. The relevant products identified can be either polyurethane or polysulphide-based and may indeed contain a significant concentration of SCCPs.

[5] A spillway is a structure used to provide for the controlled release of flows from a dam or levee into a downstream area, typically being the river that was dammed. Spillways release floods so that the water does not overtop and damage or even destroy the dam.

Table 3.6: Examples of SCCP-containing Sealant and Adhesive Formulations and Description of Properties and Uses

Country	Product description	SCCPs content %	Date on SDS	Source
CZ	No data	2.5-10	May 2004	ACR Czech (2004)
CZ	Two-component polyurethane flame retardant sealant. Use to: • seal horizontal expansion joints, • balance uneven and porous materials, glue wood, plastic, metal, paper, textiles; and • impart flame retardancy with a solvent-free coating.	<13	Jun 2006	Colorlak (2010); Colorlak (2006)
DE	Two-component, permanently flexible sealant on polysulphide-based, pourable, self-levelling, cold processable, for: • sealing horizontal expansion joints in building construction, civil engineering and road construction; • sealing of joints according to DIN 18540 - F for expansion joints to 25% of joint width; • concrete and asphalt joints; and • joints that need to be resistant to fuels.	2.5-25	May 2007	Bornit (2009); Bornit (2007); Holz.- und Bautenschutzbedarf (undated)
FR	One-component, ready-to-use liquid polyurethane resin, intended for waterproofing of non-trafficable roofs. Come sin two colours (sand and anthracite) and is resistant to water stagnation. Use for: • roof waterproofing; • sealing of complex shapes such as domes, arches, domes, gutters, parapets, cornices; • restoration of old waterproofing based on bituminous or asphalt materials; • restoration of metal roofing, or fibre-cement roofing. Application by brush or roller (in two coats).	20-25	Jul 2009	Flag Soprema (2010); Soprema (2010); Soprema (2007); Soprema (undated)
IT*	Adhesive for road marking tapes. These were road marking rubber tape which can later be removed. The adhesive helps a hydrophobic material (rubber) to adhere on a hydrophilic substrate (road) (adhesion of a polar polymer to a non-polymer). Normally, the concentration of SCCPs ranged between 2% and 4%.	2	Jul 2002	Snoline (2002)
UK*	Rapid-set accelerator for adhesive - Organometallic compound solution in chlorinated paraffin carrier. The company suggested that this SDS should have been changed, as they had ceased use of SCCPs more than three years ago. A revised datasheet was provided and this contains chlorinated paraffin with a CAS number of 63449-39-8. This apparently is an LCCP with 23 carbon atoms.	>95	Nov 1999	Envirostik (1999)
UK*	Automotive window sealant. Communication with the company indicates that they no longer produce this range of products. The whole range, including the window sealant was discontinued over nine months ago.	25-50	Aug 2007	ICI Paints (2007)

Table 3.6: Examples of SCCP-containing Sealant and Adhesive Formulations and Description of Properties and Uses

Country	Product description	SCCPs content %	Date on SDS	Source
UK	Water-based structural adhesive. Rapid-drying, water borne, trowelling grade co-polymer adhesive with a wide range of uses, including: • bonding foam, cork, felt or fibrous slabs to themselves, or to wood, glass, painted metal, rigid plastics or to building surfaces; and • approved by MOD (Navy) to specification NES 782 for bonding mineral wool marine board to ships platework. It remains semi-flexible when dry, and exhibits very good water resistance.	1-5	Sep 2005	Bostik (2005); Kitsons (undated)
UK*	Synthetic rubber based one-part polysulphide sealant, for resistance to deterioration from weathering, chemical attack, oils and greases. Its elasticity enables it to withstand repeated cycles of compression and extension over a wide temperature range, and its adhesion to all commonly used construction materials enables it to effectively seal all joints, including those that are subject to above average movement. Use for: • sealing both horizontal and vertical joints; • sealing around doors and window surrounds; • sealing around external cladding and walling in high rise construction. It is not recommended for use in joints subject to foot, wheeled traffic or hydrostatic pressure and due to its relatively slow through cure this should not be used where movement is anticipated during its curing period. It should not be used where it will remain permanently immersed in water. Communication with the company suggests that this product has not been manufactured for more than six years. It was replaced with silicones as they were considered to be a better product at a better price and having a better health and safety profile.	N/A	N/A	CM Sealants (undated); CM Sealants (undated-b)
UK	2-part polyurethane adhesive system for seam bonding short to medium pile synthetic grasses to seaming tapes. Also suitable for bonding directly to rubber, concrete and asphalt bases.	5-10	Dec 2005	Bostik (2009); Bostik (2005b)

Table 3.6: Examples of SCCP-containing Sealant and Adhesive Formulations and Description of Properties and Uses

Country	Product description	SCCPs content %	Date on SDS	Source
UK	Chemically curing, pitch-free polyurethane sealant specially formulated to provide a durable seal in movement or construction joints in concrete subject to contamination by oil and fuel spillage. The sealant is high modulus with good durability, and damage resistance. It can be used in: • concrete roads, hard standings, runways, petrol filling stations and industrial production areas; • sealing joints in building facades and potable water containing structures – it has been tested and listed under the UK Water Bylaws Scheme; • membrane terminations; • sewage treatment works; • concrete factory floors; • culverts - culvert is a conduit used to enclose a flowing body of water. It may be used to allow water to pass underneath a road, railway, or embankment; • sea defence works; and • spillways.	50-100 & 20-30	Feb 2005	Grace (2010); Grace (2005); Grace (2005b); Grace (2004)
UK	Two-part, cold applied, pouring grade polysulphide sealant for sealing horizontal movement joints in buildings, and civil engineering structures. It is resistant to environmental pollution, weathering and immersion and is capable of accommodating shear and transverse movement. It is also resistant to occasional spillage of dilute acids, alkalis, fuel and oil. Applications may include horizontal movement and construction/contraction joints in: • reinforced concrete structures; • bridges; • subways; • tunnels; • culverts; • tanks; and • silos and other reinforced concrete buildings.	10-20	Feb 2005	Grace (2006); Grace (2005c)

Table 3.6: Examples of SCCP-containing Sealant and Adhesive Formulations and Description of Properties and Uses				
Country	**Product description**	**SCCPs content %**	**Date on SDS**	**Source**
UK	Gun grade, high performance polysulphide sealant for general civil and structural applications and is suitable for all types of joints in potable water retaining structures. It can be used in wide joints up to 40mm and is resistant to environmental pollution, weathering and immersion and capable of accommodating shear and transverse movement. It can be used for sealing movement and construction joints in vertical faces of: • reinforced concrete structures; • masonry walls; • service reservoirs; • building facades; • sewage treatment works; and • sea defence works.	20-30	Jan 2005	Grace (2010); Grace (2006b); Grace (2005d)
UK	Acrylic/polyurethane hybrid overlay system suitable for coating low-pitched sheeted roofs that can be applied to substrates such as asbestos, plastisol coated sheeting and composite metals. It provides a totally waterproof and seamless membrane. It can be used in conjunction with systems applied to waterproof gutters and waterproof rooflights. It comes with a guarantee of up to 10 years.	1-5	Jun 2007	Polyroof (2007); Polyroof (2006)
UK	High performance acrylic waterproofer for roofs. It can be applied in wet conditions to provide flexible seamless coating. It lasts up to 10 years.	1-20	Jan 2005	Wickes (2010); Wickes (2005)
UK	High performance acrylic based roof coating dispersed in solvent, designed to prevent the ingress of water, which will allow any trapped moisture to escape and evaporate naturally. Fibres have been added into the coating thereby eliminating the need to use scrim. Durable thermoplastic roofing compound, formulated for a wide range of roofing substrates including bitumen, asphalt, tile, slate and asbestos sheets. Requires only one coat and can be used in damp weather conditions. It has good solar reflectivity and is sold as being unaffected by temperature.	>10	Aug 2004	Sandhill Products (2004)
UK	Two-part high movement intumescent sealant (polysulphide polymer, chlorinated paraffin, inorganic fillers, antimony trioxide, manganese dioxide). Under fire conditions it intumesces, forming a foam-like structure, which insulates and provides a barrier to hot gas and flame. It forms a tough, flexible rubber-like seal with a movement accommodation factor of 25% for high movement situations. It is resistant to a range of chemicals and is suitable for fire protection of expansion joints in building superstructures and may be used in both internal and external joints (joints in walls, floors and ceilings).	2.5-10	May 2002	Fosroc (2007); Fosroc (2002); SCP (undated)

Table 3.6: Examples of SCCP-containing Sealant and Adhesive Formulations and Description of Properties and Uses				
Country	**Product description**	**SCCPs content %**	**Date on SDS**	**Source**
UK	Multi-component, gun and pouring grade, polysulphide sealant. It forms a tough, elastic, rubber-like seal and accommodates continuous and pronounced cyclic movement. It shows excellent adhesion to most common substrates, including primed concrete, glass, aluminium and stainless steel, and high resistance to ageing reduces physical damage due to climatic extremes. Available in gun and pouring grades; the gun grade is ideal for general application, and is available in a range of colours. It is packed in a ready to mix, 2.5-litre tin containing the base and curing agent in the correct proportions. The pouring grade for joints in horizontal surfaces is supplied in grey only in 5 litre packs with the base and curing agent in separate tins. Uses include: • sealing movement joints in building and civil engineering structures, including superstructures, reservoirs, floors, basements and subways; and • particularly recommended for use in high-rise buildings and other applications where access for subsequent maintenance will be difficult and the risk of early movement failure must be minimised; Should not be used in direct contact with materials containing pitch or bitumen. Only gun grade grey should be used in vertical or horizontal joints in reservoirs or other water retaining structures.	25-50	May 2001	Fosroc (2002b); Fosroc (2001)
** An asterisk indicates a product which has been confirmed to have now been discontinued.*				

Outside these SDSs, we have confirmed the potential use of SCCPs in adhesive tapes as testified in a recent patent submitted to the UK Patent authorities. This relates to a sealing tape for a cold-applied joint in a pair of cables where at least one of the cables is a paper-insulated lead cable including paper insulation impregnated with oil. The sealing tape comprises an inner layer carried on an outer layer. The internal layer may be a form of sealing mastic material based on an oil resistant elastomer such as epichlorhydrin, nitrile and fluorosilicone. This layer may contain SCCPs (with 60-71% chlorination) at 100 parts per hundred rubber (Tyco, 2007).

<u>Information from consultation</u>

The following table displays the numbers companies contacted within the EU sealants and adhesives industry.

Table 3.7: Numbers and Locations of Companies Contacted in the EU Sealant/Adhesive Manufacturing Sector

Country	Number of companies	Country	Number of companies	Country	Number of companies
Austria	2	Denmark	2	Italy	8
Belgium	3	Greece	2	Netherlands	5
Switzerland	4	Spain	3	Romania	1
Czech Rep.	3	France	1	Sweden	2
Germany	14	Ireland	3	UK	35

We also contacted the Association of European Sealant and Adhesives Manufacturers (FEICA). FEICA contacted its members and reached the conclusion that they do not use SCCPs in adhesives and sealants. FEICA has noted "*it is not an issue for our Industry because we have moved away from SCCPs some years ago*". The association claims "*SCCPs have been discontinued since 10 to 20 years in sealants*". Through its direct company membership and the members of the National Association members at FEICA, the association estimates its coverage of the EU sealants/adhesives market at >80%. FEICA is not represented by national associations in the 'new' member states in central Europe but its direct members are operating in these countries. In these emerging countries, there are still a limited number of national adhesive and sealant producers. Most of the products are imported from the West or manufactured locally by Western companies which are using Western product formulations.

A total of 26 companies responded to our requests for information. Of them, only two confirmed or implied that they currently use SCCPs:

- **Sealant Company 1** indicated that SCCPs in almost all its formulations have been replaced by alternative plasticisers. The company was unwilling to provide any additional information; and

- **Sealant Company 2**, which has facilities in several locations in the EU, submitted a completed questionnaire. The company uses SCCPs in sealants for the construction industry (for examples, for pavement sealants to prevent seepage of dirty water) but is currently working towards eliminating SCCPs from its product range.

The company consumed a significant quantity of SCCPs in 2009 and a similar quantity in 2008 but earlier annual tonnages could have been even higher. The relevant products are used in a variety of civil engineering applications such as:

- bund walls (to prevent contamination of chemicals, fuel spillages) for installations such as sewage plants;
- basements;
- structure joints;
- water reservoirs for non-potable water (but not swimming pools - in swimming pools, the polymer is not resistant to ozone and chlorine, hence it is not used);
- subways; and
- other applications where resistance to water, chemicals, alkalis, solvents and biological agents is required and where low temperatures may prevail (at which buildings tend to contract and the sealant needs to be able to expand - polysulphide sealants tend to stress-relax and this reduces the force exerted on the bond).

The SCCP-containing products manufactured by this company are not used for double glazing nor are they used for potable water, only for ‘dirty water’/run-off (for potable water, sealant products would need to pass strict tests).

The company sells directly to applicators but also to distributors. They do not sell to DIY stores as they are not really concerned with DIY construction. One-man firms could be among the users but not really individual consumers. The company estimates that they may have 10-20 direct applicators and a few dozen distributors as customers. The products may be specified in construction contracts and designers may be encouraged to use chemicals of a particular type.

The typical concentration of SCCPs ranges between 20% and 30% and the degree of chlorination of SCCPs is 56%. The company suggests that no releases of SCCPs during production take place and only <100 kg per year is disposed of as special waste.

3.4.2 Locations of use of SCCPs

The above table provides an indication of where use of SCCPs may have taken place in recent years. During consultation for this study, we have confirmed the use of SCCPs in the Czech Republic, France (where two companies apparently manufacture of adhesive ribbons and fire retarded acrylic adhesives), Germany, the Netherlands and the UK.

Past use of SCCPs in sealant manufacture has also been confirmed through consultation with Member States. In the UK, less than 100 tonnes were used in 2005. In Germany, marketing and use exemptions for sealants and conveyor belts expired at end of 2004. In Finland, there seems to have been some kind of the joint sealing compound containing SCCP imported in 1994. This product has not been on the market ever since.

3.4.3 Size of the EU Sealants and Adhesives Industry

Information from the British Adhesives and Sealants Association (BASA, 2009) can be used to estimate the size of the EU sealants and adhesives industry. In terms of tonnage, the market seems to represent around three million tonnes of products consumed and it terms of value a total of €8.6 billion in 2009. The EU-27 demand for adhesives and sealants maintained practically the same levels in 2007 and 2008. In 2009, however, the EU-27 demand was experiencing a contraction of about 5.5%, which was mainly influenced by the strong production drops in the automotive and durable goods sectors – these manufacturing sectors being typically export orientated.

The growth of the demand for adhesives and sealants varies from country to country. The UK, Italy and Spain are the countries where the adhesives and sealants demand has been most severely impacted by the economic crisis. The other Member States, even the twelve 'new' Member States, having enjoyed more sustained demand growth than fifteen 'older' Member States in recent years, were all experiencing a demand contraction in 2009. A modest recovery was expected in 2010. While the EU-27 demand for adhesives and sealants is projected to average nearly 2% growth the 'new' Member States were expected to enjoy higher than average growth (BASA, 2009).

By way of comparison, sales of adhesives and sealants in Europe were worth around €6 billion per year based on 2003 sales data. Spending on research and development (R&D) in the industry was around 3.1% of sales or €190 million per year (HSE, 2008).

The end-use markets for sealants and adhesives in the EU-27 are reported to have been in 2009 as follows.

Table 3.8: 2009 Market Share of Selected Adhesive and Sealant End-Use Markets in the EU-27

End-use market	Market share (% of tonnage)
Packaging	37
Woodworking	10
Transportation	8
Consumer/DIY	9
Other	36
Total	***100***

Source: BASA (2009)

3.4.4 Summary

Relevant applications: information collected from literature and consultation indicates that SCCPs are used in both sealants and adhesives. This includes polysulphide and polyurethane formulations, although literature also suggests acrylic and butyl sealants. The relevant applications are wide and include the filling of expansion and movement joints in building and general engineering, the filling of joints for protection from spillages and where resistance to water, chemicals, alkalis, solvents and biological agents is required and where low temperatures may prevail, the waterproofing of roofs and adhesives suitable for a variety of substrates.

Products that could be considered to be dam sealants and contain SCCPs appear to be on the market. However, the few industry stakeholders that made an input to this SEA did not raise specific concerns with regard to a restriction on SCCPs. Generally, the sealant and adhesives industry appears to be moving away from SCCPs.

Concentration and chlorination: the concentration of SCCPs could vary greatly. Overall, a concentration of 20-30% appears to be common. Information from one source only indicates that the degree of chlorination of the SCCPs used is 56% but could well be higher.

Numbers and locations of users: we have confirmed the use of SCCPs in the Czech Republic, France, Germany, the Netherlands and the UK. We cannot be sure of the number of users but it is likely to be modest.

Importance of SCCPs in the wider sealants and adhesives industry: assuming an SCCPs consumption of 237 tonnes per year (see **Table 3.4**) and a concentration in sealants and adhesives of 20-30%, a total tonnage of 790-1,185 tonnes of finished products can be calculated. This tonnage is a very small fraction of the EU consumption of sealants and adhesives of 3 million tonnes in 2009. Therefore, SCCPs are of limited importance to the wider sealant and adhesive industry. We have not received any input from industry suggesting that any particular sealant or adhesive product based on SCCPs may be particularly critical. Companies that were contacted because identified SDS suggested possible uses of products as dam sealants did not make an input to our work; therefore, the criticality or this or any other application of such sealants and adhesives has not been confirmed.

3.5 Use of SCCPs in paints and coatings

3.5.1 Use of SCCPs in paints and coatings

Information from past studies

Literature suggests that SCCPs are used as plasticisers and flame retarding agents in paints and coatings. ECHA (2008) suggests that the main types of paints that are likely to contain chlorinated paraffins are those based on chlorinated rubber and vinyl copolymers. The EU Risk Assessment Report indicates that the predominant types of chlorinated paraffins used in paints are the longer-chain length grades, however SCCPs are used in some applications, mainly in acrylic based coatings. Chlorinated rubber-based paints are typically used in aggressive environments such as marine and industrial applications. Vinyl copolymer-based paints are used mainly for exterior masonry (ECHA, 2008).

There are several sources discussing the presence of SCCPs in paints and coatings:

- ECHA (2008) indicates that the application rate of chlorinated paraffins in paints is between 1 and 10% by weight in paints based on resins such as chlorinated rubber, vinyl copolymers and acrylics, with 10% being considered typical for most paint types;
- Environment Agency for England and Wales (2008) reports the results of a survey of the use of chlorinated paraffins in general in paints and coatings in the UK. The survey was carried out in 1999 by the British Coatings Federation and it showed that the coatings shown in **Table 3.9** may contain SCCPs at variable concentrations; and
- further, information from Eurochlor suggests that the typical level of a chlorinated paraffin in the formulated paint would be 4-15% by weight. After drying (evaporation of solvent) the chlorinated paraffin content of the coating would be around 5-20% by weight (Environment Agency for England and Wales, 2007).

Table 3.9: Presence and Concentration of Chlorinated Paraffins in Coatings (UK, 1999)

Coating type	Chlorinated paraffin content (% wt)
Organic solvent borne chlorinated rubber primers and topcoats	1-5
Organic solvent borne chlorinated rubber systems for swimming pools/fishponds	5-20
Organic solvent borne zinc rich (epoxy) primers	2-5
Organic solvent borne acrylic container coatings	2-10
Organic solvent borne chemical and water resistant coatings	5-20
Organic solvent borne vacuum metallising lacquers	1-5
Organic solvent borne flame retardant coating for wood	1-5
Organic solvent borne intumescent coating for structural steel	20-30
Organic solvent borne floor paints	5-10
Organic solvent borne water-proofing coatings for walls	5

Source: Environment Agency for England and Wales (2007)

Information from publicly available Safety Data Sheets

The table that follows summarises information collected on products that contain SCCPs and have been on the market in the past. We have confirmed that some of these products are no longer on the market, including some products with Safety Data Sheets that were reasonably up to date (dated 2008). Although we cannot be sure whether the products identified are still sold to EU customers, the table provides some useful information on the nature, characteristics and applications of products that may still contain SCCPs. The key conclusions from the information presented in the table are:

- applications of the relevant formulations include:
  - road marking paints;
  - anti-corrosive coatings for metal surfaces;

  - swimming pool coatings;
  - decorative paints for internal and external surfaces;
  - masonry paints (pliolite is often used as masonry paint for external façades);
  - primer for polysulphide expansion joint sealants;
  - intumescent coatings; and
  - textile printing inks.

  Road marking paints appear to be a key application and will be discussed further in this report;

- the concentration of SCCPs may vary, but not as widely as in sealants and plastics. There are products with a very low concentration of SCCPs (<0.025) which is apparently the result of using MCCPs (which contain impurities in the form of shorter chain molecules). The most common concentration range is 2.5-10%;

- it is apparent that the division between paints and sealants is somewhat blurred. Paints for swimming pools evidently find overlapping applications with sealants used in such environments; and

- there is also a product which may not strictly fall under the paints and coatings category. SCCPs may be found in unsaturated polyester resin which is used in the production of fibre reinforced composites.

Table 3.10: Examples of SCCP-containing Paint and Coating Formulations and Description of Properties and Uses				
Country	**Product description**	**SCCPs content %**	**Date on SDS**	**Source**
CZ*	Road marking paint – White. The company has argued that SCCPs is of no relevance to its products.	<0.5	May 2005	Siga (2005)
CZ	Single-layer anti-corrosive paint. Intended for the manufacture of single-layer exterior coating of metal and galvanised surfaces, exposed to direct weather. The company has claimed during consultation that SCCPs is not of relevance to its products.	<3	Dec 2008	Martina (2010); Teluria (2008)
CZ	Dispersion of pigments and fillers in a solution of chlorinated rubber and synthetic resins in organic solvents. Used for concrete pools.	12.5-13	Jun 2009	Colorlak (2009); Colorlak (2008)
CZ	Polymer-based primer designed for basic coating of metal surfaces. This coating system is resistant to aggressive chemicals (alkaline, acid), and weather. The product was tested for direct contact with potable water under Reg. No 37/2001 Coll. and Reg. No. 376/2000 Coll., in accordance with Act No. 258/2000 Coll. It was found that it meets the requirements cited in the Order of monitored parameters for short-term direct contact with drinking water and requirements for contact with cold and hot potable water.	<2.5	Jul 2008	Colorlak (2008b); Colorlak (2008c)
NL	Water borne micaceous iron oxide pigmented acrylic primer. Particularly suitable when solvents are not permitted because of health and safety reasons and developed to give excellent adhesion to galvanised steel (sweep blasted or otherwise roughened). Can be overcoated with water-based acrylics, water-based epoxy coatings and alkyd paints as well as certain solvent based two component products. It contains non-toxic anticorrosive pigments.	2.5-10	Jul 2004	Sigma (2007); Sigma (2004)
PT	Paint for interior and exterior applications, resistant to alkalis and the development of fungi.	<0.1	May 2007	Neuce (2007)
PT	Treatment for plaster walls, stone or concrete to reduce the development and efflorescence of saltpetre.	<0.025	May 2007	Neuce (2007b)
ES*	Industrial coating. The company has advised that SCCPs are not used any more in this formulation.	<2.5	Mar 2008	Jotun (2008)
ES	Decorative paint for professional use.	2.5-10	Feb 2009	Hepym (2009)

Table 3.10: Examples of SCCP-containing Paint and Coating Formulations and Description of Properties and Uses

Country	Product description	SCCPs content %	Date on SDS	Source
UK*	Primer for use on porous substrates prior to the application of specified polysulphide products. These polysulphide products may be used in: • expansion joints in brickwork and blockwork; • for the perimeter sealing of timber frames and where overpainting of sealant is required; • for structural joints in heavy cladding; • for sealing joints in flat roofs, heavily trafficked floor joints, structural joints in swimming pools (tanks and surrounds); and • for water retaining (non drinking water) and sewerage structures where bio-degradation resistance is required (resistant to most alkalis and dilute acids, petrol, diesel or jet fuel and many solvents and vegetable oils). The company has advised us that they no longer use SCCPs in any of their products. In light of the classification as carcinogen and the requirement to restrict/eliminate their use, the company switched to C_{14-17} chlorinated paraffins more than one year ago.	10-30	Jan 2008	Adshead Ratcliffe (2009); Adshead Ratcliffe (2008)
UK	Unsaturated polyester resin – used in the production of fibre reinforced composites.	5	Oct 2006	Cray Valley (2006)
UK	A white emulsion, with a paint-like odour, applied as a spray. It is used to provide Class 1 or Class 0 fire protection on internal timbers or timber-based boards. When dry, this intumescent surface coating will give a high-density matt finish. When exposed to fire the product instantly reacts to form a dense insulating barrier which minimises heat transfer delaying ignition of the base material and impeding the spread of the fire.	2.5-10	Jun 2009	Decorate4Less (2010); Rentokil (2009)
UK	Non-toxic water based thixotropic intumescent coating, which, in a fire reacts at 250ºC-350ºC, and expands, insulating the structure from intense heat. Intended for use as a intumescent coating for ferrous substrates.	5-10	Mar 2008	Bollom Fire Protection (2008): Bollom Fire Protection (undated)
UK*	Plastisol screen printing inks for textiles. The company that uses these products has indicated that they used to sell these inks (they have now been replaced) to textile print shops. The company was supplied these products from a UK manufacturer. The manufacturer has indicated that these products are no longer made and have been replaced by SCCP-free formulations.	10-25	Nov 2003	Clubshop (2003); Clubshop (2003b)

** An asterisk indicates a product which has been confirmed to have now been discontinued.*

Information from Consultation

The following table displays the numbers of companies in the paint and coatings sector that were contacted in the course of this SEA.

Table 3.11: Numbers and Locations of Companies Contacted in the EU Paint Manufacture Sector

Country	Number	Country	Number	Country	Number	Country	Number
Austria	1	Denmark	6	Ireland	1	Portugal	8
Belgium	2	Greece	2	Italy	9	Sweden	2
Switzerland	1	Spain	8	Latvia	1	Slovenia	1
Cyprus	2	Finland	1	Netherlands	10	UK	26
Czech Rep.	3	France	4	Norway	2		
Germany	7	Hungary	1	Poland	2		

We also contacted the main EU trade association, Paints, Printing Inks and Artists' Colours in Europe (CEPE). The association suggested that the use of SCCPs in this area will have now decreased further since SCCPs were proposed as a PBT substance. Therefore CEPE considered that there is now little or no use of SCCPs in paints and coatings in the EU. The association believes that there is no need to do more work on the use of SCCP in paints (as this use is not relevant for its members) and, if there were some use, it would be extremely marginal.

At the same time, the Spanish Asociacion Española de Fabricantes de Pinturas y Tintas de Imprimir which is a member of the EU body forwarded to us an anonymous completed questionnaire from a paints manufacturer that uses SCCPs. The details of this response are provided further below.

Further communication was established with the Association of Paint Manufacturers of the Czech Republic. The Czech association indicated that it has dealt with the SCCPs issue for a number of years. Members of the association had considered the inclusion of SCCPs into Annex I of the POPs Protocol and the majority of them concluded that, in the majority of instances, SCCPs can be substituted with some types of MCCPs, which have a more favourable classification and which are generally produced in higher volumes. Following the inclusion of SCCPs among POPs, the process of their registration and authorisation becomes very demanding and the cost of such a process will have an impact on the production costs of companies.

Almost all Czech paint manufacturers which in the past have used SCCPs (in the manufacture of chlor-rubber, polymer and acrylate coatings) are researching into alternatives or have already substituted SCCPs with alternatives (including with MCCPs). This corresponds with the approach taken by the Slovak manufacturer of chlorinated paraffins which has traditionally been an important supplier of these substances to Czech paint manufacturers.

In total, 32 companies responded to our consultation, the majority of which indicated that SCCPs are no longer or had never been used. Notable responses from individual companies include the following:

- **Paint Company 1** indicated that they are currently using SCCPs but alternatives are available. No further information has been provided although judging from the profile of the company's products; it is believed that SCCPs is used in intumescent coatings[6]. We have identified a patent submitted by this company in the early 2000s in which chlorinated paraffins are used as a plasticiser in an aqueous acrylic vinyl acetate copolymer for an intumescent coating to be used in fire doors and fire panels[7];

- **Paint Company 2** does not use chlorinated solvents or chlorinated paraffins. In its home country (Austria), use of chlorinated hydrocarbon compounds for road marking products is prohibited by law since 1995;

- **Paint Company 3** used SCCPs in the past as plasticisers but these have been replaced with MCCPs;

- **Paint Company 4** has indicated that they used a considerable quantity of SCCPs per year which in 2009 (with a higher tonnage back 2008 and an even higher one back in 2006). The company started using SCCPs in 1984 when SCCPs replaced PCBs. Almost all of the produced paint formulations are sold domestically; a very small fraction is sold to one other EU countries. In summary, the company's products include:
  - chlor-rubber chemical resistant clear varnish - interior coating for concrete and metal facades exposed to humidity and acidic and alkali vapours; does not protect against organic solvents, fatty acids and compounds which contain them, and temperatures above 40°C. SCCP concentration: 12.5-15%;
  - synthetic anti-corrosion white base coat (in five colours) - anticorrosion base coat for steel, aluminium, and their alloys for interior and exterior use. SCCP concentration: 0-1%;

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6 Intumescent paints, the chemical-physical defence mechanism of which is triggered by fire itself, are one of the most efficient system for fire-protection of building materials such as steel, wood, masonry, reinforced and pre-stressed concrete, because of their appearance, weight, size, easy maintenance and repair. As a result of their characteristics and performance, intumescent paints offer an effective technical solution for modern and correct anti-fire prevention engineering (Amonn, 2010). With intumescent coatings, in the event of a fire, once the temperature at the door surface rises to above the service temperature of the coating, the coating will intumesce to create an effective barrier to the passage of fire, heat and smoke. Literature suggests that additives with intumescent properties may include ammonium polyphosphate, melamine and pentaerythritol system. Intumescent coatings can swell up by a factor of 100 on heating (from 1mm to 10 cm thick foam) (Perstorp, undated).

7 Another product that contains chlorinated paraffins is available in Perstorp (undated). A solvent-based intumescent paint contains chlorinated paraffins (MCCPs and chlorinated paraffin wax, presumably LCCPs in concentrations of 2.7% and 5.8%), again probably as a plasticiser. However, it may be possible that chlorinated paraffins are used as a gas source alongside melamine, ammonium polyphosphate, tris-(hydroxyethyl) isocyanurate or even the resin binder itself (Leigh's Paints, 2007).

- synthetic single layer paint (transparent and in white) - universally applicable coating for single coatings of metal for interior or exterior use, durable and used on structures, containers, and other industrial metal objects (industrial halls, machinery, piping) where high corrosion is not expected and where high speed of drying is needed. SCCP concentration: 3.5-4%;
- chlor-rubber paint for coating concrete pools (in two colours) - coating of pools and water tanks, protects concrete or metal from impact of water, chemicals and detergents. SCCP concentration: 8-10%;
- chlor-rubber chemical resistant top coat (in eleven colours) - for coating of surfaces exposed to chemicals, water and normal detergents, does not protect against organic solvents, fatty acids and compounds which contain them; suitable for concrete floors, plastered walls, wood, metals; must not be permanently exposed to temperatures above 40°C. SCCP concentration: 10-15%;
- polymer base coat - base coat for metal objects which will have topcoat shown below applied and which will be exposed to aggressive chemical environments. SCCP concentration: <2.5%;
- polymer top coat (in two colours) - base coat for metal objects which will have above base coat applied or for porous bases, such as concrete (examples that have been offered include use on stainless steel surfaces (say, containers) of articles used in areas of handling raw rood (dough, meat) for short periods where the paint offers water-resistance, low releases and do not chip. For concrete applications, use in cellars and basements has been given as an example). SCCP concentration: 9-10%;
- acrylate road marking paint (two products each one in two colours) – aromatic and non-aromatic acrylate paints for road markings and other asphalt and concrete surfaces. SCCP concentration: <1%;
- tinting enamel semi-finished product (in two colours) – used in the manufacture of the chlor-rubber chemical resistant top coat shown above. SCCP concentration: 10-15%.

The company also manufactures an SCCP-containing polyurethane fire-retarding 2-pack sealant in light grey colour.

Not all of the above products are manufactured continuously; a small number are only made to order.

Among these products, the most important ones (from a tonnage perspective) appear to be white acrylic road marking paints (around half of the entire SCCP-related production) followed by chlor-rubber chemical resistant top coats, chlor-rubber paints for coating concrete pools, and quick-drying single layer paints. Only an estimated 1% of the company's production of SCCP-containing paints may have been used by private consumers.

It should be noted that SCCPs are used as plasticisers; flame retardancy is not a key feature. It is also worth noting that in the most important applications (from a tonnage perspective) SCCPs are used at a concentration of only <1%. There are a variety of users such as large construction companies, local authorities, highways agencies (those responsible for road maintenance). The key advantage of SCCPs is that they can help make the relevant formulations: (a) waterproof; (b) resistant to chemicals and oils; and (c) able to adhere well in mineral surfaces (concrete/road). For road markings, important properties are brightness, durability and the ability of the paint to fix on the surface.

SCCP-based paints form < 5% of the total production by volume or even less and SCCP-based products are not among their top sellers. The company has around 250 types of paints in their portfolio[8];

- **Paint Company 5** indicated that it uses SCCPs in road marking paints. Its consumption in 2009 was modest (much lower than the consumption of **Paint Company 4**). The decline is due to the fact that, in the last few years, many roads have been painted with water-based paints that do not contain chlorinated paraffins. However, the company has also noted that both in its domestic and some other EU road paint markets, there has been a trend towards decreasing paint prices. So while SCCPs have hardly been used to date, the need to make the paints cheaper i.e. more competitive has meant that paints with a higher proportion of styrene (i.e. cheaper) had to be used. Styrene makes paints more rigid and therefore increases their need to be plasticised. SCCPs are less costly compared to other major plasticisers such as phthalates.

  With regard to the company's products:

  - *SCCP presence*: SCCPs are used as a plasticiser at a concentration of 2-10% and have a chlorine content of 50-54%. Depending on the rigidity of the acrylic-styrene skeleton (amount of styrene, rigid acrylic polymers, etc.), the formulator may need to put more or less plasticiser. An average percentage for SCCPs could be 3-4%. Besides solvent-based paints of acrylic-styrene nature, SCCP are also used as plasticisers in cross-linkable polyester systems with peroxides for the production of long-term road markings;
  - *Relevant applications*: for road marking paints of an acrylic-styrene nature, the substrates are cement (<10%) and asphalt (> 90%). The end-users of road marking are normally the public administration, central government, autonomous communities and city halls, with only a small percentage (<20%) being private individuals. The road marking paint is atomised by air pressure. On the other hand, long-term cross-linkable polyester systems are used in road markings for cities, roads, motorways and dual carriageways;
  - *Importance of products for the company's portfolio*: the company makes four types of paint and each comes in six different colours. This represents around 60% of its total paint production; and

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8 This is in line with the findings of the BCF survey in the UK in 1999. The survey had found that paints containing chlorinated paraffins made up only a very small proportion of the total paint manufactured at any one site (typically <1-2% of the total, up to 5% in some cases) (Environment Agency for England and Wales, 2007).

- *Supply chain*: the company estimates that it has four downstream users located in its own country and 50 end-users of its road marking products located in its country and a neighbouring EU Member State. It is estimated that the company holds the 3rd or 4th position in the domestic road marking market.

3.5.2 Locations of use of SCCPs

Direct consultation with manufacturers of paints has confirmed the use of SCCPs in the manufacture of coatings and paints in the Czech Republic, Spain and the UK. Consultation with distributors has confirmed the use of SCCPs in paint manufacture in France and Slovenia.

The key applications appear to be road marking paints, industry protective (anti-corrosion) coatings, swimming pool coatings and intumescent fire protection coatings. Only a few relevant Safety Data Sheets that might suggest that SCCPs may still be in use were identified for companies located in countries such as the Netherlands and Portugal (in the latter case, SCCPs may only be present as an impurity in MCCPs).

Past use of SCCPs in paint manufacture has been confirmed through consultation with Member States in the UK with an estimated 50 tonnes being used in 2005. According to the Finnish National Product Register, there was a product (manufactured by a Finnish paint manufacturer) for road marking in 2001. However, this should not be on the market (or contain SCCP) any more according to the manufacturer's notification.

3.5.3 Size of the EU paints industry

CEPE brings approximately 85% of this industry together in its membership. Together this represents a value of around €17 billion. In total 120,000 people are directly employed in this industry. The people that apply the products of this industry are a multiple of this number (CEPE, 2010). There are around 2.5 million professional painters in the EU (HSE, 2008).

The total paint market in Western Europe in 2006 was estimated at 6.67 million metric tons, which corresponded to average growth of 0.7% per year over the previous three years. Future growth expectations for the market were stronger, with optimistic industry estimates of growth being about 2.4% per year, which would place the market at 7.53 million metric tonnes by 2011 (Finishing Today, 2007). BASF (undated) suggests that the total European market in 2006 amounted to 9.1 million tonnes.

However, the demand for paint and printing inks follows the waves of the economic activity. The paint and the printing ink industries in the European Union saw in 2009 one of the severest drops in demand since many years and European coating manufacturers reported double digit drops. Industrial coatings, which went down between 15 and 25%, were already severely affected in 2009, whereas automotive coatings were harshly hit with a drop as high as 30%. The difficult development in 2009 reflects in the figures reported by industry (European Coatings, 2009). However, Cefic hopes for a year-on-year production growth for the European chemical industry of 9.5 % for 2010 and 2 % in 2011 (European Coatings, 2010).

If we assume the 2006 figure of 9.1 million metric tons and an annual increase of 2.5% for the years 2007 and 2008 followed by a 20% drop in 2009, the current size of the market would be around 7.6 million metric tons. With a present value of €17 billion, the average value of one tonne of paint would be €2,200.

3.5.4 Summary

Relevant applications: research and consultation indicates that SCCPs are generally used in chlor-rubber and acrylic protective coatings as well as in intumescent paints. Typical applications include road marking paints, anti-corrosive coatings for metal surfaces, swimming pool coatings, decorative paints for internal and external surfaces, and primers for polysulphide expansion joint sealants. SCCPs may also be used in cross-linkable polyester systems with peroxides for the production of long-term road markings and it may be found in unsaturated polyester resin which is used in the production of fibre reinforced composites.

SCCPs generally act as a plasticiser and they reduce the cost of the formulation by (partly) replacing primary plasticisers such as phthalates.

Concentration and chlorination: the concentration of SCCPs in paints and coatings vary. In intumescent coatings, it may range between 2.5% and 10%. In road marking paints it can be fairly low from <1% to 10% but typically towards the lower end of this scale. In anti-corrosive and protective coatings, SCCPs' concentration could be 10-15%. Only one consultation source has provided information on the chlorination levels of SCCPs; these seem to be 50% to 54%, although considerably higher levels are possible, especially for coatings for which water repellence or fire retardancy (e.g. intumescent paints) is important. Literature sources have mentioned higher chlorination levels which may reach 70%.

Numbers and locations of users: use has been confirmed in the Czech Republic, Spain and the UK. Indirect consultation with distributors has confirmed the use of SCCPs in paint manufacture in France and Slovenia. Use elsewhere in the EU is still possible. No indication is available on the number of users but the combined tonnage of the companies that we have consulted with account for a significant proportion of the assumed consumption of SCCPs in this sector.

Importance of SCCPs in the wider paints and coatings industry: assuming an SCCPs consumption of 101 tonnes per year (see **Table 3.4**) and a concentration in coatings and paints of 1-15%, a total tonnage of ca. 675-10,000 tonnes of finished products can be calculated. This tonnage is a very small fraction of the estimated EU market for paints of 7.6 million metric tons Therefore, SCCPs are of limited importance to the wider paints and coatings industry. However, this may not be true for all individual stakeholders; while one company with a significant consumption of SCCPs uses the substance in less than 5% of its production, another company we have consulted with uses SCCPs in road marking products that account for around 60% of its total paint production. A small number of companies we have contacted in the course of developing this SEA have argued that SCCPs are important in achieving the required plasticisation while keeping formulation costs low. It is clear however that SCCPs are not the 'best' plasticisers available (for instance, phthalates are much more effective plasticisers but also more costly); moreover, alternatives appear to be available. Thermoplastic paints are widely used in Western and Northern Europe and even companies such as **Paint Company 5**, who support the continued use of SCCPs in road marking paints, agree that in recent years water-based paints that do not contain chlorinated paraffins find increasing use. Therefore, on the basis of available information, the loss of SCCPs would result in an increase in the cost of raw materials but their use in road marking paint cannot be considered to be critical.

3.6 Use of SCCPs in textiles

3.6.1 Uses of SCCPs in textiles

Information from past studies

According to the Environment Agency for England and Wales (2007), SCCPs are mainly used as a flame retardant for backcoating of textiles. A very small amount also appears to be used for waterproofing textiles. The EU Risk Assessment Report had indicated that SCCPs with high chlorine contents had been used in the production of flame-retarding, water repelling and rot-preventing textile finishes. The major historic use of chlorinated paraffins was in military tents but according to the Report this use no longer occurs in the EU (ECHA, 2008).

The actual types of textiles for which short-chain chlorinated paraffins are used as a flame retardant were unclear in past studies. However, based on a comparison with the known usage of other flame retardants that are used in the backcoating of textiles (for example decabromodiphenyl ether (decaBDE) and hexabromocyclododecane (HBCDD), it has been considered likely that they may find application in textiles for furniture upholstery, seating upholstery in transport applications, and interior textiles such as blinds and curtains. The EU Risk Assessment Report also indicates that there may also have been a use of SCCPs in industrial protective clothing (ECHA, 2008).

In the backcoating process, the SCCP is applied to the back of the textile in a viscous polymer latex, which is then cured (usually by heating to 130-140°C for a few seconds to drive off water). Once cured the SCCP is effectively physically incorporated in a polymer matrix on the back of the textile.

ECHA (2008) refers to earlier studies which reported that there were three to four major compounders (formulators) of textile backcoatings within the UK along with three or four smaller ones. There were also thought to be two major formulators in Germany and three or four other formulators that imported into the UK (giving the total number of formulation sites as up to 14). The same source also gives some information on the number of sites that apply backcoatings to textiles. There were thought to be four large contract coating sites and six smaller ones, along with two in-house weaver/coaters, in the UK and between 20- 30 others dealing with flame retardant coatings in the rest of the EU (giving the total number of textile backcoating sites as up to 42). It should be noted that not all of these sites would use SCCPs and so the number of formulation site and backcoating sites currently using SCCPs will be smaller than indicated above.

Information from consultation

The following table displays the numbers of companies contacted in the field of textile finishing.

Table 3.12: Numbers and Locations of Companies Contacted in the EU Textile Finishing Sector

Country	Number of companies	Country	Number of companies	Country	Number of companies
Austria	1	Greece	3	Poland	2
Belgium	11	Spain	4	Portugal	1
Switzerland	2	Finland	1	Sweden	1
Czech Rep.	6	France	7	UK	44
Germany	28	Italy	11		
Denmark	2	Netherlands	5		

Very limited information has been received from trade associations. The European Apparel and Textile Organisation[9] disseminated the study questionnaire but did not provide further information (it also did not receive any input from its members). The German association TEGEWA[10] confirmed that, in the textile field, SCCPs were used for flame retardant applications a long time ago (>10 years). By the time the restriction on metalworking fluids and leather fat liquors was published, German companies had already stopped the application in the textile field.

On the other hand, the Confederation of British Wool Textiles identified a relevant company which still uses SCCPs (this is further discussed below) and provided background information on the current uses of SCCPs. A UK textile finishing expert has advised that the textile finishing process which is of relevance to SCCPs has been called "dry proofing" in the UK. This entails the use of an emulsion, essentially without water, which is produced by melting a wax. Under the coating process, cotton textile was passed through a mixture at a temperature of 60°C – the right temperature was key in reducing viscosity to the desired level. The key advantage of this system was its very low price. In this application SCCPs, were in the past used alongside pentachlorophenyl laurate (LPCP) as a biocide. Tentage has been treated by impregnation i.e. dipping and squeezing through

9 The former European Textile Finishers Association (CRIET) now forms part of the European Apparel and Textile Organisation.

10 TEGEWA is the association of the German textile auxiliaries producers, leather auxiliaries producers, etc. About 30 member companies produce textile auxiliaries and a maximum of 10 companies are active in the flame retardant field.

a mangle to produce a controlled deposit on the fabric. This is not a coating process, as coating is generally a one-sided approach and not suitable for tent fabrics.

In the past (as far back as 50 years ago), SCCPs would normally be purchased as a commodity by the textile finishing companies and would be mixed in-house with Sb_2O_3 powder (to enhance the frame retarding properties of the mixture) and a biocide. Many companies would have used SCCP-containing mixtures but could remove these by specifying the chain length i.e. only using MCCPs. Only the UK used the hot-wax system known as dry proofing and here it has proven more difficult to replace the SCCP usage.

In the distant past, there was at least one major textile finishing company in each Western European country. Names have been provided of large companies that may have been using SCCPs in the past in Belgium, France, Germany and the UK. A Spanish company may also have been involved in such textile finishing. Gradually, companies abandoned SCCPs and it is now understood that only one company based in the UK uses the chemical for proofing of tents (potentially both commercial and military tents). It is also fair to assume that this hot-wax application of SCCP-containing emulsion has historically been prominent in the UK but not really elsewhere in the EU.

At present, it is suggested that tents is the only application of relevance to SCCPs. SCCPs are used for rot-flame-water proofing of heavy textiles (> 350 g/m^2 up to 750 g/m^2) which require specialist equipment for their processing. The types of fibres involved may be polyester-cotton, cotton or linen-flax.

Generally, the use of SCCPs declined due to the industry switching to PVC but that is now in decline and there is a shift back to traditional tentage. In recent years, a more popular finish for rot-flame-water proofing is based on a combination of MCCPs, decaBDE and biocide in a formulation based on aqueous dispersions and emulsions. It should be noted that tentage fabrics are generally very stiff and stitching them in a way that would allow waterproof joints is very difficult, hence, the textiles that are now used for tenting have changed. They tend to be lighter than in the past, mostly made of spun polyester-cotton which provides greater strength at lower weight. They also come in 'rip-stop' versions in which thick yarn is used every so often in the fabric to prevent the product from ripping apart under stress. Such products find applications both in the military but also commercially (marquees).

With regard to upholstery, it has been suggested that SCCPs are unlikely to find any use in the EU at present. It may be that cheaper products with some SCCP content are available but the change to avoid SCCP in emulsion products is easier i.e. the right grade of chlorinated paraffin with MCCP content. It should be considered that replacing SCCPs in upholstery back coating is no longer an issue, according to the expert.

Information collected from specific individual companies is limited and may be summarised as follows:

- **Textile Company 1** currently uses SCCPs in tentage impregnation. The company has declined to provide details of this use; it is understood that the company is in the process of replacing SCCPs but there may be issues of cost and practicality;

- **Textile Company 2** mainly coats upholstery fabrics for the UK market. Since 2006 (when they started compounding themselves), SCCPs or any other chlorinated paraffin has not been used;

- **Textile Company 3** abandoned SCCPs (which were previously used in textile coating) upon the amendment of its hazard classification by Directive 98/98/EC. It took the company 1-2 years to reformulate and switch to LCCPs and halogen-free flame-retardants. The company found at the time that higher amounts of bromine-containing flame retardants were required;

- **Textile Company 4** stopped using SCCPs 35 years ago due to environmental/human health concerns. The substance was used in flame retarding treatments of tent material. Initially, there were some impacts in the first few years due to demand for the flame retarded products from customers (generally based in the UK, due to the stricter fire safety regulations in the UK). Initially, SCCPs were not replaced by any particular alternative but later on were substituted with phosphorus/nitrogen compounds. The company has emphasised that the character of a SCCP-based product differs so much that it cannot really be compared to products based on phosphorus/nitrogen chemistry;

- **Textile Company 5** used SCCPs more than ten years ago probably on cotton and cotton blends for articles such as furnishings, workwear, etc.;

- **Textile Company 6** indicated that they have not used SCCPs for six or seven years. They were used at the time as flame retardant softening agents for the back coating of upholstery textile. They were applied by knife coating, foam generator or kiss roll. SCCPs were abandoned because they were under pressure for environmental protection reasons and because it was easy to replace them with MCCPs. LCCPs may also be used; and

- **Textile Company 7** confirmed that they used SCCPs in the past, but phased their use out because of several reasons such as incompatibility with their binder-systems and environmental issues.

It is also worth noting that a manufacturer of SCCPs has suggested that use of SCCPs in textile finishes still occurs and has indicated the use of the substance as a flame retardant for polyester resin back coating.

3.6.2 Locations of use of SCCPs

It appears that the UK has generally been at the epicentre of textile finishing with SCCPs in the past; not only through undertaking finishing in the country but also by requesting that SCCP-based coatings are applied on textiles outside the UK if those were intended to be used within the UK. We have confirmed the use of SCCPs in the UK where tentage rather than upholstery or industrial textiles (workwear) are treated with SCCP-based compounds. Another user is located in France (according to input made by a distributor) but we do not have information on the nature of their operations. Past users in countries such as Belgium, France, Germany and the Netherlands have apparently moved on to alternatives.

Consultation with the UK Member State authority confirms previous use of SCCPs in textile finishing (in the UK), with an estimated 50 tonnes being used in 2005.

3.6.3 Size of the EU textile finishing industry

Information from Eurostat (provided by the European Apparel and Textile Organisation) suggests that there are around 8,110 enterprises involved in textile finishing in the EU with total turnover of around €9 billion and employing around 100,000 workers.

3.6.4 Summary

Relevant applications: traditionally, SCCPs have been used as a flame retardant for backcoating of textiles and in the production of flame-retarding, water repelling and rot-preventing textile finishes. Typical applications potentially included furniture upholstery, seating upholstery in transport applications, and interior textiles such as blinds and curtains as well as industrial protective clothing. Consultation for this SEA suggests that use in the impregnation of commercial and military tents (to provide a flame-retardant, waterproof and rot-proof finish – 'dry proofing' of heavy textiles) is still ongoing. On the other hand, backcoating of upholstery or industrial textiles (workwear) is unlikely. The types of fibres still impregnated with SCCPs may be polyester-cotton, cotton or linen-flax.

Concentration and chlorination: we do not have information on the concentration of SCCPs in the compounds used on textiles. Environment Agency for England and Wales (2008) suggests a concentration of 4-15% while a UK textiles expert advises that the actual concentration is a commercial secret but it should be assumed to be quite considerable. Environment Agency for England and Wales (2007) also reports a chlorine contents of around 56-60% chlorine by weight for backcoating of textiles; no further information was made available through consultation.

Numbers and locations of users: the number of users is expected to be very small and there have been suggestions that only one major tent textile processor uses SCCPs in the UK. Another user is located in France (according to input made by a distributor) but we do not have information on the nature of their operations. Past users in countries such as Belgium, France, Germany and the Netherlands have apparently moved on to alternatives.

Importance of SCCPs in the wider textile finishing industry: given the very low consumption of SCCPs in the textiles sector, it is reasonable to assume that SCCPs are of limited importance to the wider textile finishing industry. Their potential loss could however cause problems of practicality and cost for the apparently few companies that still use them.

4. AVAILABILITY OF ALTERNATIVES

4.1 Available alternatives for manufacturers

If SCCPs were banned, the manufacturer(s) would be able to supply MCCPs and/or LCCPs as a replacement. However, there are alternatives sold by competitors (for example, manufacturers of brominated flame retardants and phthalate plasticiser). Therefore, chlorinated paraffin manufacturers would lose some business.

4.2 Available alternatives for distributors

There is a range of alternative substances for each of the key applications of SCCPs. It appears reasonable to expect that a distributor selling SCCPs may also be selling MCCPs/LCCPs made by the same or a different manufacturer. Therefore, for the relevant applications, it would be straightforward (but not necessarily without problems) to move their customers to alternative chlorinated paraffins.

4.3 Available alternatives for the rubber Industry

4.3.1 Information from literature and past studies

Alternatives for any rubber application

Several sources of information discuss the availability and technical suitability of alternatives to SCCPs for rubber formulations.

Dick (2001) suggests that the use of chlorine or bromine halogen sources to impart flame retardancy is well known in the elastomer industry. In the additive approach, a halogen source such as a chlorinate paraffin or decaBDE is added at the compounding stage. In the reactive approach, halogen is introduced to a polymer backbone, such as in polychloroprene (CR). Where the plasticising effect is important, chlorinated paraffins and phosphate esters can be used to replace more flammable plasticisers. Therefore, phosphate esters can be considered to be alternatives to SCCPs.

Dick (2001) also refers to the replacement of chlorinated paraffins in EPDM elastomer with alicyclic chlorinated compounds[11], decaBDE or ethylene, bis-tetrabromophthalimide as halogen sources, alongside diantimony trioxide. However, it is noted that these formulations have significant afterglow combustions in the fire safety UL 94 test. Zinc borate and phosphate esters can reduce the afterglow combustion.

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[11] One suggested is Dechlorane Plus (IUPAC name: 1,2,3,4,7,8,9,10,13,13,14,14-dodecachloro-1,4,4a,5,6,6a,7,10,10a,11,12,12a-dodecahydro-1,4,7,10-dimethanodibenzo[a,e]cyclooctene, EC Number: 236-948-9, CAS Number: 13560-89-9).

Substances that may be considered to be alternatives to SCCPs (phthalates and phosphates or decaBDE and other halogen sources) may indeed be used alongside SCCPs, as Dick (2001) describes for products such as SBR and nitrile rubber. It appears that SCCPs is added to reduce costs by partly replacing a range of other more costly additives (plasticisers and flame retardants).

Peter Fisk Associates (2003) discuss the availability of flame retardants in rubber formulations and suggest the following families:

- **inorganic flame retardants**: these include antimony trioxide and aluminium trihydroxide which are used at variable loadings (mostly 1-15%) alongside halogenated flame retardants in applications such as automotive, aerospace and railway applications, military face masks, gaskets/sealing rings, belts, etc.;

- **brominated flame retardants –** no further detail given; and

- **organophosphorus compounds –** no further detail given.

The OSPAR Commission (2006) refers to alternatives such as diantimony trioxide, aluminium hydroxide, synthetic and natural esters, calcium sulphonates, alkyl phosphate esters and sulphonated fatty acid esters.

BiPRO (2007) indicates that alternative flame retardant in rubber are diantimony trioxide, aluminium hydroxide, acrylic polymers and phosphate containing compounds. The report also discusses information from Eurochlor according to which end-users believed at the time that it would be difficult to substitute SCCPs, particularly in those applications where they are used as a flame retardant additive. In some cases, transition to MCCPs from SCCPs had already been possible. LCCPs are also reported as potential replacements for SCCPs in rubber.

ECHA (2008) mentions MCCPs and LCCPs as possible alternatives and it also notes that communication with producers of aryl phosphates, suggests that their products may be used in coal mine belting probably for PVC belts rather than rubber ones. ECHA notes that it is not clear if alternatives to SCCPs exist for underground mining conveyor belts but also points out that both MCCPs and LCCPs are used in rubber applications, and the amount of SCCPs used in this application has fallen in recent years. This therefore suggests that alternatives are available, at least in part, for this application. The following table summarises ECHA's comparison between SCCPs and selected alternatives in terms of availability, use pattern and performance.

Table 4.1: ECHA Comparison of Technical Characteristics of Alternatives to SCCPs in Rubber Applications			
Alternative	**Availability**	**Use pattern**	**Performance**
MCCPs	Commercially available	Similar to SCCPs	Technically viable alternative
LCCPs	Commercially available	Similar to SCCPs	Technically viable alternative
Cresyl diphenyl phosphate	Commercially available	Probable use in PVC rather than rubber	Currently used in PVC belting
Tertbutylphenyl diphenyl phosphate	Commercially available	Probable use in PVC rather than rubber	Currently used in PVC belting
Isopropylphenyl diphenyl phosphate	Commercially available	Probable use in PVC rather than rubber	Currently used in PVC belting
Source: ECHA (2008)			

HSE (2008) discusses alternatives to MCCPs which are also used in rubber formulations. The report suggests LCCPs as a potential alternative in some applications (e.g. profiles for fire-proof doors) but these may lead to a brittle end-product in certain conveyor belts. There were also concerns with approvals for fire resistance in bellows for buses/trains.

Alternatives specific to rubber conveyor belts

Goodyear Tire & Rubber Company (2007) describes the key differences between halogenated and halogen-free flame retardants for rubber (and plastic). Halogenated materials (chlorine or bromine based) are very effective for propagation resistance and have a lower cost than alternative materials. Halogen-free materials require higher levels to be effective for propagation and have a higher cost than halogenated materials – this depends on the type/level of flammability resistance required. However, halogen-free materials have a number of benefits such as (Goodyear Tire & Rubber Company, 2007):

- low smoke – improved visibility, less irritating, more time to escape, increases the time available to exit the fire area;

- low corrosivity – acid gases from halogens corrode and damage equipment during and after fire; and

- low toxicity – less harmful emissions, increases the time available to exit the fire area.

Information collected from consultation shows that SCCPs may be used in solid woven conveyor belts of the so-called PVG type which combine PVC, rubber and textile. These can be compared against PVC solid woven conveyor belts (i.e. belts with PVC covers) and inherently flame-retarded CR belts (i.e. those with polychloroprene rubber covers). Multi-ply belts can be very adequately flame-retarded with CP covers and CP interlayers.

The positive features of PVC solid woven conveyor belts include low elongation, high mechanical fastener retention, avoidance of ply separation and the possibility of using smaller pulley diameters. Disadvantageous, however, is their low wear-resistance and slippery surface. Rubber conveyor belt features include high wear resistance, high traction and poor sensitivity to temperature (Küsel, 2004). Thus the logical task was to combine the advantages of PVC and of rubber conveyor belts, in spite of their opposing characteristics. PVC is an amorphous thermoplastic made by polymerisation, linking the chains of the monomer vinyl chloride. Unlike rubber, PVC melts or flows when heated. Rubber can be stretched easily and is almost completely reversible, to high extensions. This is due to the irreversible process of vulcanisation, which crosslinks the molecules. To achieve this, the raw rubber is mechanically mixed with a number of compounding ingredients like fillers, anti-degradants, accelerators, etc., and then cured. The following table provides an overview of the key characteristics of the three types of underground mining conveyor belts discussed here.

Table 4.2: Comparison of Self-Extinguishing Textile Conveyor Belts

Property	**PVC solid woven**	**CR multi-ply**	**PVG solid woven***
Wear resistance	Poor	Good	Excellent
Robustness, impact and rip resistance	Good	Good	Excellent
Edge stability	Good	Poor	Excellent
Suitability for belt-to-belt drives	Poor	Excellent	Excellent
Suitability for man riding	Poor	Excellent	Excellent
Tracking stability	Good	Excellent	Excellent
Slope conveying	Poor	Excellent	Excellent
Cleanliness (carry-over)	Poor	Excellent	Excellent
Noise level	Poor	Excellent	Excellent
Elongation properties	Excellent	Good	Excellent

Source: Küsel (2007)
** this has been indicated by industry consultees to potentially contain SCCPs*

This analysis excludes flame-retarded belts such as those based on SBR (until recently used in the US but also in some European countries) or steel-cord belts. SBR belts would not meet the relevant fire safety requirements, especially under the new standard EN 14973:2006+A1:2008. Steel cord belts have a good range of characteristics such as the smallest elongation with long conveyor routes, high breaking strength with highest capacity, long working life with the lowest need for maintenance and are economical for use above and below ground (Phoenix Conveyor Belts, 2008). They do not show, however, the mechanical properties required to act as a replacement for PVG belts that may be retarded with SCCPs. Steel cord belts with CP covers have been suggested by a consultee as being easy to rip and cannot be joined with fasteners. Therefore, SBR belts or steel cord belts cannot realistically be considered to be potential alternatives to those belts currently containing SCCPs.

4.3.2 Information from consultation

Information on alternatives (mostly for rubber conveyor belt formulations) that has been collected from industry stakeholders in the course of this SEA has generally be of limited detail and can be summarised as follows:

- **Rubber Company 1** (conveyor belts) changed its rubber formulations containing SCCPs (one product only, exclusively used in underground mining) around six months ago and the company now uses MCCPs. The company apparently did not face any cost or technical implications from the switch to alternatives and has indicated that there will be no problem meeting the relevant safety standards;

- **Rubber Company 2** (conveyor belts) has confirmed that they are in the process of changing to longer-chain chlorinated paraffins;

- **Rubber Company 3** (conveyor belts) switched to LCCPs (solid paraffin waxes), aluminium hydroxide, and brominated products (in small quantities) in 1995;

- **Rubber Company 4** (conveyor belts) has been working with its suppliers for almost two years to develop an alternative which performs satisfactorily at a reasonable price. They sell only one product to customers in several European countries. No specific information was provided on the identity of alternative substances trialled but it was suggested that a positive result is expected by the end of 2010. The company confirmed that PVC covers could be an alternative but PVC has a number of disadvantages compared to rubber. CP covers without a flame retardant could also be considered to be an alternative. Only-PVC belts have worse ageing and mechanical properties: PVG belts last 50% longer than PVC belts for the same level of wear. At the same time, PVG belts are 10-30% more costly than PVC ones; and

- **Rubber Company 8** (other rubber products), a past user of SCCPs, replaced SCCPs with aluminium trihydroxide and magnesium hydroxide.

4.4 Available alternatives for the sealants/adhesives industry

4.4.1 Information from literature and past studies

There are several sources that provide information on alternatives to SCCPs (and chlorinated paraffins more generally) in sealant and adhesive formulations. A summary of the information available is given below.

Takahashi *et al* (1974) and Wahlström (undated) indicate that chlorinated paraffins and substances such as phthalic esters and phosphoric esters have been used as plasticisers for sealants.

Special Chem (2003) also notes that phthalate, phosphate, and glycolate esters have replaced PCBs as plasticiser in polysulphide sealants.

Wypych (2004) provides a list of frequently used plasticisers in polysulphide sealants, where these include:

- isooctyl benzyl phthalate – used at reported concentrations of 15-30% or 5-45% (according to different sources);
- benzyl butyl phthalate;
- alkyl sulphonic acid esters of phenol and/or cresol – used in the recycling of hardened adhesives and sealants;
- hydrogenated terphenyls – used in corrosion-inhibiting sealants; and
- 2,2,4-trimethyl-1,3-pentaniediol and 1-isobutyrate benzyl phthalate – at a concentration of >20%.

BiPRO (2007) also reports information from earlier studies which indicate MCCPs, LCCPs and phthalates as potential alternatives to SCCPs.

ECHA (2008) agrees that MCCPs and LCCPs may be used to provide flame retardant properties and phthalates may also be used as plasticisers. The report notes that a possible critical use of SCCPs is in dam sealants and it is not clear whether alternatives to SCCPs exist in this application. However, it notes, both MCCPs and LCCPs are used in sealant applications, and the amount of SCCPs used in this application has fallen in recent years. The report also refers to information from Environment Canada according to which technical barriers may exist for some potential (non-chlorinated paraffin) alternatives in that they may be more prone to bleeding from the sealant and hence may affect the durability of the formulations.

HSE (2008) mentions terphenyls (presumably of the hydrogenated type as the polychlorinated ones are restricted under Annex XVII of the REACH Regulation) as potential alternatives to MCCPs in polysulphide sealants with a per tonne price five times higher and an inferior performance.

Mittal & Pizzi (2009) confirm that polysulphide sealants were originally plasticised with PCBs. Chlorinated paraffins that replaced PCB were good performers and reasonably inexpensive. Alternatives to them include diisoundecyl phthalate (DIUP), polymeric plasticisers, certain phosphate plasticisers and butyl benzyl phthalate (BBP), although the last is reported to be less efficacious. Mittal & Pizzi (2009) confirm that the key problem with these alternative plasticisers is that they are more prone to bleeding from the sealant product, thus affecting both the sealant and the substrate.

With regard to acrylic polymers, Mittal & Pizzi (2009) mention the following as suitable plasticisers: benzyl butyl phthalate, dipropylene glycol benzoate, diethylene glycol dibenzoate, dipropylene glycol dibenzoate, propylene glycol alkyl phenyl ether and mixtures of these.

McBride (2010) indicates that butyl benzyl phthalate, di-2-ethylhexyl adipate and di-2-ethylhexyl phthalate are suitable plasticisers for polysulphides while dipropylene glycol dibenzoate is suitable for polyurethane formulations.

Apart from alternative plasticisers, there is also the possibility of using alternative sealant/adhesive formulations. The Swiss Federal Office for the Environment Substances, Soil and Biotechnology Division (2008) indicates that while SCCPs have been used in sealants based on polysulphide, polyurethane and butyl rubber, today silicone sealants have the highest market share. Plasticisers used in this type of sealants are polydimethylsiloxanes rather than SCCPs.

According to Special Chem (2003), in the early days of commercialisation, the polysulphides' most interesting property was their unusual inertness to solvents and hydrocarbon fuels in contrast to natural rubbers. They immediately found uses in automotive and aerospace applications because of this characteristic and are still used in these markets. Because of their cost and the development of competing products, the use of polysulphides has been somewhat restricted today to specialty sealants and insulating glass adhesives. **Table 4.3** shows the early markets for polysulphide adhesives and sealants and the products that provide competition.

Table 4.3: Major Applications of Polysulphide Adhesives and Sealants

Application	**Major characteristic**	**Competitive products**
Aircraft sealants for fuel tanks, and other applications	• Outstanding resistance to fuels • Good adhesion and weather and corrosion resistance	Fluorosilicone
Insulating glass (housing)	• Flexibility • Low permeability to moisture and gas • UV resistance	Hot melt butyl, silicone, and polyisobutylene
Automotive windshields	• Fast curing plus benefits for insulating glass (housing)	Urethane
Airport runway expansion joints	• Outstanding resistance to fuels • Good adhesion and weather resistance	Plasticised PVC hot melt
Building and construction (general)	• Good adhesion and flexibility • Fast curing	Urethane and silicone

Source: Special Chem (2003)

In recent years, silicone and urethane sealants have become significant competitors to polysulphide sealants in the building and construction markets. Special Chem (2003) compares polysulphide sealants to silicone and urethane ones. The results are shown in **Table 4.4**. A quick reading of the table would suggest that urethane sealants generally perform better than polysulphide ones (with the notable exception of the issue of bubbling). For silicones, the picture is mixed; silicones perform better in terms of recovery from stress, UV resistance, cure rate and low temperature gunability but appear to be worse in terms of paintability, colour availability, resistance to hydrolysis and availability of self-levelling formulations.

Table 4.4: Comparison of Properties of Polysulphide, Silicone, and Urethane Sealants			
Property	**Polysulphide**	**Silicone**	**Urethane**
Recovery from stress	-	++	++
Ultraviolet resistance	-	++	+
Cure rate	-	++	- to ++
Cure rate, two component	+	NA	++
Cure rate, latent hardener	NA	NA	++
Low temperature gunability	-	++	-
Tear resistance	-	-	++
Cost	-	-	++
Paintability	++	--	++
Available in colours	+	-	++
Unprimed adhesion to concrete	-	-	++
Resistance to hydrolysis	++	-	++
Non-bubbling	++	++	-
Self-levelling formulations available	++	-	++
Source: Special Chem (2003)			

4.4.2 Information from consultation

The following information has been collected from consultees during the preparation of this SEA:

- **Sealant Company 2** is aware of phthalates and benzoates. The former are good mostly for use in polyurethane sealants. The latter are probably good replacements. The company has already asked its suppliers for additional information on alternatives. The company notes that chlorinated paraffins have a long history and formulators know what they are good or bad at doing. For other alternatives, new expertise would be needed. As the relevant markets are large, a gradual move from SCCPs to MCCPs is believed to make most sense. MCCPs have a similar cost to SCCPs but may not perform as well as SCCPs, therefore reformulation would be necessary. The company does not consider the continued use of SCCPs as being critical to its business;

- **Sealant Company 3** has a relevant product which was identified on its Internet site. Communication with the company suggests that this product has not been manufactured for more than six years. It was replaced with silicones; these were considered to be a better product at a better price and having a better health and safety profile; and

- **Sealant Company 4** has replaced SCCPs with chlorinated paraffins with 23-carbon atom chain length.

4.5 Available alternatives for the paints and coatings industry

4.5.1 Information from literature and past studies

Peter Fisk Associates (2003) provides some discussion on suitable flame retardants for coatings. The key categories identified in their report include:

- **inorganic flame retardants**: these may include ammonium polyphosphate in conjunction with melamine in intumescent paint formulations;
- **brominated flame retardants**: these may include hexabromocyclododecane and 1,2-Bis(2,4,6-tribromophenoxy)ethane which are used in conjunction with diantimony trioxide in paints, lacquers and varnishes;
- **organophosphorus compounds**: used at a typical concentration of 7% in intumescent coatings, latex paints, lacquers and varnishes;
- **halogenated phosphorus compounds**: used at a typical concentration of 5-12% in intumescent coatings, latex paints, lacquers and varnishes; and
- **nitrogen-based compounds**: such as melamine derivatives used in intumescent coatings.

BiPRO (2007) refers to MCCPs as a potential alternative to SCCPs in coatings and paints, while also referencing previous studies which identify LCCPs as a potentially suitable alternative. Other alternatives proposed include plasticisers such as phthalate esters, polyacrylic esters, diisobutyrate as well as flame retardants such as phosphate and boron containing compounds (the latter for applications where flame retardancy is important).

ECHA (2008) also suggests that MCCPs and LCCPs are possible alternatives and refers to the other substances mentioned by BiPRO (2007). ECHA notes that the technical and economic feasibility of some of these suggested alternatives is unclear.

4.5.2 Information from consultation

Information has generally been collected for three general areas of use: intumescent paints, road marking paints and other paints.

For intumescent paints, the following information is available:

- **Paint Company 1** has suggested that SCCPs may still be used but suitable alternatives are available (without specifying what these are); and

- **Paint Company 6** is a manufacturer of intumescent paints and has suggested several potential alternatives: organic polyalcohols, amines, acids and ester derivates; inorganic salts based on phosphorous, boron, silicon and sulphur derivates.

For road marking paints, the following information is available:

- **Paint Company 4** has suggested MCCPs as a potential alternative but has not explored this in great detail yet, neither does it know what the likely cost implications might be. A concern was however expressed with regard to the higher viscosity of MCCPs compared to SCCPs;

- **Paint Company 5** has suggested that some alternatives are available but their suitability may not be proven before 2015 – the company does not think the markets can change as rapidly so as to replace the current products before that date. The company has mentioned phthalates (dioctyl phthalate, dicyclohexyl phthalate) as possible alternatives but with a very high cost which would be used at concentrations similar to those of SCCPs. The cost of paints manufactured with phthalates could be somewhat controlled by using smaller amounts of styrene in the resin and additional long chain acrylic polymers (to ensure 'internal' plasticisation), but the final cost would still be higher. The company has not yet investigated alternatives in detail as it has not considered necessary to modify something that has been working well and is more economical.

  For cross-linkable polyester systems with peroxides for the production of long-term road markings, the company has argued that finding alternatives would be more difficult than in the case of solvent-based paints; and

- **Paint Company 7**, based in Northern Europe, has noted that in their country road marking paints are not used. Instead thermoplastics are used because they are more hardwearing: they can last for 4 years, while road marking paints may need remarking after only one year.

The UK Highways Agency has also noted that due to the climatic conditions in the British Isles, most road markings in the UK are thermoplastic rather than paint based markings. The drying time for most paints is longer in the UK due to lower temperatures - for most of the year one cannot lay legacy paint markings overnight and have them dry enough to open the road the next day. Most of Scandinavia uses thermoplastic markings rather than paints. The British Standards Institute has also advised us that not many paints are used for road use in the UK as the high traffic volumes require more durable products such as thermoplastics, methyl methacrylate and 2-part hardened products. Paints would more generally be used for low traffic areas as car parks and airports.

Finally, the French Laboratoire Central des Ponts et Chaussées contacted several French road marking paint manufacturers concerning their potential use of SCCPs. They indicated that they were not concerned with the issue of SCCPs as those using chlorinated paraffin plasticisers have already opted for longer-chain molecules.

For other types of paints, we have collected the following information:

- **Paint Company 4** noted that MCCPs could be used but they are more viscous and the company would need to add solvents to make the end product less viscous. Solvents that could be used include ethanol, solvent naphtha, butyl acetate, white spirit. These are not particularly expensive but meeting the existing VOC limits could become an issue, especially for decorative paints;

- **Paint Company 8** has not used SCCPs since 2001, when they were replaced by longer-chain chlorinated paraffins. The relevant products were acrylic solvent borne paints used for masonry only sold domestically. The company discontinued the use of SCCPs because of forthcoming regulation and because the product was stopped by its then suppliers. It took only a few months for the company to reformulate its paint products with MCCPs and LCCPs. The price of alternatives was almost the same as SCCPs, perhaps marginally more costly. The company does not recall encountering any technical problems with the reformulated products, neither did it receive any negative feedback from its customers;

- **Paint Company 9** has, on average, used 300 kg per annum of chlorinated plasticisers (C_{22-30} chain length) over the last five years. The company emphasised that the importance of using purely chlorinated plasticisers is debatable, when the plasticising effect is more important than fire retardant properties. The company believes that it is possible to substitute chlorinated plasticisers with citrate and/or phthalate plasticisers; and

- **Paint Company 3** has noted that MCCPs is an alternative frequently used. SCCPs have a higher tendency to migrate and evaporate from the film than MCCPs and LCCPs, because of their lower molecular weight. Other alternatives include phthalate ester plasticisers. Compared to them, the alkali resistance and also water resistance of chlorinated paraffins is higher.

4.6 Available alternatives for the textiles industry

4.6.1 Information from past studies

Peter Fisk Associates (2003) generally discuss flame retardants for textiles. The key categories identified in their report include:

- **inorganic flame retardants**: they include antimony trioxide which are used at variable loadings (8-10%, 15-20%, 20-30%) alongside halogenated flame retardants on textiles such as wool, cotton, polyester, and polyamide fibres and their blends, for e.g. upholstery fabrics and roof insulating fabric;

- **brominated flame retardants**: they include decaBDE, hexabromocyclododecane (HBCDD) and 1,2-bis(2,4,6-tribromophenoxy)ethane which are used at variable loadings (5-10%, 10-15%) alongside antimony trioxide on textiles such as polyester and cellulosic fibres, modacrylic fibres, nonwovens for drapery, upholstery and clothing, and textile coatings;

- **organophosphorus compounds**: they include tris(isopropylphenyl)phosphate which is used at a 7% loading on textiles such as cellulosic, nylon and polyester fibres, for e.g. upholstery fabric, garments and flexible ducting;

- **halogenated phosphorus compounds**: these can be used at a loading of 5-12% on textiles for car, rail and aircraft furnishing trim; and

- **nitrogen-based compounds** – no additional information on these is given.

BiPRO (2007) suggests that antimony trioxide, aluminium hydroxide, acrylic polymers and phosphate containing compounds could be used as alternative flame retardants in textiles (and also in rubber and PVC). ECHA (2008) summarises the potential alternatives to SCCPs to those presented by Peter Fisk Associates, i.e.:

- MCCPs;
- LCCPs;
- decaBDE (with antimony trioxide);
- HCBDD (with antimony trioxide); and
- ethane, 1 ,2-bis(pentabromophenyl)

The three brominated substances named above are those among a list of brominated substances most typically used for textiles back coating, hence ECHA suggests that they might be considered the most likely candidates. We have discussed already, however, the difference between back coating and impregnation of tentage.

From a technical perspective, ECHA (2008) provides the following assessment of the alternatives in comparison to SCCPs.

Table 4.5: ECHA Comparison of Technical Characteristics of Alternatives to SCCPs in Textile Applications

Alternative	Availability	Use pattern	Performance
MCCPs	Commercially available	Similar to SCCPs, possible higher use rate	Technically viable alternative, less volatile than SCCPs
LCCPs	Commercially available	Similar to SCCPs	Technically viable alternative, less volatile than SCCPs
DecaBDE	Commercially available	25% by weight (in conjunction with ATO)	Technically viable alternative
HBCDD	Commercially available	25% by weight (in conjunction with ATO)	Technically viable alternative
Ethane, 1-2 bis(pentabromophenyl)	Commercially available	Typical loading 10- 30 g/m^2	Technically viable alternative

Source: ECHA (2008)

4.6.2 Information from consultation

Some information on alternatives has been provided by certain consultees:

- **Textile Company 3** replaced SCCPs in 1999 after efforts of 1-2 years. The alternatives chosen were LCCPs, brominated and halogen-free flame retardants. The company found that higher amounts of bromine-containing flame-retardants were required;

- **Textile Company 4** replaced SCCPs with phosphorus/nitrogen substances in flame-retardant formulations for tents. Replacement took place many years ago; and

- **Textile Company 6** replaced SCCPs six or seven years ago with MCCPs. LCCPs may also be used but the most widely used alternative at the moment is MCCPs because they are more efficient and more economical.

5. RESTRICTION SCENARIO

5.1 Definition of the "proposed restriction" scenario

For this study, three main policy options are considered in the context of implementing restrictions; these are:

- ***Option 0 – Do Nothing Option***: this is the baseline situation and includes not only the current situation across the EU, but also potential future trends resulting from the potential impact of the existing REACH Regulation on the continued production, marketing and use of SCCPs;

- ***Option 1 – UN ECE restriction***: UN ECE restriction on the manufacture, marketing and use of SCCPs, with exemptions for conveyor belts and dam sealants. One sub-option is considered briefly (and qualitatively) under this:
  - ***Option 1a – UN ECE restriction with a limit on the chlorination levels***: as for Option 1 with the addition of a limit on the chlorination level of SCCPs that may still be used in the two exempted applications (conveyor belts and dam sealants); and

- ***Option 2 – UN ECE restriction without exempt applications***: total restrictions on the production, marketing and use of SCCPs (with no exemptions). This would also reflect the fact that the replacement of SCCPs will be required for the above two exemptions once suitable alternatives become available.

5.2 Time and geographical boundaries of the SEA

This SEA focuses on the current use of SCCPs in the EU-27. With regard to time boundaries, we will consider that a reasonable time boundary would be the year **2015** when the first report of Parties to the LRTAP Convention would be required under the ban agreed by UN ECE. We assume that within this period of five years, alternatives will be developed and any substitution costs would be absorbed by industry stakeholders.

6. ASSESSMENT OF IMPACTS

6.1 Key assumptions and information used in the assessment of impacts

6.1.1 Current cost of SCCPs

It has not been possible to identify the current price per tonne for SCCPs or other chlorinated paraffins. Information on previous prices is, however, provided in literature:

- in 1997, RPA prepared a risk reduction strategy on the use of SCCPs in leather (RPA, 1997). In this report, it was indicated that the price of SCCPs was £1,000 per tonne. At the £/€ exchange rate existing in 1998, this would equate to around €1,400 per tonne;

- in 2001, RPA undertook a study to assess the UK cost of marketing and use restriction for SCCPs (RPA, 2001). In this report, it was calculated that the price of SCCPs was £470 per tonne (on the basis of the then size of the UK market for SCCPs). Information from consultation for that study indicated prices ranging from £500 to £700 per tonne and an average price of £600 per tonne was used in the study. At the £/€ exchange rate existing in 2001, this would equate to €960 per tonne;

- in 2008, HSE (2008) indicated a price for MCCPs of around €500 per tonne with a cost of LCCPs 20%-160% higher than that of MCCPs, i.e. €600-€1,300. ECHA (2008) describes the cost of MCCPs as similar to that of SCCPs. A current user of SCCPs has also confirmed that the price of MCCPs is similar to that of SCCPs (although this user may be getting favourable prices due to the significant amounts of SCCPs being purchased); and

- BiPRO (2007) notes that for manufacturers of chlorinated paraffins, the unit cost of MCCPs is lower by around 25% per tonne compared to SCCPs.

Overall, it can be seen that the trend in price per tonne of SCCPs has been clearly declining over the last 15 years. While ECHA (2008) suggests that SCCPs and MCCPs have a similar price at around €500/tonne, consultation undertaken for this study indicates that due to the shrinking market for SCCPs, their price has increased in recent years. It is also worth remembering that the production of chlorinated paraffins is based on paraffin fractions and their prices fluctuate with the price of oil (Yan, 2008).

On the basis of the above, we will assume that:

- the current price of SCCPs is **€600/tonne** (€100 higher than MCCPs and reflecting the fact that their diminishing availability may have made some users to turn to non-EU (Asian) suppliers);

- the current price of MCCPs is **€500/tonne** (at the same level as indicated in HSE (2008) and perhaps, reflecting the price gains from greater quantities being produced); and

- the current price of LCCPs is **€1,000/tonne** (approximately the average price within the range of €600-1300 given above).

6.1.2 Key assumptions

Overview

Due to the absence of specific information, a number of assumptions have been made throughout this document. These assumptions relate to the current situation of the market and therefore, the baseline situation and form the basis on which the impacts of restrictions on different stakeholders are assessed. The most important ones can be summarised by category below.

Assumptions relating to SCCPs manufacturers

For the SCCP manufacturers, it is assumed that:

- 75-90% of the tonnage sold to the rubber sector is associated with underground mining conveyor belts and 5-20% of the tonnage sold to the sealants industry is associated with dam sealants (where mining conveyor belts and dam sealants are exempted uses). The tonnages relating to the exempt uses are: 122-146 for conveyor belting and 12-47 tonnes for dam sealants, i.e. a total range of 134-193 tonnes. Therefore, there will be a need to replace 337-396 tonnes of SCCPs out of the 530 tonnes currently used in the EU;

- manufacturers of SCCPs will be able to replace a significant proportion of the tonnage of SCCPs currently sold in the EU with manufacture and sales of MCCPs and LCCPs. We assume this proportion will be between 50% and 75%. Conservative worst-case scenarios whereby SCCP manufacturers are <u>not able</u> to replace any (0%) or are able to replace all (100%) of their current manufacture and sales are also considered;

- the use of MCCPs (as compared to LCCPs) as a replacement for SCCPs would be more widespread and would account for 75% of the SCCP tonnage replaced. Conservative worst-case scenarios in which there is a full replacement using only MCCPs or only LCCPs are also considered;

- due to their lower chlorine content, MCCPs would require a 10% additional loading to ensure equivalent flame retardancy with SCCPs. This is based on ECHA (2008). A similar assumption is not made for LCCPs because LCCPs may reach the chlorination levels of SCCPs;

With regard to SCCPs **consumption** by various industry sectors, it is assumed that:

- according to the data provided by Eurochlor (see Section 3.2), in 2009, the most prominent use of SCCPs in the EU was in paints, sealants and adhesives. Within this category, paints are assumed to represent 30% of the consumption tonnage with sealants and adhesives representing the remaining 70%;

- also in 2009, the next most important application was as a flame retardant in textiles and rubber. Within this category, rubber is assumed to represent 85% of the total and the remainder 15% is used in textiles;

- the amount of SCCPs sold by EU-based distributors (assumed to be 100 tonnes per year) is allocated proportionately among the four key industry sectors after half of it is sold to non-EU customers.

Assumptions relating to the rubber industry

For the rubber industry, it is assumed that:

- the concentration of SCCPs in rubber for conveyor belts may be up to 10% by weight and the rubber element may consist 20-33% of the end product by weight;

- the concentration of SCCPs in rubber products other than conveyor belts is 10-17%;

- of the total tonnage of SCCPs used by the rubber industry, 75-90% is used in the manufacture of conveyor belts with the remainder used in other rubber products;

- there are no more than three conveyor belt users of SCCPs and up to ten companies using SCCPs in rubber products other than conveyor belts which will undertake research and development (R&D) work on alternatives. We assume that two of the three conveyor belt manufacturers have completed at least 50% of their R&D work required for developing alternative formulations. For the companies manufacturing other rubber products, we assume that all of them have completed at least 25% of their R&D work (more details on the scenarios considered are provided later in this report);

- the price of organophosphates is three times that of SCCPs, i.e. €1,800 per tonne; and

- PVG belts last 50% longer than PVC belts but PVC belts are 10-30% less costly.

Assumptions relating to the sealants and adhesives industry

For the sealants and adhesives industry, it is assumed that:

- a total of 20 EU manufacturers of sealants and adhesives would have to incur one-off R&D costs of €50,000 per company. We also assume that one third of the companies (i.e. 7 companies) have completed 25% of their R&D, another 7 have finished 50% of their R&D and another 6 have completed 75% of their R&D;

- re-approval costs for reformulated products are assumed to be nil;

- in the absence of specific information on the use of SCCPs in dam sealants, we assume that dam sealants account probably for only 5% of the total consumption of SCCPs in this sector. As a more conservative scenario, we will also assume that this percentage may rise to 20%; and

- hydrogenated terphenyls have a price per tonne five times higher than MCCPs or €2,500.

Assumptions relating to the paints and coatings industry

For the paints and coatings industry, it is assumed that:

- we assume that a total of 20 paint manufacturers, 10 will manufacture road marking paints and 15 companies will manufacture other paints (anti-corrosive or intumescent paints) and coatings and are willing to engage in R&D work for the reformulation of their paints;

- the one-off cost for R&D work before reformulation is possible is assumed to be €20,000-75,000 per company;

- five companies have completed 25% of their R&D work, five more have completed 50% and another five have completed 75% of theirs;

- each road marking paint manufacturer manufactures two such products and each manufacturer producing other types of products will manufacture a total of five products requiring certification;

- each road marking paint needs to be certified in a maximum of five different EU countries;

- each of the other types of paint needs to be certified in a maximum of three different countries; and

- the cost of certification for each road marking product is €2,600-€5,000 per product and the cost of certification of each product other than road marking paint is €700-€1,850.

Assumptions relating to the textile finishing industry

For the textile finishing industry, it is assumed that:

- treated textile is of 400 grams per square metre of which 35% (140 grams per square meter) is SCCPs-containing compound;
- the width of treated textile produced is 1 metre (i.e. the length of 1 m^2 of textile is also 1 metre);
- the cost difference for textile finishers when moving from SCCP-containing compounds to SCCP-free compounds is €0.23/metre (effectively, a doubling of the cost incurred when using SCCP-containing compounds); and
- the market price of textile treated with SCCP-based is around £10 or €11.5 per square meter.

6.2 Option 0: Do nothing

The 'do nothing' option represents a situation where there no restrictions are introduced on the use of SCCPs. In practice, if SCCPs are added to the Annexes of the Stockholm Convention and the EU POPs Regulation, Member States have an obligation to comply. Also, there may be additional threats from the REACH Regulation, which could effectively restrict (via authorisation) the use of SCCPs.

Overall, the option is thus considered only for the purposes of estimating the incremental benefits and costs of the additional controls or UN ECE restrictions. From a more practical perspective, it is expected that the requirements of REACH and the ongoing discussions on SCCPs in the framework of the Stockholm Convention on Persistent Organic Pollutants (POPs) will result in a gradual decline of the use of SCCPs in the EU (if not an 'abrupt' cessation, depending on legislative developments).

6.3 Option 1: UN ECE restriction

6.3.1 Economic impacts for manufacturers of SCCPs

Importance of SCCPs and drive behind their manufacture

As discussed in Section 3.1, there are currently two manufacturers of SCCPs in the EU with the prospect that, after 2010, there will be only one. The tonnage of SCCPs produced and consumed in the EU has steadily declined since the mid-1990s when regulatory pressures on SCCPs mounted. Considering the range of products produced by the key EU-based manufacturer as well as the associated production tonnages and turnover, it is clear that SCCPs form only a small part of the business. The production tonnage of MCCPs and LCCPs is expected to be much higher as they have already largely replaced SCCPs in previously popular applications such as metalworking lubricants and leather fat liquors.

Currently, SCCPs are still being produced because there is a demand for them as downstream users believe that they offer a good combination of properties at an acceptable price (for instance, brominated flame retardants may show better flame retardant properties but could be three or more times more expensive and do not display plasticising properties; phthalates are better plasticisers but are more costly and do not impart flame retardancy). Also note that a significant percentage of the EU production of SCCPs is exported to customers outside the EU.

Possibilities for continued production of SCCPs in the EU

The requirement of the UN ECE restriction is that production of SCCPs ceases with the exception of production relating to conveyor belts for underground mining and dam sealants. As discussed already:

- the production tonnage of SCCPs in the EU is currently assumed to be 1,500 tonnes/year;
- of the tonnage of SCCPs sold to the rubber industry, we assume that 75-90% (i.e. 122-146 tonnes) is associated with underground mining conveyor belts; and
- of the tonnage of SCCPs sold to the sealants/adhesives industry, we assume that 5-20% (i.e. 12-47 tonnes) is associated with dam sealants.

Therefore, the amount of SCCPs production that would have to be lost would range between 1,307 tonnes (= 1,500 – 146 – 47) and1,366 tonnes (=1,500 – 122 – 12).

The question that arises is: would the EU manufacturer(s) of SCCPs choose to continue production in support of the two exempted uses? There are certain elements that need to be considered before we can answer this question.

Sensitivity to production economics: in pure production process terms, this appears to be possible. Production takes place in batches; therefore, a low demand for the substance could be accommodated – as long as it is profitable, of course. We are advised that there is a minimum size of a production batch; if an order were to be made for this amount or more, the manufacturer(s) could in theory produce the required SCCPs. Our discussions with industry stakeholders would suggest that only a small number of downstream users would actually purchase SCCPs in tonnages that exceed the minimum batch tonnage. This would mean that for some remaining users direct purchase of SCCPs from the manufacturer would be impossible (the quantity requested would be too small for the manufacturer to produce on demand) and purchases might only be possible through distributors who may be able to place orders for SCCPs in sufficiently large tonnages. On the other hand, storing small quantities of SCCPs could be burdensome and this could be sensitive to economics.

Pressures from non-EU competitors: it should be considered that EU-based manufacturers face the prospect of increased competition from non-EU competitors and a continued EU production of small quantities would be vulnerable to imports from non-EU countries. As discussed in Section 3.1, imports from non-EU countries have traditionally been very small but are potentially on the rise and users of SCCPs may be seeking to source the substance at a lower cost from non-EU manufacturers.

We understand that in India and China there are a large number producers. According to Entao (2003), chlorinated paraffin production in China has undergone rapid development in the past dozen years. The capacity increased sharply to 300,000 t/y by the end of 2003 and the output reached 150,000 tonnes. China has already become the biggest chlorinated paraffin producer in the world. Production figures for North America estimate 6,000 to 8,800 tons/year (UN ECE, 2007).

A more recent article provides further information on the global production of chlorinated paraffins. Jabr & Environmental Health News (2010) confirm that chlorinated paraffin production is growing in China and possibly in India. They report that the production of chlorinated paraffins in China soared from 20,000 tonnes in 1990 to over 600,000 tonnes in 2007, according to a 2009 presentation by Jiang Gui-bin of the State Key Laboratory of Environmental Chemistry and Ecotoxicology in Beijing, China. India also may be increasing its production of SCCPs. Please note that these figures refer to chlorinated paraffins in general and not specifically to SCCPs; however, they do provide a good indication of the growing role of Asian producers in the global markets for chlorinated paraffin and, by inference, SCCPs.

A recent report by the Environment Agency for England and Wales (2008) notes that all the products that incorporate chlorinated paraffins are mature global commodities where the ability to undercut manufacturing costs will be the key source of competitive advantage. For the majority of these products there are relatively low technical and investment barriers to entry.

Implications of the REACH processes and the Stockholm Convention discussions: the upcoming deadline for registration of (PBT) substances by 1 December 2010 will be an important marker. As a result, information submitted by manufacturers has been limited. Admittedly, the relative timing of the registration and authorisation of SCCPs and that of the UN ECE ban further complicates matters and requires the manufacturers and downstream users to develop specific plans for future action.

It is currently uncertain whether the substance will be registered or not. Even if registration is a hurdle that can be passed, it is not certain that authorisation will proceed. Indeed, a restriction on the substance under REACH may precede any attempt to secure an authorisation for any of the remaining applications of SCCPs. At the same time, it has been several years now that SCCPs has been discussed under the framework of the Stockholm Convention on POPs. If these discussions are concluded and the substance is included in the relevant Annexes of the EU POPs Regulation, the continued use of the substance in the EU would be an unrealistic scenario.

Summary: we could make strong arguments against the possibility that SCCPs production in the EU would continue after the implementation of the UN ECE restriction. It appears that economies of scale would not able to achieve and it would be unlikely that SCCPs production would continue in the EU. If any downstream user wished to continue the use of SCCPs in one of the two exempt applications, it could perhaps become less costly to purchase SCCPs from non-EU manufacturers. Therefore, in the calculations below, we will assume that the lost sales for EU manufacturers of SCCPs would be ca. 1,300-1,500, with the latter figure being a conservative assumption.

Quantification of impacts

The scale of impacts on the manufacturer(s) would crucially depend on the choices made by downstream users. If users opt for alternatives other than MCCPs/LCCPs, manufacturers of chlorinated paraffins will lose out while manufacturers of alternatives will see their sales of their flame retardants and plasticisers increasing. A calculation on the impact on the manufacturers' turnover can be performed, if a series of assumptions are made. For these purposes, we assume that:

- the tonnage of SCCPs sold in the EU that may need to be replaced is 1,300-1,500 tonnes;

- manufacturers of SCCPs will be able to replace a significant proportion of the tonnage of SCCPs currently sold with MCCPs and LCCPs. We assume this proportion will be between 50% and 75% but for completeness we will also consider worst-case percentages such as 0% and 100%;

- on the basis of consultation with downstream users (who seem to be familiar with MCCPs, including replacing SCCPs with MCCPs), we assume that, between MCCPs and LCCPs, the use of MCCPs would be more widespread and could account for 75% of the SCCP tonnage replaced (importantly, they are also much less costly than LCCPs). Again, for completeness, we will consider the worst-case percentages of 0% MCCPs-100% LCCPs and 100% MCCPs-0% LCCPs;

- due to their lower chlorine content, MCCPs would require a 10% additional loading to ensure equivalent flame retardancy with SCCPs; and

- the sale price for SCCPs, MCCPs and LCCPs is €600, €500 and €1,000 respectively.

The following tables provide our estimates for the turnover losses for EU-based manufacturers of SCCPs under the two assumed tonnages of SCCPs that would need to be replaced (1,300 and 1,500 tonnes).

Table 6.1: Estimate of Turnover Impact for EU Manufacturers of Chlorinated Paraffins (Low Tonnage)

SCCPs tonnage to be replaced	% to be replaced by chlorinated paraffins	New sales of chlorinated paraffins (t)	0% MCCPs 100% LCCPs		75% MCCPs 25% LCCPs		100% MCCPs 0% LCCPs	
			New sales of MCCPs (t)	New sales of LCCPs (t)	New sales of MCCPs (t)	New sales of LCCPs (t)	New sales of MCCPs (t)	New sales of LCCPs (t)
1,300	0%	0	0	0	0	0	0	0
1,300	50%	650	0	650	536	163	715	0
1,300	75%	975	0	975	804	244	1,073	0
1,300	100%	1,300	0	1,300	1,073	325	1,430	0

% to be replaced by chlorinated paraffins	Turnover loss from loss of SCCPs markets	Overall turnover loss (+)/ gain (-) from new sales of MCCPs/LCCPs			Present Value over 5 years*		
		0% MCCPs 100% LCCPs	75% MCCPs 25% LCCPs	100% MCCPs 0% LCCPs	0% MCCPs 100% LCCPs	75% MCCPs 25% LCCPs	100% MCCPs 0% LCCPs
0%	€780,000	€780,000	€780,000	€780,000	€4.3 m	€4.3 m	€4.3 m
50%	€780,000	€130,000	€349,375	€422,500	€0.71 m	€1.9 m	€2.3 m
75%	€780,000	-€195,000	€134,063	€243,750	-€1.1 m	€0.73 m	€1.3 m
100%	€780,000	-€520,000	-€81,250	€65,000	-€2.8 m	-€0.44	€0.35 m

** we use a discount factor of 4% over 5 years*
The figures above have been rounded

Table 6.2: Estimate of Turnover Impact for EU Manufacturers of Chlorinated Paraffins (High Tonnage)

SCCPs tonnage to be replaced	**% to be replaced by chlorinated paraffins**	**New sales of chlorinated paraffins (t)**	**0% MCCPs 100% LCCPs**		**75% MCCPs 25% LCCPs**		**100% MCCPs 0% LCCPs**	
			New sales of MCCPs (t)	**New sales of LCCPs (t)**	**New sales of MCCPs (t)**	**New sales of LCCPs (t)**	**New sales of MCCPs (t)**	**New sales of LCCPs (t)**
1,500	0%	0	0	0	0	0	0	0
1,500	50%	750	0	750	619	188	825	0
1,500	75%	1,125	0	1,125	928	281	1,238	0
1,500	100%	1,500	0	1,500	1,238	375	1,650	0

% to be replaced by chlorinated paraffins	**Turnover loss from loss of SCCPs markets**	**Overall turnover loss (+)/ gain (-) from new sales of MCCPs/LCCPs**			**Present Value over 5 years***		
		0% MCCPs 100% LCCPs	**75% MCCPs 25% LCCPs**	**100% MCCPs 0% LCCPs**	**0% MCCPs 100% LCCPs**	**75% MCCPs 25% LCCPs**	**100% MCCPs 0% LCCPs**
0%	€900,000	€900,000	€900,000	€900,000	€4.9 m	€4.9 m	€4.9 m
50%	€900,000	€150,000	€403,125	€487,500	€0.82 m	€2.2 m	€2.7 m
75%	€900,000	-€225,000	€154,688	€281,250	-€1.2 m	€0.84 m	€1.5 m
100%	€900,000	-€600,000	-€93,750	€75,000	-€3.3 m	-€0.51 m	€0.41 m

** we use a discount factor of 4% over 5 years*
The figures above have been rounded

The conclusions we are led to by the two tables are:

- the losses or gains for the EU-based manufacturer(s) of SCCPs are very similar when either 1,300 or 1,500 tonnes are used as a starting point;

- due to the increased price per tonne for LCCPs, when LCCPs represent at least 25% of new chlorinated paraffin and longer-chain chlorinated paraffins replace at least 75% of the lost sales of SCCPs, then the manufacturers may have an overall gain (negative figures in red font) rather than a loss. Under most scenarios, however, manufacturers of chlorinated paraffins would suffer some loss;

- as noted above the tables, we believe it is reasonable to assume that 50-75% of lost SCCPs sales would be replaced by news sales of MCCPs/LCCPs and that MCCPs would be likely to account for 75% of such new sales. This combination of assumptions results would result in a loss of turnover for manufacturers of SCCPs with a present value (over 5 years) of **€0.73-2.2 million** (the worst-case values shown in the cells in grey background in both table above).

Costs of converting the existing SCCPs production to MCCPs/LCCPs production are nil[12]. As there is already legislation in place (on metalworking lubricants and leather fat liquors) which has led to the partial replacement of SCCPs by MCCPs, the costs of conversion should have already been borne by the manufacturers.

The above tables do not take into account the direct and indirect effects of the requirements of the REACH Regulation (registration, authorisation). Perhaps more important for the EU manufacturer(s) of SCCPs would be potential knock on effects from the loss of the non-EU markets for SCCPs. This could affect the companies' use of chlorine and therefore their production of other products that are based on chlorine chemistry.

Finally, it is worth remembering that, under the concerted pressures of several concurrent regulatory processes (REACH, Stockholm Convention on POPs), it is conceivable that the EU SCCPs market will decline further. Eventually, this could make the manufacture of SCCPs in the EU uneconomical, leading to a de facto cessation of production.

Other potential impacts on manufacturers of SCCPs

In addition to the alkanes comprising the primary carbon chain lengths of the feedstock (e.g., C_{10-13}), the feedstock will contain impurities of other carbon chain lengths, as well as chemicals other than alkanes, such as olefins (alkenes) and aromatic compounds, which can also become chlorinated (POPRC, 2007).

The chemical industry considers the term "chlorinated paraffins" to refer to products produced through chlorination of a petroleum-based hydrocarbon stream that has a distribution in carbon chain lengths. Individual chlorinated alkanes are typically not considered chlorinated paraffins by industry. When a specific description is given for commercial chlorinated paraffins, it can be expected that the mixture will fall, on average, within that description, but other compounds may be present. For example, a product described as SCCP, 40% chlorine, will, on average, be composed of chlorinated alkanes that are 40% chlorine by weight and contain predominantly chain lengths between 10 and 13 carbons; the product may also contain lower and higher chlorinated alkanes as impurities (POPRC, 2007).

A key industry stakeholder has confirmed that the EU-based manufacture of chlorinated paraffins uses paraffins for feedstock with specification-controlled chain lengths. The manufacturers purchase a C_{14-17} paraffin feedstock for MCCPs production and a C_{10-13} feedstock for SCCPs production. The feedstocks and products remain separate throughout the manufacturing process. Manufacturers do not mix these feedstocks, nor do they mix the resultant SCCPs and MCCPs products. It therefore manufactures distinct commercial grades of SCCP and MCCP (the same is true for LCCPs).

12 BiPRO (2007) notes that, due to the fact that production is a batch process, the technical/conversion costs of the transition from SCCPs to MCCPs is limited (estimated at the time at <€100/tonne).

The paraffin fractions purchased are collected using molecular filters. However, this method will never give 100% certainty that the final product will fall 100% within the range requested and it can be accepted that up to **1%** of the paraffins could fall outside the requested distribution. The company has commented that achieving 100% certainty is not only unfeasible but also commercially unviable. The C_{13} molecule could be the one most likely to be present in MCCPs. On the other hand, it is very unlikely that any molecules of a C_{10} to C_{13} chain length might find their way into LCCPs.

It was particularly emphasised by industry that whereas it is true to say that for any given C_{14-17} paraffin feedstock there will be a very small amount of chain length outside the C_{14-17} range, it would not be accurate to describe the MCCPs product as containing SCCPs or LCCPs as these are distinct commercial products that are not mixed with MCCPs.

It is also worth noting that products from different suppliers may differ in their chemical composition but risk management of SCCPs in the EU has been based on the properties for molecules of this given range (C_{10-13}). Markets for chlorinated paraffins have developed around what feedstock is available. Products based on different feedstocks may also have different registrations under REACH.

The above discussion suggests that MCCPs may contain up to 1% impurities of shorter-chain molecules. While a claim has been made that this impurity should not be considered to be an "SCCPs impurity" (SCCPs as a product cover a range of chain lengths rather than the C_{13} length only), it is possible that a low concentration limit introduced under an UN ECE restriction (or even a restriction under the POPs legislation) could have implications for the placing on the market of MCCPs grades that contain impurities.

6.3.2 Economic impacts for distributors of SCCPs

Importance of SCCPs and drive behind their use

SCCPs are one of the many products supplied by distributors. The tonnages sold by each individual distributor may not be particularly large but may serve niche markets where the relevant users may still be keen to continue using the substance. Overall, we do not consider that SCCPs currently are of key importance to distributors. The general lack of responses to our consultation efforts and the ongoing replacement of SCCPs with alternatives would suggest that the potential loss of SCCPs would give little rise to concern among distributors.

Quantification of impacts

A quantification of impacts is not possible; the price of chemical products fluctuates and also depends on the business relationship between distributor and customer as well as upon the tonnage ordered by the customer. In general terms, alternative substances would appear to be more costly per tonne than SCCPs (with the notable exception of MCCPs, a key alternative to SCCPs). This however does not necessarily mean that profit margins on more expensive products are larger. We may only envisage some distributional effects with some distributors currently supplying SCCPs losing some of their business while other companies that supply alternatives witnessing a modest increase in turnover.

Distributors who may sell to customers outside the EU might continue to do so, if their countries are not signatories to the POPs Protocol/LRTAP Convention. However, EU manufacture of SCCPs would also be impacted and it might be more costly for EU-based distributors to source the substance from non-EU manufacturers.

6.3.3 Economic impacts for the rubber manufacturing industry

Importance of SCCPs and drive behind their use

Past literature and consultation has revealed that the attributes of SCCPs that make their use in rubber attractive (both in conveyor belts and other articles) include:

- **good flame retardancy at low viscosity**: their flame retarding effect depends on the presence of chlorine (increases with the chlorine content of the paraffin);
- **compatibility**: a key advantage of SCCPs is its compatibility with polymers so that higher quantities can be incorporated and also remain in the product throughout its lifetime;
- **lubrication effect**: in rubber processing, SCCPs also act as an internal lubricant and a processing oil; and
- **low cost**: SCCPs are used to deliver a range of effects at a fraction of the price of substances such as brominated flame retardants.

Quantification of impacts

The extent of the costs to be incurred would differ for:

- **manufacturers of rubber products**, where the key costs aspects would include:
  - R&D costs;
  - re-approval costs;
  - additional cost of alternative substances or of alternative materials; and
- **users of rubber products**, where the key costs aspects would result from the:
  - replacement of SCCPs;
  - replacement of solid woven (PVG) belts;
  - impact of meeting new fire safety standards.

<u>Impacts for manufacturers of rubber products (conveyor belts and other products)</u>

There may be several elements of cost that might arise for companies which use SCCPs in rubber manufacturing as a result of a restriction on SCCPs. The discussion below focuses on conveyor belts due to the apparent criticality of this application and the lack of information on other rubber-based applications of SCCPs but also addresses, to the degree possible, the potential ongoing use of SCCPs in other rubber products. The key parameters and assumptions made in relation to the use of SCCPs in the wider rubber industry in the EU are as follows:

- the manufacture of SCCP-containing conveyor belts may only form part of the production of any one manufacturer. For example, a manufacturer of conveyor belts has indicated that 70% of his products are fire resistant. Yet, only one product contains SCCPs. This represents around 20% of the total conveyor belt production of the company;

- the concentration of SCCPs in rubber may be up to 10% by weight and the rubber element may consist up to one third of the end product by weight. We know the SCCPs consumption of a key conveyor belt manufacturer and his assumed share of the conveyor belt market in the EU (unfortunately, we cannot provide this information on grounds of confidentiality). This information confirms that conveyor belt manufacture must currently account for the majority of the estimated 162 tonnes of SCCPs currently consumed per year by the EU rubber industry (see **Table 3.4**). In the absence of detailed information on the use of the substance in rubber products other than conveyor belts, we assume that 75-90% of this tonnage (i.e. 122-146 tonnes) is used in conveyor belts and the remainder (i.e. 16-40 tonnes) is used in other rubber products. On this basis, we can calculate the tonnages of rubber conveyor belts and other rubber products that contain SCCPs and are placed on the market in the EU;

Table 6.3: Calculation of Assumed Tonnages of Rubber End-Products that Contain SCCPs in the EU

Parameter	**Rubber conveyor belts**		**Other rubber products**		**Notes**
	Low	**High**	**High**	**Low**	
Assumed tonnage of SCCPs consumption	122	146	40	16	
Assumed concentration of SCCPs in rubber	10%	10%	10-17%		For conveyor belts we use 10% which has been indicated by consultees; for other rubber products we use information presented in literature (see **Table 3.3**)
Assumed rubber quantity (tonnes)	1,215	1,458	400	95	For other rubber products, dividing lowest tonnage with the highest rubber concentration (17%) and vice versa
Assumed percentage of rubber in end-products	20-33%		100%		Given that different conveyor belts may have a different percentage of rubber cover, we assume that rubber represents one fifth to one third (20-33%) of the end product. For other rubber products, we assume that SCCP-containing rubber is the only component
Assumed tonnage of rubber-containing end-products marketed in the EU	**ca. 3,700**	**ca. 7,300**	**400**	**95**	For conveyor belts, dividing lowest tonnage with the highest rubber concentration (33%) and vice versa

- the typical market price of a conveyor belt is around €4,000 per tonne of finished product. Therefore, the market value of the SCCP-containing conveyor belt would be around **€14.8–29.2 million per year**. We do not have any information on the prices of other rubber products that contain SCCPs; hence we cannot provide a realistic similar estimate for the value of the relevant market (we would expect however, other, simpler rubber products to have a market price substantially lower than the highly engineered rubber conveyor belts for which SCCPs are used).

Taking the above into account, our estimates of the costs to manufacturers of conveyor belts from a restriction on SCCPs are as follows:

- **one-off costs – research and development**: there is a mixed picture with regard R&D in the rubber sector. Information from some companies (including conveyor belt manufacturers) would suggest a reasonably straightforward transition from SCCPs to alternatives. Other companies are still in the process of developing alternatives; some of them have been in this process for some years. For those companies that have already switched to alternatives, we do not hold information on the time and effort that was necessary for the successful development of alternatives. We will have to assume that some companies may have started their research on alternatives earlier than others.

  Past studies provide some guide on the costs that might arise: BiPRO (2007) notes that reformulation costs were assumed to be in the order of €75,000 per producer. HSE (2008) provides an analysis of the costs of developing alternative formulations for the replacement of MCCPs. A total of 3,750 tonnes of MCCPs would require an overall cost of €6 million for development of alternative formulations in the EU. In the absence of information, we opt to use the figure quoted by BiPRO and assume that there are three conveyor belt users of SCCPs[13] which will undertake R&D work and up to ten companies using SCCPs in rubber products other than conveyor belts which will undertaken R&D work. As we cannot be certain at what stage in their research process each company might be, we assume a range of scenarios as shown in the following table.

[13] We are reasonably certain that there are only two large multinational conveyor belt manufacturers who still use SCCPs but we make a conservative assumption to encompass any smaller users we have not identified.

Table 6.4: Estimate of Outstanding R&D Work Required of Rubber Product Manufacturers					
Number of conveyor belt manufacturers that have completed …% of R&D work					**Cost of remaining research (€75,000 per company for the entire R&D work)**
0%	**25%**	**50%**	**75%**	**100%**	
1		2			€150,000
	1	2			€131,000
		3			€113,000
		2	1		€94,000
		1	2		€75,000
			3		€56,000
			2	1	€38,000
Number of other rubber product manufacturers that have completed …% of R&D work					**Cost of remaining research (€75,000 per company for the entire R&D work)**
0%	**25%**	**50%**	**75%**	**100%**	
10					€750,000
	10				€563,000
		10			€375,000
			10		€188,000
				10	Nil

Notes:
As we have discussed with two of the three assumed EU-based conveyor belt manufacturers and we know that they have made considerable progress in the development of alternatives, we assume that these two companies have completed at least 50% of their R&D work.
For all rubber products, given the well-known issues surrounding the properties of SCCPs and ongoing legislative pressures, we believe it is extremely unlikely that any company may have not started looking at alternatives yet. Therefore, we assume that companies have completed at least 25% of their R&D work.

The above table would indicate that the remaining R&D work for manufacturers of rubber conveyor belts could be **€38,000-131,000**. For manufacturers of other rubber products, the remaining work could be as high as **€563,000**. Therefore, the overall one-off cost for the rubber industry could range between **€0.04-0.69 million** and will crucially depend on the number of manufacturers of other rubber products and the stage at which their R&D work currently is.

We would also note that it is possible that the flame-retarded rubber is not produced by the conveyor belt manufacturer. It may be manufactured in the form of granulate by another company and is then purchased by the conveyor belt company, is vulcanised and is used to make a composite belt. With this arrangement, the main R&D work will be undertaken by the rubber formulator who will send samples to the conveyor belt manufacturer for testing;

- **one-off costs – re-approval costs**: BiPRO (2007) indicates that re-approval costs could be in the order of €1.5 million for the larger producers. Consultation with industry has indeed highlighted the costs of meeting the relevant fire safety standards but the figures quoted are much smaller[14]. At present, it appears that every country has different fire safety standards. A new one, 14793-2008:A1 has almost been agreed but still does not apply everywhere in the EU[15]. At present, and until the new standard has been fully implemented in the EU, new approvals will be needed in different countries where an approval exists after a change from SCCPs. A manufacturer of conveyor belts has indicated that around four months are typically required for obtaining a new approval and country-by-country applications need to be submitted. The cost per application has been suggested to be ca. €50,000 per country. As any one manufacturer could easily sell his belts to 5-10 different countries, the overall re-approval cost could be quite significant. However, the introduction of the new standard (which is more stringent than individual national standards) means that approvals need to be re-issued anyway, therefore, a restriction on SCCPs should not be considered the sole or indeed the real drive behind this cost. Notably the US MSHA standard which applies from the 1st of January 2010 (US MSHA, 2009) is also very stringent and existing conveyor belt products may not be able to meet it (according to the testimony of a conveyor belt manufacturer). The new standard requires that effective 31 December 2018, all conveyor belts used in underground coal mines must be approved under Part 14. Under the final rule, operators will have up to ten years to use existing belt, which has been placed into service by 31 December 2009. This assures that all belt used in underground coal mines will meet the requirements of Part 14 within ten years. Also, under the final rule, mine operators may continue removing, trimming down and re-installing belts in their underground mines, if the belts have been placed in service in their mines prior to or during a one-year transition period. Belts that have been placed in service prior to or during the one-year transition period can be used until 31 December 2018. This belt may not be marketed for use in other underground coal mining operations after 31 December 2009, but may be used by the same mine operator;

- **ongoing costs – additional cost of alternative substances**: some information on the cost of alternative flame retardants is provided in the literature. BiPRO (2007) refers to analyses undertaken in the late 1990s according to which available alternatives were substantially more expensive than SCCPs, required in greater quantities to achieve desired chlorine level, or up to four or five times as costly. ECHA (2008) refers to past RPA work on SCCPs in which "other organophosphorus" flame retardants are presented as costing significantly more than "other chlorinated" flame retardants (€4.2/kg compared to €1.4/kg). ECHA (2008) suggests that apart from MCCPs that have a similar cost to SCCPs, LCCPs would be more costly and organophosphates would be significantly more costly in comparison to SCCPs. HSE (2008) suggests a price per tonne of €500 for MCCPs and €600 for LCCPs. If we assume that:

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14 The information from BiPRO is based on a 1999 report by ERM (*Study on the Economic and Social Implications of Introducing Community-wide Restrictions on the Marketing and Use of Short Chained Chlorinated Paraffins, Draft Final Report for the European Commission DGIII, Environmental Resources Management, June 1999*) and most likely reflects the then knowledge of the availability and suitability of alternatives and the consequent costs of re-approving conveyor belt products..

15 Apparently, there are some EU countries that are faster than others at adopting the new standards.

- the price of SCCPs is €600 per tonne, the price of MCCPs is €500 per tonne and the price of LCCPs is €1,000 per tonne;
- an increased loading of MCCPs of 10% would be required to achieve equivalent retardancy (due to lower degree of chlorination, compared to SCCPs – percentage taken from ECHA (2008));
- the price of organophosphates is 3 times that of SCCPs, i.e. €1,800 per tonne (but please note that organophosphates may not be suitable alternatives as they tend to be used for PVC rather than rubber); and
- as discussed above, we assume that 75-90% of this tonnage (122-146 tonnes) is used in conveyor belts and the remainder (16-40 tonnes) is used in other rubber products,

then the replacement of the 162 tonnes of SCCPs used per year in the EU rubber industry would mean an additional ongoing cost, as shown in **Table 6.5**.

Table 6.5: Estimated Costs/Savings to Rubber Formulators from a Restriction on SCCPs

Chosen alternative	Conveyor belt manufacture			Other rubber products manufacture		
	Maximum tonnage required	**Overall additional annual cost**	**Present Value over 5 years***	**Tonnage required**	**Overall additional annual cost**	**Present Value over 5 years***
75-25% tonnage split						
MCCPs	134	-€6,100	-€33,000	44	-€2,000	-€11,000
LCCPs	122	€48,800	€266,000	40	€16,000	€87,000
Organo-phosphates	122	€146,400	€798,000	40	€48,000	€262,000
90-10% tonnage split						
MCCPs	161	-€7,300	-€40,000	18	-€800	-€4,400
LCCPs	146	€58,400	€318,000	16	€6,400	€35,000
Organo-phosphates	146	€175,200	€955,000	16	€19,200	€105,000

*** we use a discount factor of 4% over 5 years*
Note: the figures above have been rounded

It should be noted that the above calculation is probably an oversimplification. The introduction of a new substance could mean that a more extensive reformulation may be necessary. It is also important to remember that even if an alternative is less costly (MCCPs, for instance) this does not mean that their use is not accompanied with loss of performance or other problems. In fact, consultation with a manufacturer of conveyor belts indicates that the use of alternative flame retardants would be likely to result in an increase in the price of the rubber formulation of around 5-10%; and

- **one-off costs – additional cost of alternative materials**: consultation with industry indicates that polychloroprene rubber (CR) can be 30-40% more expensive than SCCP-retarded nitrile rubber.

The number of workers employed by manufacturers of conveyor belts in the EU could be fewer than 1,000. A manufacturer we have been in contact with expressed doubts whether the loss of SCCPs would result in job losses.

Impacts for users of rubber products (mainly conveyor belts)

Discussions with a manufacturer of conveyor belts suggest that their first choice would be to replace SCCPs with a suitable alternative that ensures acceptable mechanical properties and capable of meeting the relevant safety standards (especially the new EN standard) and they would probably avoid passing the cost on to their customers. One reason for doing this would be the fact that contracts with clients are signed in advance and price changes cannot be amended in retrospect. A manufacturer of conveyor belts brought the example of an existing contract with an EU-based customer that has a duration of 5 years and contact prices stipulated therein would be difficult to re-negotiate. However, given that in order to meet the new EU-wide safety standards reformulation will be required, the price of finished conveyor belts is likely to increase anyway (to incorporate the cost of re-approval) and such increase could well incorporate the cost increase resulting from the replacement of SCCPs.

If costs were passed on to downstream users, the following impacts could be envisaged for current users of SCCP-containing conveyor belts:

- **impacts on users from replacement of SCCPs**: BiPRO (2007) suggests that the loss of SCCPs could lead to a rise in cost of finished products of 15-20% (and to possible losses of jobs). A similar estimate has been provided by a manufacturer of conveyor belts during consultation for the present study: he estimates that the rise in the cost of finished conveyor belts would be 10-15%. Considering the given typical price per tonne of €4,000 per tonne, the SCCP-free belts would see their price rise to €4,400 - €4,600/tonne. As shown in **Table 6.3**, the relevant tonnage of conveyor belts is 3,700-7,300 per year. Hence, the value of the market would hence rise to €16.3 - €33.6 million per year meaning an additional cost for the users of conveyor belts of **€1.5 - €4.4 million per year** (Present Value: €8.2 - €24.0 million over 5 years at a discount rate of 4%).

  We cannot estimate the cost for users of SCCP-containing rubber products other than conveyor belts as we are not familiar with the typical price per tonne of final product. We can speculate that this will be lower than the €4,000/tonne for conveyor belts. Combined with the much lower tonnage of final products involved (95-400 tonnes, see **Table 6.3**), the costs to downstream users will be much lower than what is calculated above for conveyor belt users.

- **impacts on users from replacement of solid woven (PVG) belts**: the following sub-scenarios may be envisaged:
  - *PVG belts are replaced by PVC belts*: according to a manufacturer of conveyor belts, PVG belts last 50% longer than PVC for the same level of wear and the lifetime of SCCP-containing belt is ca. 15 years. At the same time, PVG belts are 10-30% more costly than PVC belts. Therefore, in the period of 15 years (typical

lifetime of an SCCP-containing belt), a PVC belt would need to be replaced at year 10 and the second belt would need to be used for half its lifetime of 10 years. If the PVC belt costs 0.9 times the cost of the PVG equivalent (PVG_{eq}), the total cost of the PVC alternative belt would be (0.9 x PVG_{eq}) + (0.9 x PVG_{eq})/2 = 1.35 x PVG_{eq}. If the PVC belt costs 0.7 times the cost of the PVG equivalent (PVG_{eq}), the total cost of the PVC alternative belt would be (0.7 x PVG_{eq}) + (0.7 x PVG_{eq})/2 = 1.05 x PVG_{eq}. In both cases, the user would be worse off. The estimate that PVC belts cost 10-30% less than PVG belts was provided by **Rubber Company 4** (see Section 4.3.2) and is considered to be reliable. However, if PVC belts became more than 33% less costly than PVG belts, the user of belts could be better off purchasing the PVC belt. It should also be noted that this simple calculation does not take into account the impacts of the poorer performance of the PVC belt compared to the PVG equivalent; and

- *PVG belts are replaced by multi-ply belts with CP covers*: we cannot estimate the magnitude of this cost; however, as noted above, CP covers could be 30-40% more costly than SCCP-retarded nitrile rubber. If for reasons of simplification we assumed that the remaining components of the two types of conveyor belts had an identical cost and that in both cases the rubber cover constitutes 33% of the conveyor belt, the increase in the price of the finished product could be between 10% and 13% (effectively similar to the increase in costs if SCCPs were replaced by an alternative substance). Again this calculation does not take into account of any differences in the performance of the two different conveyor belts.

As BiPRO (2007) notes, having in mind the high total investment and operating costs that are expended in underground mining, additional costs caused by a ban of the use of SCCPs in rubbers e.g. for conveyor belts seem to be economically justifiable. It is not expected that price increases will influence investment decisions in underground mining.

Other issues

Meeting new fire safety standards is an important turning point for the industry at this time. Manufacturers of conveyor belts would need to have their products re-tested (normally in government laboratories) to achieve re-approval. In this regard, separate re-approval as a result of the replacement of SCCPs may not be necessary and the re-approval costs described above should not be assigned to a restriction on SCCPs.

The analysis above does not take into account the potential changes in the price of SCCPs. Now that the number of manufacturers of SCCPs in the EU has declined, the availability of SCCPs may reduce and their price might continue to increase making the use of alternatives more attractive.

Our understanding of the current situation is that alternatives to SCCP are available (as some companies have already moved on to them); however, there is a need for a compromise between economics and technical performance so that they the new products meet the relevant standard and performance requirements of the customers while achieving an acceptable market price. The exemption provided for under the UN ECE restriction for the use of SCCPs as flame retardants in conveyor belts would prevent the immediate impact of a restriction on the substance and would allow all remaining conveyor belt manufacturers to move on to alternatives.

Summary

The following table summarises the estimated costs to rubber formulators and rubber users. As the UN ECE ban does not affect conveyor belts, the key costs to arise would be those for manufacturers and users of rubber products other than conveyor belts. For these uses, unfortunately, limited information is available. It is safe to assume, however, that the actual costs would be much lower than if the ban had affected the underground mining conveyor belt industry.

Table 6.6: Summary of Estimated Costs/Savings to the EU Rubber Industry from the UN ECE Restriction on SCCPs

Cost element	Conveyor belting	Other rubber products
Rubber product manufacturers		
One-off R&D costs	Exempt	Up to €563,000 (but probably much lower)
One-off re-approval costs	Exempt	Unknown
Cost of alternative substances	Exempt	**For a current SCCPs consumption of 40 tonnes:** -€0.011 to €0.26 million (present value over 5 years)
	Exempt	**For a current SCCPs consumption of 16 tonnes:** -€0.004 to €0.11 million (present value over 5 years)
Cost of alternative materials	Exempt	Unknown
Rubber product users		
Cost of using products with alternative flame retardants	Exempt	Unknown
Cost of using products with alternative rubber products	Exempt	Unknown

6.3.4 Economic impacts for the sealant/adhesive industry

Importance of SCCPs and drive behind their use

The reasons for the continued use of SCCPs are as follows:

- **low cost**: a manufacturer of sealants has indicated that SCCPs are cost-effective and, as such, companies are keen to continue using the substance;
- **low viscosity**: SCCPs have the ability to cause modulus reduction and substitution of SCCPs may not be easy, especially when the product needs to remain liquid. SCCPs have low viscosity and can be easily mixed on-site. If, for instance, MCCPs were used and the temperature was low (5-10°C), the product would become viscous and harder to mould to the required shape;

- **water repellence combined with flame retardancy**: due to their high chlorine content, SCCPs offer a good combination of water proofing and flame retardancy;

- **good compatibility**: SCCPs are compatible with polymers and, as such, relatively higher quantities can be incorporated into the product and can also remain in the product throughout its lifetime; and

- **industry inertia**: so far, while companies may have been aware of regulatory pressures on SCCPs (for instance, with the change of their classification a few years ago), they did not see a very urgent need to change them. A lack of resources has been suggested as a major drive behind this slow progress and the recent economic turmoil in the EU has made any R&D expenditure hard to justify.

Quantification of Impacts

The extent of the costs to be incurred would differ for:

- **manufacturers of sealants and adhesives**, where the key cost aspects would include:
  - R&D costs;
  - re-approval costs;
  - additional cost of alternative substances or alternative formulations; and

- **users of sealants and adhesives**.

<u>Impacts for manufacturers of sealants and adhesives</u>

The loss of SCCPs will result in both one-off and ongoing costs for EU-based manufacturers of sealants and adhesives. The available information is summarised below:

- **one-off costs – research and development**: in 2001, a survey of a number of sealant manufacturers suggested that there would be costs associated with the need to reformulate products. One company indicated that considerable time had been spent on R&D to replace SCCPs in their polysulphide sealants. The time spent was estimated at one full time equivalent year, possibly accounting for around £60,000 (at 2001 prices, ca. €100,000) (RPA, 2001).

  During consultation for the present study, a major user of SCCPs indicated that around €10,000 would be required for research and development. Our understanding is that this cost estimate reflects the work that remains to be done by the company. We further understand that some initial attempts at preparing an alternative formulation had been made and whilst the results were promising, additional work will be needed. The company has indicated what percentage of the work has been undertaken but it cannot be disclosed here for reasons of confidentiality. However, a breakdown of the €10,000 can be considered to include:

- *laboratory work*: it could take 3-5 months to get the performance right (changing the polymer, fillers, curing agents, etc.)[16]. It is assumed that this work in the laboratory would involve 1-2 persons working at €25/h, possibly for a total of 100 hrs, i.e. a total of €5,000;
- *factory testing*: assuming a new formulation is developed, it will be necessary to conduct trials in the factory, i.e. produce the sealant with the new formulation. This could take one month with a full scale trial on a half-batch at the factory costing €1,200; and
- *compliance testing*: if the new product needs to meet required standards, the formulation needs to be tested against the relevant standards by an external laboratory. This will typically take three months, unless the material fails. Independent testing is estimated to cost around €2,500-3,500 (although checking against specific standards could be more expensive).

In total, it can be estimated that around nine months would be required.

The information provided by the company suggests that the total cost of R&D work is €100,000 which is in good agreement with the previous estimate made in 2001. We note however that the company that has provided this information is particularly large with a range of relevant products that need to be reformulated. Therefore, a lower cost per company would perhaps be more appropriate for what we would consider as an 'average' sealant/adhesive manufacturer. We will therefore opt for a cost of €50,000 per company and will use the figure of €100,000 per company as a conservative worst-case scenario.

Considering the available information on the number and location of relevant companies (from SDSs and consultation), we assume that a total of 20 EU manufacturers would have to incur such a one-off R&D cost. We also assume that, one third of the companies (i.e. 7 companies) have completed 25% of their research, another 7 have finished 50% of their research and another 6 have completed 75% of their research. The overall one-off cost of R&D is given in the table below;

Table 6.7: Assumed Remaining R&D Costs for Sealant/Adhesive Investigating Alternative Formulations

Progress in R&D	Assumed number of companies	Cost of remaining R&D work
25% completed	7	€262,500 – 525,000
50% completed	7	€175,000 – 350,000
75% completed	6	€75,000 – 150,000
Total	***20***	***€512,500 – 1,025,000***

- **one-off costs – re-approval costs**: we have been advised that for some types of sealants, some re-approval costs may arise after their reformulation. The cost of a certification per product has been quoted by a company based in an Eastern EU

[16] The company believes that they have a fairly typical their laboratory in this industry, albeit a slightly better equipped perhaps. The important issues are mainly time and knowledge rather than the equipment used.

Member State at around €700 with an ongoing annual 'maintenance' cost of ca. €70. These costs are very low compared to the re-formulation costs discussed above, hence, they will be omitted from our calculations. Arguably, the R&D costs may incorporate at least part of the certification cost: the manufacturer will need to send samples of the new formulation to a specialist laboratory to establish the key technical and performance characteristics of the formulation. The results of such testing would support a re-certification application;

- **ongoing costs – additional cost of alternative substances**: the extent of on-going costs incurred by manufacturers of sealants and adhesives will crucially depend on the specific alternative used and the intended role of SCCPs. For instance:
  - if MCCPs were chosen, then a higher loading would be required (we will again assume this will be 10% by weight);
  - if a plasticiser such as a phthalate is used in a formulation where SCCPs have acted as both plasticisers and flame retardants, the phthalate would need to be accompanied by an alternative flame retardant, thus potentially increasing the overall cost of the formulation;
  - if the chosen alternative does not ensure adequate viscosity, one or more additives will be needed to ensure that the final product has the required rheology characteristics.

  All these changes would inevitably affect the concentration of the remaining ingredients (resins, fillers, etc.) in the formulation and consequently their contribution to its overall cost. For simplicity and due to the lack of more detailed information, we will only consider the direct cost of replacing SCCPs with a series of alternative substances such as:

  - *MCCPs*: their price per tonne is €500 and an additional loading of 10% will be required;
  - *LCCPs*: their price per tonne is €1,000;
  - *di-isononyl phthalate*: ECHA (2008) indicates a cost per tonne of €800 for the substance; and
  - *terphenyls*: these are referred to in HSE (2008) and are assumed to be hydrogenated terphenyls. HSE assumes a price per tonne five times higher than MCCPs or €2,500; and
  - we do not have any specific information on what the share of dam sealants among all SCCP-containing sealants and adhesives is. Among the products we identified in the open literature (e.g. SDSs available on the Internet, see **Table 3.6**), very few products appear to have been marketed as dam sealants. Discussions with industry stakeholders (including a company that manufactures a variety of SCCP-containing sealants/adhesives and currently consumes a substantial tonnage of SCCPs) show a lack of awareness of specific uses of SCCP-containing sealants as dam sealants or indeed of the supposed criticality of such products. Therefore, we assume that the use of SCCPs in dam sealants is very limited; we assume that dam sealants account for 5% of the total tonnage of SCCPs used. As a second, more

conservative scenario, we assume that 20% of the total tonnage is used in dam sealants; therefore, only the remaining 190-225 tonnes of SCCPs will need to be replaced by alternatives under the UN ECE restriction.

The estimated costs for replacing SCCPs with alternative substances are shown in **Table 6.8**.

Table 6.8: Estimated Costs/Savings to Sealant and Adhesive Formulators from the UN ECE Restriction on SCCPs

Chosen alternative	Dam sealant usage of SCCPs	Maximum tonnage required	Overall additional annual cost	Present Value over 5 years*
MCCPs	5%	248	-€8,200	-€61,000
	20%	209	-€6,600	-€52,000
LCCPs	5%	225	€64,800	€490,000
	20%	190	€54,400	€414,000
Di-isononyl phthalate	5%	225	€32,400	€245,000
	20%	190	€27,200	€207,000
Terphenyls	5%	225	€307,800	€2,330,000
	20%	190	€258,400	€1,970,000

** we use a discount factor of 4% over 5 years*
Note: the figures above have been rounded

- **one-off costs – additional cost of alternative materials**: we do not have information on the cost of alternative products, such as polyurethane or silicone sealants and how this compares to SCCP-containing products.

<u>Impacts for users of sealants and adhesives</u>

No specific information is available from consultation on the impacts on users of sealants. One manufacturer, however, indicates that they will endeavour to ensure that customer will not notice any difference in his products after they have reformulated them without SCCPs. BiPRO (2007) refers to information according to which some sealant manufacturers would need up to two years to find and test alternatives and that costs to end-users may increase by 5%. BiPRO highlights the fact that other companies had substituted SCCPs with MCCPs and reported no apparent loss in performance or increase in cost.

Other Issues

SCCPs are used in specific ranges of products. If they became unavailable, it would be possible that these products might simply disappear rather than be reformulated. In the current economic climate, it is hard to justify R&D expenses, especially for products and markets that may not be considered to be critical within a company's overall portfolio. It is also possible that people in some companies may not know that they are still using SCCPs as they tend to be used in specialised products only.

Summary

The following table summarises the estimated costs to sealant and adhesive formulators and their downstream users. As the UN ECE ban does not affect dam sealants, the key costs to arise would be those for manufacturers and users of the remaining relevant sealant and adhesive formulations.

Table 6.9: Summary of Estimated Costs/Savings to the EU Sealant and Adhesive Industry from the UN ECE Restriction on SCCPs

Cost element	Estimated magnitude
Sealant and adhesive manufacturers	
One-off R&D costs	€0.5-1 million
One-off re-approval costs	Negligible
Cost of alternative substances	-€52,000 to €2.33 million (present value over 5 years)
Cost of alternative products (different chemistry)	Unknown
Sealant and adhesive users	
Cost of using products with alternative plasticisers	Unknown; literature suggests 5% price increase
Cost of using alternative sealant/adhesive products	Unknown

6.3.5 Economic impacts for the paints and coatings industry

Importance of SCCPs and drive behind their use

The performance and cost advantages of SCCPs that have already been described for rubber and sealants/adhesives will generally apply to their use in paints and coatings.

Two companies, both of which are active in the field of road marking paints (although one of them produces a variety of SCCP-containing paints for a range of applications) have also put forward some further arguments in favour of the use of SCCPs.

The first company summarised the key advantages of SCCP-based formulations as being waterproof, being resistant to chemicals and oils, and being able to adhere well to mineral surfaces (concrete/road). The company has argued that formulations based on alternatives do not show the same resistance to chemicals or adherence to surfaces such as roads. For this company, it should be noted that SCCPs are used mainly as plasticisers and their flame retardancy is a secondary feature.

The other company's arguments relate mainly to costs. It has noted that its national market for road marking paints (in Southern Europe) and some other EU markets have seen decreasing prices in recent years. Therefore, there has been a need to cut costs and make products cheaper and more competitive; in effect, this has meant that resins with high proportions of styrene which are generally cheaper have been more widely used. The use of increased proportions of styrene results in the final product being more rigid and, as such, an additional amount of plasticiser is needed. Given the high cost of primary plasticisers (e.g. phthalates), SCCPs have found increasing use.

Quantification of Impacts

The extent of the costs to be incurred would differ for:

- **manufacturers of paints and coatings**, where the key cost aspects would include:
  - R&D costs;
  - re-approval costs;
  - additional cost of alternative substances;
  - additional cost of certificate maintenance; and

- **users of paints and coatings**.

<u>Impacts on manufacturers of paints and coatings (based mostly on road marking paints)</u>

The loss of SCCPs will result in both one-off and ongoing costs for EU-based manufacturers of coatings and paints. The information we have is presented below:

- **one-off costs – research and development**: no quantified information has been provided by consultees. A company which uses SCCPs in a variety of paint products (including road marking paints, anti-corrosion paints and decorative paints) has suggested that the time that would be required to reformulate all its products (nine products based on chlor-rubber or polymer resins, some of them in a variety of colours) would be ca. 2 to 3 years and they have already been looking at alternatives for at least one year already. In the absence of quantified information, we consider the information in HSE (2008) which provides information on the reformulation costs of paints that contain MCCPs. This was estimated between €2,000 and €75,000 per company depending on the type of coating (anti-corrosive paints appear to have the highest reformulation costs) and the alternative plasticiser chosen. HSE (2008) uses an average figure of €20,000 per company. To ensure that we capture the variability in R&D cost in the sector, we will use the range of €20,000-75,000 in the calculation of this one-off cost.

  We do not have a clear picture of the number of companies that may be involved in the manufacture of SCCP-containing paints. The relevant industry associations suggest that that the use of SCCPs is limited and we have identified users of SCCPs which account for a considerable proportion of the estimated consumption of SCCPs in this industry sector (101 tonnes/year, see **Table 3.4**). From consultation and identified SDSs, it can be concluded that around ten or so companies may be using the substance. To account for those companies that may not have been identified or perhaps do not belong to the relevant trade associations, we will assume a total of 20 companies still use SCCPs in the manufacture of paints and coatings and are willing to engage in R&D work to develop SCCP-free formulations.

We also assume that, one third of the companies (i.e. 7 companies) have completed 25% of their research, another 7 have finished 50% of their research and another 6 have completed 75% of their research. The overall one-off cost of R&D is given in the table below;

Table 6.10: Assumed Remaining R&D Costs for Paint Manufacturers Investigating Alternative Formulations		
Progress in R&D	**Assumed number of companies**	**Cost of remaining R&D work**
25% completed	7	€105,000 – €393,750
50% completed	7	€70,000 – €262,500
75% completed	6	€30,000 – €112,500
Total	***20***	***€205,000 – €769,000***

- **one-off costs – re-approval costs**: according to a road marking paint manufacturer, in order to sell in different countries, he needs to obtain authorisation from the authorities in those countries (the UK Highways Agency notes that road markings need to meet the relevant classes specified in European Standards such as EN 1790, EN 1871, EN 1423 and EN 1424. EN 1436 deals with the on-road performance of road markings and all road markings are tested to EN 1824). Even for paints for swimming pools, certification is needed as the releases of the product to water need to be measured. With regard to the cost of the testing required after reformulation, the following estimates have been made:
  - according to a road marking paint manufacturer, authorisation is a long process and takes 2-3 years to complete and production needs to be audited (the company currently holds certificates for road marking paints which are valid until 2013). The following table summarises the costs of certification that have been provided. These reflect costs per product rather that cost per tonnage. It is worth noting the difference in costs between road marking paints and other products;

Table 6.11: One-off Compliance Cost per Product for Coatings and Paints (2009)		
Type of product	**Cost of initial compliance, flame retardancy testing**	**Cost of initial special testing (waterproofing, corrosion characteristics, road adhesion)**
Interior coating	€720	
Anti-corrosion coating	€720	€565
Swimming pool/water tank coating	€720	€1,130
Chemical resistant coating	€720	
Basecoat for aggressive environments	€720	€1,130
Basecoat for porous substrates	€720	€1,130
Road marking paint	€905	€1,700
Source: Consultation		

- another manufacturer of road marking paints has estimated that the cost of re-certification could exceed €4,000-5,000 per product;
- road marking product testing in the UK by BSI is in accordance with BS EN 1824 and BS EN 1436 and there is a minimum of 12 months for permanent products. Testing costs approximately £2,500 (ca. €2,900) per product, but traffic management fees are also required for the testing to be performed on the trial site each year and it is not possible to predict these costs as it is dependent on time which is itself dependent on the number of products and the weather. Each product with a different formulation has to be tested. White and yellow only are included in the scope of the standard BS EN 1436 and every product must meet the colour requirements. In relation to the certification of road marking products in the UK, there is no legal requirement but the BSI operates a voluntary certification scheme for the performance of road marking materials against BS EN 1824 and BS EN 1436. BSI also operates a Kitemark voluntary product approval scheme for the manufacture of road marking line markings to BS EN 1871. These approvals are generally used by the Highways Agency and local authorities;

To estimate the costs across the EU we assume the following:

- of the assumed total of 20 paint manufacturers, 10 will manufacture road marking paints and 15 companies will manufacture other paints (anti-corrosive or intumescent paints);
- each road marking paint manufacturer manufactures two such products and each manufacturer producing other types of products will manufacture a total of five products requiring certification;
- each road marking paint needs to be certified in a maximum of five different countries;
- each of the other types of paint needs to be certified in a maximum of three different countries;
- the cost of certification for each road marking product is €2,600-€5,000 per product; and
- the cost of certification of each product other than road marking paint is €700-€1,850.

Table 6.12: One-off Compliance Cost per Product for Coatings and Paints (2009)

Parameters	**Re-certification of road marking paints**	**Re-certification of other types of paints**
Number of companies involved	10	15
Number of relevant products requiring re-certification	20	75
Number of differrent re-certifications needed across the EU	100	225
Cost of re-certification per product per country	€2,600 - €5,000	€700 - €1,850
Overall cost of re-certification	€260,000 - €500,000	€157,500 - €416,250
Total cost	***ca. €418,000 - €916,000***	

The above costs are based on a series of assumptions and should be considered to be indicative. More importantly, certifications (at least for road marking paints) are issued for a limited time only, therefore, even without reformulating these paints, manufacturers would still have to incur certain costs for re-certifying their SCCP-containing products (existing certifications will most likely expire before the implementation of the UN ECE restriction on SCCPs);

- **ongoing costs – additional cost of alternative substances**: the ongoing cost for manufacturers of paints and coatings will crucially depend on the choice of alternative and the intended role of SCCPs. For instance:
  - if MCCPs are chosen, then a higher loading would be required (we will again assume this will be 10% by weight);
  - if a plasticiser such as a phthalate is used in a formulation where SCCPs have acted as both a plasticisers and a flame retardant, the phthalate would need to be accompanied by an alternative flame retardant, thus potentially increasing the overall cost of the formulation;
  - if the chosen alternative does not ensure adequate viscosity, one or more additives will be needed to ensure that the final product has the required rheology characteristics; and
  - MCCPs' price per tonne is €500, LCCPs' is €1,000 and di-isononyl phthalate's is €800 per tonne.

  All these changes would inevitably affect the concentration of the remaining ingredients (resins, fillers, etc.) in the formulation and consequently their contribution to its overall cost. For simplicity and due to the lack of more detailed information, we will only consider the direct cost of replacing SCCPs with a series of alternative substances. The estimated costs for replacing SCCPs with alternative substances are shown in **Table 6.13**.

Table 6.13: Estimated Costs/Savings to Paint and Coating Formulators from the UN ECE Restriction on SCCPs

Chosen alternative	Maximum tonnage required	Overall additional annual cost	Present Value over 5 years*
MCCPs	111	-€5,000	-€28,000
LCCPs	101	€40,400	€220,000
Di-isononyl phthalate	101	€20,200	€110,000

** we use a discount factor of 4% over 5 years*
The figures above have been rounded

It is not possible to calculate the additional cost to manufacturers of paint when complex changes to the formulation are made such as a reduction in the presence of styrene and an increase in the presence of long chain acrylic polymers to ensure 'internal' plasticisation. The above calculations do not take into account changes to the performance characteristics of the formulations; and

- **ongoing costs – certificate maintenance**: the following table summarises the annual costs of certification that have been provided by a current user of SCCPs. These reflect costs per product rather that cost per tonnage. It is worth noting the difference in costs between road marking paints and other products. These costs are considered too small in comparison to other costs identified above and are not taken into account in the estimate of the overall costs.

Table 6.14: Annual Compliance Cost per Product for Coatings and Paints (2009)

Type of product	**Cost of annual maintenance of certifications**	**Cost of special annual maintenance of certifications**
Interior coating	€75	
Anti-corrosion coating	€75	
Swimming pool/water tank coating	€75	
Chemical resistant coating	€75	
Basecoat for aggressive environments	€75	
Basecoat for porous substrates	€75	
Road marking paint	€565	€1,700

Source: Consultation

<u>Impacts on users of paints and coatings (mainly for road marking paints)</u>

Information on how end users may be affected has been provided by a manufacturer of road marking paints. The company assumes that the substitution of SCCPs by a phthalate may represent a 10% increase in the final cost of the paint. Alternatively, internal plasticisation by replacing styrene with flexible acrylic monomers would be even more burdensome, resulting in more than 20% increase in the final price of the paint.

On the other hand, data from BiPRO (2007) suggest that a ban in the EU on SCCPs might lead to a 7% increase in the cost of acrylic paints. The difference between the company’s estimates and those reproduced by BiPRO could be explained by the fact that road marking paints are very demanding products and their re-formulation may be more costly than for the ‘average’ SCCP-containing paint.

Finally, it is worth noting that SCCP-based paints are generally used by professional/industrial users. A paint manufacturer that uses SCCPs in a variety of paint products has indicated that only around 1% of its relevant products were sold to private consumers in 2009.

Other Issues

As discussed for sealants, SCCPs are used in specific ranges of products. If they became unavailable, it would be possible that these products might simply disappear rather than be reformulated (it is also possible that people in some companies may not know that they are still using SCCPs). A manufacturer of SCCP-containing paints noted that these products account for less than 5% of the total production by volume within a portfolio of 250 types of paints. For swimming pool paints, only the SCCP-based product is sold by this company. For road marking, they sell two products, one of which is SCCP-based. The company has indicated that they would prefer to discontinue the manufacture of these products as the REACH authorisation process can be quite expensive.

On the other hand, another road marking paint manufacturer indicated that SCCPs-based paints account for 60% of his production. Therefore, the scale of impacts might differ considerably among users of the substance.

Summary

The following table summarises the estimated costs to paint and coating formulators and their downstream users.

Table 6.15: Summary of Estimated Costs/Savings to the EU Paints and Coatings Industry from the UN ECE Restriction on SCCPs

Cost element	Estimated magnitude
Paint and coatings manufacturers	
One-off R&D costs	€205,000 – €769,000
One-off re-approval costs	€418,000 – €916,000 (but probably lower)
Cost of alternative substances	-€28,000 – €220,000 (present value over 5 years)
Cost of alternative products (different chemistry, i.e. thermoplastics)	Unknown, but alternatives could last longer than SCCP-containing paints (4 years vs. 1 year)
Paints and coatings users	
Cost of using products with alternative plasticisers	7% for acrylic paints (literature) 10-20% for road marking paints (consultation)
Cost of using alternative paint/coating products	Unknown (but thermoplastic road markings could last longer than SCCP-containing road marking paints)

6.3.6 Economic impacts for the textile treatment industry

Importance of SCCPs and drive behind their use

Past literature and consultation has revealed that they attributes of SCCPs that make their use in textile treatment attractive include:

- **poor water solubility**: SCCPs are poorly soluble in water; this relates to their chlorine content and chain length. SCCPs impart this water repellence to the matrix of the end product and prevent the product from degrading in water;

- **simplicity of use**: the method of use of SCCPs is apparently very simple and effective. Textile finishers[17] have traditionally been able to purchase the product and prepare their own compound and then apply it to textiles;

- **long tradition**: impregnation of textiles with SCCPs goes more than 50 years back. We have been advised that, during World War II, SCCPs were used on canvas to stop it from rotting, to make it water repellent and to protect fabrics from degradation; and

- **low cost**: tent textile impregnation with an SCCP-based system appears to come at half the price of alternatives (€0.23/metre while alternative systems might cost typically around €0.46/metre).

Quantification of impacts

The extent of the costs to be incurred would differ for:

- **users of SCCP-based flame retarding compounds**, where the key cost aspects would include:
  - R&D costs;
  - re-approval costs;
  - costs from the use of alternative flame retardants; and

- **users of treated textiles** (tents).

<u>Impacts on users of SCCP-based flame retarding compounds</u>

There may be several elements of cost that might arise for companies involved in textile finishing with SCCPs as a result of the UN ECE ban. These might include:

- **one-off costs – laboratory research and factory tests**: no specific information is available on this and the cost is generally expected to vary between different companies. An indication of the length of time required was given by company **Textile Company 3** which suggested that 1-2 years were required before SCCPs were replaced in the late 1990s. This period may be shorter for any companies involved in upholstery back coating rather than tent impregnation. For the former, we are advised that transition to MCCPs should be fairly straightforward and must have largely taken place already within the EU. With regard to tentage, a UK expert on flame-retarded textiles has suggested that, as tents last a long time (10 years or more), a company would have to spend a significant amount of time and money on special testing and even then the company can only test factory production in volume. This could entail a significant cost.

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17 Note that for tentage the word 'impregnation' is more accurate than 'finishing', as discussed earlier in this report.

We may also assume that tents destined for use by the military would also need to be processed in accordance with specifications set by the relevant Ministry of Defence of other national defence agency. This could entail an additional cost for testing new tent material that has been impregnated with alternative products. Unfortunately, we do not have sufficient information estimate the scale of this cost element;

- **ongoing costs – use of alternative flame retardants**: ECHA (2008) presented in tabular format the comparison of the costs per tonne for different alternatives.

Table 6.16: ECHA Comparison of Costs of Alternatives to SCCPs for Textile Applications

Alternative	Cost
MCCPs	Similar cost of substance, possible higher use rate; additional one-off costs
LCCPs	Higher cost of substance; additional one-off costs.
DecaBDE	Significantly higher substance cost than SCCPs; additional one-off costs. Requires diantimony trioxide
HBCDD	Significantly higher substance cost than SCCPs; additional one-off costs. Requires diantimony trioxide
Ethane, 1-2 bis(pentabromophenyl)	Significantly higher substance cost than SCCPs; additional one-off costs. Requires diantimony trioxide

Source: ECHA (2008)

As discussed in earlier in this SEA, the price per tonne of SCCPs, MCCPs and LCCPs is assumed to be €600, €500 and €1,000 respectively. These prices however do not provide an accurate reflection of the costs. MCCPs, for instance may need to be used at higher loadings than SCCPs. From a practical point of view, of help is the information provided by an expert in textile finishes. He has indicated that SCCPs may need to be replaced by a combination of MCCPs and decaBDE. It is not clear what the percentage of SCCPs in the flame retarding compounds at present is. It has been suggested, "*the recipe is based on using a lot of SCCP but this is a secret known only to those doing the processing*". In the alternative flame retardant compound, decaBDE is the one that offers fire resistance (it is actually a better flame retardant than SCCPs) while MCCP are added "*purely as a cheap plasticiser for the system that helps waterproof and flame-retard*".

We have been advised that alternative formulations may contain 5% MCCPs and 8% decaBDE. We have also been advised that decaBDE has a per tonne price which is three times higher than the price of SCCPs. Unfortunately, it is not possible to estimate whether and by how much the cost of 1 tonne of flame retardant compound would increase as we do not know at what concentration SCCPs are used and what the cost of the remaining components is. However, we have been advised that the cost to the textile processors of alternative impregnation systems for tentage would be double that of SCCP-based system, €0.46/metre as opposed to €0.23/metre for SCCPs-based treatment compounds. We can therefore calculate the costs to the EU textile finishing industry by making these assumptions:

- the EU textile industry consumption of SCCPs is 29 tonnes per year (see **Table 3.4**)
- the treated textile is of 400 grams per square metre of which 35% (140 grams per square meter) is SCCPs-containing compound (this is information provided by a UK expert);
- the width of treated textile produced is 1 metre (i.e. the length of 1 m^2 of textile is also 1 metre)[18]; and
- the cost difference for textile finishers when moving from SCCP-containing compounds to SCCP-free compounds is €0.23/metre.

Calculations are shown in the following table. The table assumes five different concentrations of SCCPs in the flame retarding compound since we are told that its concentration is "*a lot*" but we do not have a clear indication what this exactly means in quantitative terms (the composition of the compound mixture is confidential).

Table 6.17: Estimates of Additional Costs to EU Textile Finishing Industry

SCCP % in compound	Tonnage of compound produced	Tonnage of treated textile produced	Metres of treated textile (1m width)	Additional cost per year	Present value cost over 5 years*
10%	290	829	2,070,000	€476,000	€2,595,000
20%	145	414	1,036,000	€238,000	€1,298,000
30%	97	276	690,000	€159,000	€867,000
40%	73	207	518,000	€119,000	€649,000
50%	58	166	414,000	€95,000	€518,000

** we use a discount factor of 4% over 5 years*
Note: the figures above have been rounded

We have been advised that the last remaining textile finisher in the UK is rather reluctant to move away from SCCPs due to the cost and performance implications this would result in; however, efforts are being made and a transition to alternatives has been initiated. Some companies appear to have made the transition to alternatives without serious consequences. **Textile Company 6** replaced SCCPs with MCCPs (at roughly the same price) and did not face any technical performance or cost issues with the substitution process. **Textile Company 2**, which is involved in the coating of upholstery, also moved away from SCCPs in 2006, apparently without serious implications.

<u>Impacts on users of flame retarded textiles (tents)</u>

An expert has suggested that the market price of textile treated with SCCP-based could be ca. £10 per square meter or €11.5 per square meter in finished form. The price of €0.23/m^2 that the textile processor would face if SCCPs were no longer available would

[18] We are told that width is a machinery vs. economics question. Traditionally, textiles would be 100 cm wide. Weaving at 200 cm saves money but one must invest in new looms. Notably, most cloths are woven outside EU (India/Pakistan).

be rather small compared to the price that the treated textile is sold at. However profit margins are tight through long-standing contracts so the additional cost of ca. €0.23/m^2 could be an important cost that may have to be absorbed when costs are pre-defined.

Other issues

To place the above discussion into context, the following should be noted:

- applications of SCCPs in upholstery are apparently easier to switch to alternatives, compared to ‘dry proofing’ of tents;
- the number of companies using SCCPs in this sector is apparently very small with probably only one or two major tent maker in Western Europe (apart from the confirmed user in the UK, we know that a French distributor supplies SCCPs to a textile processor in France);
- the use of SCCPs is very limited at present. For tents, SCCPs use declined due to a general switch to PVC but that PVC use is now in decline and experts suggest that there is a shift back to traditional tentage (which could in theory decelerate the decline in the consumption of SCCPs); and
- the issue of SCCPs is known to users for many years now. Indeed, even the company we have identified as a major maker of flame retarded tents has decreased its consumption of SCCPs and is in the process of developing alternative solutions. In this respect, any costs incurred for R&D and implementing changes should not be considered to stem from the UN ECE ban but rather from the company’s own initiative.

Summary

The use of alternatives could double the cost of flame retardant compounds for the textile finishing companies. With an increase of the cost from €0.23/metre to €0.46/metre and an estimated SCCPs consumption of 29 tonnes/year, the present value cost of using alternatives would be **€0.52-2.60 million** (present value over five years), depending on the concentration of SCCPs in the flame retarding compound. A certain one-off cost for R&D and re-approval to standards would also arise but specific information on its scale is not available. It is worth noting however that only a few companies may still be using SCCPs for textile impregnation in the EU.

6.3.7 Economic impacts for manufacturers of alternatives

As SCCPs will not only be substituted by other chlorinated paraffins but also by non-chlorinated substances, there will be a certain loss of sales for the existing producers; on the other hand producers of substitutes will have corresponding increases in sales of more expensive products. We cannot estimate what proportion of the current consumption of SCCPs might be replaced by any one specific alternative substance (or product), therefore it is not possible to quantify the benefits for manufacturers (and suppliers) of non-chlorinated paraffin alternatives. It is clear, however, that relevant tonnages are modest and MCCPs/LCCPs are leading alternative substances. Therefore, any benefits to manufacturers of non-chlorinated paraffin alternatives will be small.

6.3.8 Economic impacts for public authorities

We do not have information on the likely costs to public authorities from the UN ECE ban. However, the substance has already been included in the candidate list for authorisation (Annex XIV of REACH) as a Substance of Very High Concern and ECHA has recommended its inclusion to Annex XIV of the REACH Regulation. Moreover, the use of SCCPs in the EU has greatly declined in the last 15 or so years and they are apparently used at present by a limited number of users.

On the other hand, inclusion of the substance in the EU POPs Regulation is possible. This would automatically create obligations for EU Member State authorities for the safe handling of stockpiles and the environmentally sound disposal of wastes containing the substance.

It is clear that by the time the UN ECE restriction comes into force, the substance is likely to have been so comprehensively regulated (e.g. it may not be registered or it may be restricted or may have been registered but not authorised, etc.) that the costs arising for public authorities specifically from the UN ECE restriction would be negligible.

6.3.9 Social impacts

Employment and labour markets

We have received very limited specific information from industry stakeholders. Given the now greatly reduced size of the SCCPs markets in the EU, it is unlikely that any noticeable employment impacts might arise. It is possible however that for isolated companies for which SCCPs are very important implications might be noted as a result of increased formulation costs or product performance issues.

Standards and rights related to job quality

Exposure of workers to chemicals would change following the possible replacement of SCCPs by alternatives. However, we do not have sufficient information to assess this qualitatively or quantitatively in the timeframe of this SEA.

Social inclusion and protection of particular groups

Not relevant for this SEA.

Gender equality, equality treatment and opportunities

Not relevant for this SEA.

Individuals, private and family life, personal data

Not relevant for this SEA.

Governance, participation, good administration, access to justice, media and ethics

Not relevant for this SEA.

Public health and safety

As for workers, exposure of the public to chemicals would change following the possible replacement of SCCPs by alternatives. We do not have sufficient information to assess this qualitatively or quantitatively.

Generally, private individuals are not expected to handle materials and mixtures that contain SCCPs apart from a few cases (possibly some sealants or paints, commercial tents, etc.).

Crime, terrorism and security

Not relevant for this SEA.

Access to and effects on social protection, health and educational systems

Not relevant for this SEA.

Culture

Not relevant for this SEA.

Social impacts in third countries

Not relevant for this SEA.

6.3.10 Wider economic impacts

Functioning of the internal market and competition

The proposed UN ECE restriction is unlikely to have a discernible impact on the free movement of goods, capital or workers as it would apply uniformly across the EU. Given the limited presence of SCCPs in products sold to consumers, the proposed restriction will not lead to any reduction in consumer choice.

Competitiveness, trade and investment flows

The Environment Agency for England and Wales (2008) discusses the likely competitiveness impacts on UK companies from additional regulation on chlorinated paraffins. This report notes that the combination of cost advantage and technical simplicity could create increased opportunity in areas of the world with no regulatory restriction of chlorinated paraffins to compete both internationally and in the home market of the countries where restrictions apply. One symptom of this would be the growth of chlorinated paraffin manufacturing capacity as is currently being seen in China.

The Environment Agency expresses a concern that increased regulation costs and restrictions in the UK might act to encourage imports of finished products (or components for these) that may contain chlorinated paraffins to replace home production. As the chlorinated paraffin content of these would eventually reach the environment through production activities or the waste chain, this could result in exactly the same long-term damage to health and the environment that regulation of these chemicals aims to avoid. In practice it may be difficult to identify whether a product contains SCCPs or MCCPs, or indeed police or create restrictive trade rules for such products within the EU market (Environment Agency for England and Wales, 2008).

Indeed, the overall picture for chlorinated paraffins in the UK is that the reduced use reported by industry groups, in response to health/environmental concern & regulatory pressure/restrictions, is being borne out by reduced production and trade of these chemical types in and out of the UK. However, the available UK trade data show that there have been increased imports of “saturated chlorinated acyclic hydrocarbons” into the UK in 2007 (Environment Agency for England and Wales, 2008). Assuming that these trading patterns are relevant to the whole of the EU, it is possible that further regulation on SCCPs could impact EU-based businesses while indirectly encouraging imports of the substance and of SCCP-containing products/articles from non-EU countries.

It is also worth noting another point made by the Environment Agency. There is a general trend among users of SCCPs to move to MCCPs. Whilst less harmful, MCCPs have been identified as posing unacceptable risks to the environment when used in certain applications. Therefore, companies who have already incurred reformulation, development and marketing costs as a result of restrictions on SCCP might end up being exposed to further costs should restrictions on MCCP are introduced in the future.

Third countries and international relations

We discussed above the possibility that a restriction on SCCPs in the EU might encourage imports of the substance in mixtures and articles from non-EU countries. It is also worth noting other international regulatory dialogue processes that relate to SCCPs. Such a dialogue relates to the Stockholm Convention on Persistent Organic Pollutants (POPs). In November 2006, the European Union and its Member States that are Party to the Convention submitted a proposal for SCCPs to be listed in Annexes A, B or C of the Stockholm Convention pursuant to paragraph 1 of Article 8 of the Convention. In the statement of concern, it was noted that,

> *"SCCPs are highly toxic to aquatic organisms and it is considered as a possible carcinogen. SCCPs do not break down naturally and tend to accumulate to biota. The available data from remote areas clearly show contamination of the environment and biota by SCCPs. Their persistence, bioaccumulation and toxicity mean that they may have damaging environmental effects at a global level. Overall, it can be considered that SCCPs meet the screening criteria for persistence, potential to cause adverse effects, bioaccumulation and potential for long range environmental transport.*
>
> *Placing on the market and use of SCCPs have been restricted over the last years in the European Union but no total prohibition has yet been foreseen. On the other hand,* ***production and use of SCCPs continues unrestricted in many other countries.*** *As SCCPs can move in the atmosphere far from [their] sources, single countries or groups of countries alone cannot abate the pollution caused by [them]. Due to the harmful POP properties and risks related to its widespread production and use, international action is warranted to control this pollution."*

The benefits from the inclusion of SCCPs to the Stockholm Convention/EU POPs Regulation are indirect and are associated with elimination of their production and use elsewhere in the World and the reduction in their environmental concentrations and long-range transport. Also, the collection of stockpiles that contain SCCPs and their incineration could serve to reduce the risk of stockpiles being used and potentially the active ingredients being released to the environment or impacting wildlife, animals or humans. Overall, the risks of imports from third countries, especially in Asia could be addressed.

The fifth meeting of the Persistent Organic Pollutants Review Committee (POPRC-5) of the Stockholm Convention took place from 12-16 October 2009 in Geneva, Switzerland. After detailed discussions, the Committee agreed to keep SCCPs in the Annex E phase for further consideration at POPRC-6, with the provision that parties and observers would be invited to provide additional information on: production data; inventories of uses; information on releases; and additional information that could assist with evaluation, including on toxicity and eco-toxicity and on national and international risk evaluations.

Although the implementation of a UN ECE restriction could in theory support the nomination of SCCPs as a POP under the Stockholm Convention, it is likely that the discussions under the Stockholm Convention will be completed before the implementation of the UN ECE restriction. Moreover, the outcome of the discussions on the PBT properties of SCCPs will be influenced by the results of ongoing research on the persistence of chlorinated paraffins. Industry has advised that the latest biodegradation test results on chlorinated paraffins are indicating that persistence is a function of chlorination level, and that it is now found that some commercial SCCP and MCCP grades are readily degradable (some of this new information has been included in recent submissions to the UK authorities and to the UNEP POPs process).

Macroeconomic environment

No macroeconomic impacts are expected from the proposed UN ECE restriction.

6.3.11 Environmental and human health risks

Environmental emissions of SCCPs

Very limited new information was collected in the course of this SEA. More specifically:

- a conveyor belt manufacturer indicated that monitoring of SCCPs emissions is not required by the local authorities, and therefore is not undertaken;

- a sealant manufacturer indicated no emissions apart from around 0.5 kg SCCPs per year possibly disposed off as special waste (this includes cleaning solvent from cleaning tools, mixers and rugs) which may weigh <100 kg/year. This is an estimate as no measurement has been undertaken. The company noted no other emission as SCCPs is kept in drums in silos from which it is pumped through a fixed pipe into the mixer. The lid on the mixer is always on and the final product is eventually pushed out of the mixer into tins; and

- a paint manufacturer did not provide any emission information during the manufacture of its road marking paints. The company expects that the entirety of the product will end up in soil (effectively on a road surface). With regard to the application phase, the company had no information on the amount of SCCPs that could be lost to air, but believes it will be minimal due to its high boiling point.

No information further to that presented by ECHA (2008) has been identified. In this regard, it may worth noting the emission factors for the different applications and lifecycle stages of articles, as presented by ECHA (2008). These are shown in **Table 6.18**.

Table 6.18: Environmental Emission Factors for SCCPs

Sector	Lifecycle stage	Emission factors
Rubber	Raw material handling	Wastewater: 0.01%
	Compounding	Air: 0.005% Wastewater: 0.005%
	Conversion	Air: 0.005-0.025% Wastewater: 0.005-0.025% assumed for sites where air emission control is present (assumed to be 80% of the sites) Air: 0.05-0.25% Wastewater: 0.05-0.25% assumed for sites where no air emission control is present (assumed to be 20% of the sites)
	Volatilisation during life	0.05% over lifetime
	Leaching during life	0.25% over lifetime
	Erosion/particulate loss during life	2% over lifetime 2% at disposal

Table 6.18: Environmental Emission Factors for SCCPs		
Sector	**Lifecycle stage**	**Emission factors**
Sealants and adhesives	Formulation	Waste: 5%
	Application	Losses in solid waste - after use around 2-3 cm^3 of sealant would remain in the cartridge nozzle and tube and this will quickly skin over (cure) and so remain within the packaging. The discarded cartridges would be disposed of as waste to landfill
	Volatilisation during life	0.2% during lifetime
	Leaching during life	0.75% per year over a 10-30 year lifetime for sealants
	Erosion/particulate loss during life	2-5% over lifetime 2-5% at disposal
Paints	Formulation	Waste: 0.75-1% (equipment leftover and packaging)
	Application	Wastewater: 0.1% Waste: 2.5-60.5%
	Volatilisation during life	0.4% per year over a 5-7 year lifetime for painted articles
	Leaching during life	1%
	Erosion/particulate loss during life	2-6.5% over lifetime (includes emissions at disposal)
Textiles	Formulation	Wastewater: 0.5% (the formulation emitted will be in the form of a viscous mixture of SCCP with the backcoating polymer. Many sites will have a solid extraction system in place before the effluent is discharged from the site and this is likely to remove the SCCP as a "paint-like" film and so the actual releases of SCCPs are likely to be much lower than estimated using this emission factor) and 0.15-0.2 kg of SCCP per batch (losses in-between batches)
	Volatilisation during life	0.125% over lifetime
	Leaching during life	0.25% over lifetime
	Erosion/particulate loss during life	2% over lifetime 2% at disposal
Source: ECHA (2008)		

Environmental and human health hazard profile of alternatives

With regard to the environmental and health effects of alternatives, a considerable amount of information is presented in ECHA (2008). The conclusions on a number of potential alternatives are summarised in **Table 6.19**.

Table 6.19: Summary of Toxicity and Ecotoxicity Profiles of Selected Alternatives to SCCPs		
Alternative	**Toxicity**	**Ecotoxicity**
MCCPs	Reproductive toxicant, effects on liver, kidney	R50-53; not readily biodegradable
LCCPs	Possible carcinogenicity and reproductive effects	Not readily biodegradable; does not meet B and T criteria
Cresyl diphenyl phosphate	Toxicity to liver, kidney and blood	Does not meet P, B or T criteria
Tertbutylphenyl diphenyl phosphate	Possible liver, kidney and adrenal toxicity	Does not meet P and B criteria; provisional classification R50
Isopropylphenyl diphenyl phosphate	Low toxicity	Does not meet P and B criteria; acute aquatic toxicity <1 mg/l
DecaBDE	Neurotoxicant	Not readily biodegradable, low to moderate bioaccumulation potential
Hexabromocyclododecane	Developmental effects	Meets the PBT criteria
Ethane, 1-2 bis(pentabromophenyl)	Limited data, but likely to be of low toxicity	Not readily biodegradable, may be persistent
Phthalates	Possible developmental effects	Readily biodegradable; generally no effects at solubility
Source: ECHA (2008)		

This table does not include all possible alternatives. In the course of the SEA, a number of alternative materials and products have been identified as alternatives, for instance, PVC and chloroprene rubber for conveyor belts, silicone sealants, and thermoplastic road markings. At present, detailed information is not available on such alternatives. Adverse effects from alternatives could be of importance (for example, chloroprene has a classification of R45, Carc Cat 2).

6.4 Option 1b: UN ECE restriction with a chlorination level limit

6.4.1 Background

This Option is being considered due to the fact that a limit on the chlorination levels in SCCPs has also been discussed among UN ECE parties. It is not currently clear whether this clause will be added to the final version of the discussed UN ECE restriction. The cut-off limit in the level of chlorine in the SCCPs commercial grades that has been proposed in recent discussions is 48% by weight and this limit will be considered in our analysis.

6.4.2 Chlorination Levels

Chlorination levels for SCCPs used in rubber

According to literature, chlorinated paraffins with high chlorine contents (e.g. ca. 70% wt. Cl) have been used in rubber. Information provided by Eurochlor in the past indicates that, in the EU, SCCPs with chlorine contents of around 70-71% only were supplied for use in rubber. Chlorinated paraffins with lower chlorine contents may also be used in rubber, where they have a plasticising and flame retarding function (Environment Agency for England and Wales, 2007).

ECHA (2008) recalls information from the EU Risk Assessment Report according to which the SCCPs used indeed tend to be towards the higher chlorination end of the range but their chlorination can be between 63 and 71% by weight chlorine.

Consultation with an EU manufacturer of conveyor belts suggests that the chlorination of the product used in his products is around 60%, while the Bulgarian authorities suggests past use of SCCPS with 52-56% by weight Cl. There is evidence however, that higher levels are also possible.

Chlorination levels for SCCPs used in sealants and adhesives

Information is available from only one company which has indicated that the degree of chlorination of the SCCPs used is 56% but there is evidence that the chlorination level could be higher. Where flame retardancy is required, higher chlorine levels in the SCCPs used should be anticipated.

Chlorination levels for SCCPs used in paints

The survey undertaken in the late 1990s in the UK which was mentioned earlier in this report (Environment Agency for England and Wales, 2007) found that the chlorine content of the SCCPs, where used, was generally in the range 65-70% by weight. Such a high percentage would probably indicate use as a flame retardant, apart from as a plasticiser. The applications that have been identified as relevant for the year 2010 suggest that SCCPs are generally used as plasticisers. In intumescent paints, which offer fire protection, SCCPs may apparently be used as a plasticiser and a gas source, although their flame retardancy must be a welcome addition. The only downstream user that provided details of the chlorination of SCCPs used (in road marking paints) indicated a chlorination level of 50-54%. Perstorp (undated) suggests the use of MCCPs with a chlorine content of 52% but also chlorinated waxes (LCCPs) with a chlorine content of 70%.

Chlorination levels for SCCPs used in rubber

No information has become available through consultation. Environment Agency for England and Wales (2007) reports past information according to which SCCPs with chlorine contents of around 56-60% wt. Cl were supplied in the EU for backcoating of textiles.

Summary

It would appear that literature frequently suggests significantly elevated chlorination levels (up to or even above 70%), although it is clear that products with a chlorine content as low as 50% may also be used. It is very likely that a chlorination level limit of 48% would effectively prevent all current users in the EU from continuing the use of their chosen SCCPs grades.

6.4.3 Economic impacts on manufacturers of SCCPs

Consultation with industry clearly shows that manufacturers of SCCPs would in principle be able to achieve as low a chlorination level as required by a restriction. The process would not, in principle, have any discernible complication or cost.

However, it should be realised that for the majority of the current SCCP applications high chlorination is desired for fire resistance (but also for water repellence). The short chain length coupled with high chlorination provides optimum fire resistance whilst maintaining sufficiently low viscosity to enable workability in some formulations. MCCPs could have a good level of chlorination but their flame retarding effect may not be sufficient where high levels of fire retardancy are required - as noted earlier, an increased loading of MCCPs of 10% is normally required to achieve equivalent retardancy. Specific applications would potentially be problematic when using SCCPs of lower chlorination levels.

It is clear that the impacts on manufacturers of SCCPs will crucially depend on the response of downstream users to the limit on chlorination levels, i.e. on their willingness to use new SCCPs grades with a chlorination level equal to or lower than 48% by weight. This is discussed below.

6.4.4 Economic impacts on downstream users of SCCPs

It is important to note that the downstream users that might be affected by this Option are those using SCCPs in conveyor belts and dam sealants as only those two would be exempted from the UN ECE ban under this Option. For conveyor belts, high chlorine content is important to ensure high levels of fire retardancy (which meets the relevant fire safety standards) while, for dam sealants, high chlorine content is probably needed too to ensure a high level of water repellence and waterproofing.

We have not received any specific information from consultation on the practical implications of the theoretical use of SCCPs commercial grades with a chlorination content of 48% or below. Indeed we would not expect EU-based users of the substance to have any practical experience on this; the Risk Assessment Report for SCCPs notes that the chlorine content of commercially available grades in the EU typical is 49-70%.

It is difficult to predict what the response of downstream users might be but it is conceivable that where SCCPs grades with significant chlorination levels are currently used, the ‘new’ low-chlorine grades would probably be unsatisfactory. We can provide here a quick calculation on the implications of a lower chlorine level. We assume:

- a manufacturer of rubber conveyor currently uses an SCCPs grade with a chlorine content of 65% and as a result of Option 2 is required to switch to a new product with a chlorine content of 48%;

- the concentration of SCCPs in the rubber products is 10%; and
- SCCPs is the only source of chlorine that is present in the rubber cover of the belt.

The content of chlorine in the final rubber product is 6.5% (= 65% x 10%). To achieve the same level of chlorination of the final product (i.e. the same level of fire retardancy) when using a 'new' SCCPs grade with 48% chlorine by weight, the concentration of SCCPs in the final product would need to be ca. 13.5% (= 6.5% / 48%). This would represent an increase of the presence of SCCPs from 10% to 13.5% which is an increase of 35% in the presence of SCCPs in the formulation.

This is only a quick and rough calculation based on a very simplistic approach. Issues of compatibility, viscosity etc. play a very crucial role in the development of a formulation. The use of a significantly increased concentration of SCCPs will not only come with a raw material cost. It would also mean that the rheology and other characteristics of the final product would change. This would require a potentially complete reformulation of the product. With these considerations in mind, it would potentially be preferable for many companies to use MCCPs with a chlorine content higher than 48% and a price per tonne lower than that of SCCPs. It should be remembered that this SEA assumes that replacement of SCCPs with MCCPs would require a 10% increase in the loading of chlorinated paraffin; this is much lower than the simplistically calculated additional 35% in the above example for the fictional rubber manufacturer.

On the other hand, it should be remembered that SCCPs are used because they offer a combination of desirable characteristics such as a fire retarding effect, a plasticising effect, good viscosity characteristics, etc. Therefore, different users would need to consider a range of different parameters before deciding to continue using SCCPs even with a lower chlorine content of 48%.

In conclusion, it is highly possible that a limit on the chlorination levels of SCCPs commercial grades would make their use uneconomical and would probably drive the remaining downstream users away from SCCPs. The overall result could be that the use of SCCPs would cease even in the two exempt uses. The impacts from an UN ECE restriction without exempt applications are discussed in the next Section of this document[19].

19 It should be noted that this discussion on whether users would opt for a SCCPs product with a lower chlorination level or not is somewhat academic. It would be very likely that EU-based manufacturers of SCCPs would decide to discontinue the production of SCCPs after losing the vast majority of their current markets. Changing their production to manufacture SCCPs grades with low chlorine content would make little sense if the remaining markets in the EU (those for conveyor belts and dam sealants) are small. It is more likely that manufacturers of SCCPs would prefer to migrate their downstream users to MCCPs.

6.5 Option 2: UN ECE restriction without exempt applications

6.5.1 Background

This option is a variant of Option 1. Under this, manufacture and use of SCCPs in the EU would be restricted without any exemption for conveyor belts for underground mining and dam sealants. Our analysis of impacts will therefore focus on those stakeholder groups which would, in theory, suffer impacts different to those under Option 1. These stakeholder groups include:

- EU-based manufacturer(s) of SCCPs;
- EU-based manufacturers and users of SCCP-containing rubber conveyor belts for underground mining; and
- EU-based manufacturers and users of SCCP-containing dam sealants.

6.5.2 Economic impacts on manufacturers of SCCPs

Under Option 2, total sales of 1,500 tonnes of SCCPs would cease. This scenario was considered in Section 6.3.1 (see **Table 6.2**). Overall, the lost turnover would have a present value (over 5 years) of **€0.84-2.2 million**.

6.5.3 Economic impacts on downstream users

Economic impacts for the rubber manufacturing industry

In relation to the rubber industry, the economic impacts under Option 2 would be the aggregate of those applying to manufacturers of other rubber products and those for manufacturers of conveyor belts. These may be calculated using the assumptions presented in Section 6.3.3 and are summarised in **Table 6.17**.

Table 6.20: Summary of Estimated Costs/Savings to the EU Rubber Industry from the UN ECE Restriction on SCCPs without Exemption for Conveyor Belts

Cost element	**Conveyor belting**	**Other rubber products**	**All rubber products**
Rubber product manufacturers			
One-off R&D costs	€38,000 - €13,000	Up to €563,000 (but probably much lower)	€38,000-€694,000 (depending on the number of companies involved and the status of their R&D work)
One-off re-approval costs	Nil (as re-approvals are required by new EN standard)	Unknown	Unknown
Cost of alternative substances	**For a current SCCPs consumption of 122 tonnes:** -€0.033 to €0.80 million (present value over 5 years)	**For a current SCCPs consumption of 40 tonnes:** -€0.011 to €0.26 million (present value over 5 years)	€0.044-1.06 million (present value over 5 years)
	For a current SCCPs consumption of 146 tonnes: -€0.04 to €0.96 million (present value over 5 years)	**For a current SCCPs consumption of 16 tonnes:** -€0.004 to €0.11 million (present value over 5 years)	
Cost of alternative materials	30-40% increase when moving from NR to CR	Unknown	Unknown
Rubber product users			
Cost of using products with alternative flame retardants	€8.2 - €24 million (present value over 5 years)	Unknown but considerably lower than for conveyor belts	>€8.2 - €24 million (present value over 5 years)
Cost of using products with alternative rubber products	Depends on choice of alternative made; or PVC belts costing 10-30% less than PVG belts, no real cost may arise (due to the poorer durability of PVC belts. For CR belts, cost may increase 10-13% (i.e. similar level as when alternative flam retardants are used)	Unknown	Unknown (overall)
Note: a negative sign (accompanied by red colour font) indicates a saving rather than a cost			

The above table would suggest that impacts on manufacturers of conveyor belts would be more significant than on manufacturers of other rubber products; this is logical consequence of the fact that conveyor belting is assumed to account for 75-90% of the total consumption of SCCPs in the EU rubber industry.

Economic impacts for the sealant/adhesive industry

For sealants and adhesives, if no exemption for dam sealants would be included in the UN ECE restriction, the additional tonnage of SCCPs that would have to be replaced would be 12-47 tonnes (5-20% of the total consumption of SCCPs in this industry sector) compared to Option 1. Evidently, the total tonnage of SCCPs that would need to be replaced would be the whole 237 tonnes that are assumed to be currently used in the sealants and adhesives industry each year. As discussed earlier, when MCCPs are used as an alternative, an extra 10% loading would be required (hence the tonnage of MCCPs that would be needed rises to 261, as shown in the table.

The next table presents the additional costs (expressed as present values discounted over 5 years) that the EU sealants industry would incur. The second table below provides an overview of overall substitution cost for the sealants and adhesives industry if all 237 tonnes of SCCPs had to be replaced.

Table 6.21: Estimated Costs/Savings to Sealant and Adhesive Formulators from the UN ECE Restriction on SCCPs – Costs relating to Dam Sealants Only

Chosen alternative	Dam sealant usage of SCCPs	Maximum tonnage required	Overall additional annual cost	Present Value over 5 years*
MCCPs	5%	13	-€600	-€3,300
	20%	52	-€2,350	-€12,800
LCCPs	5%	12	€4,800	€26,000
	20%	47	€18,800	€102,000
Di-isononyl phthalate	5%	12	€2,400	€13,000
	20%	47	€9,400	€51,000
Terphenyls	5%	12	€22,800	€124,000
	20%	47	€89,300	€487,000

** we use a discount factor of 4% over 5 years*
Note: the figures above have been rounded

Table 6.22: Estimated Costs/Savings to Sealant and Adhesive Formulators from the UN ECE Restriction on SCCPs without Exemption for Dam Sealants

Chosen alternative	Maximum tonnage required	Overall additional annual cost	Present Value over 5 years*
MCCPs	261	-€11,850	-€65,000
LCCPs	237	€94,800	€517,000
Di-isononyl phthalate	237	€47,400	€258,000
Terphenyls	237	€450,300	€2,455,000

** we use a discount factor of 4% over 5 years*
Note: the figures above have been rounded

The costs estimates do not differ significantly to those presented in **Table 6.8** when the assumption is that dam sealants only account for 5% of the overall consumption of SCCPs in the EU sealants and adhesives industry.

For this industry sector, we believe that no R&D costs would arise in addition to those described under Option 1. The available evidence suggests that manufacturers of dam sealants most likely manufacture other SCCP-containing products too, therefore they would need to undertake the very same R&D work described in Section 6.3.4 under either Option 1 or Option 2.

6.5.4 Other socio-economic impacts

The analysis on social and wider economic impacts presented for Option 1 (Sections 6.3.9 and 6.3.10) will largely apply for Option 2.

7. COMPARING THE OPTIONS

In this Section we compare to impacts of the three Options discussed in Section 6.

As described earlier, the difference between Option 1 and Option 1a is the chlorination level limit that would apply to the exempted uses. The limit would impact on the continued use of SCCPs in the two exempted uses, especially since the two uses are likely to require the use of a flame retardant or plasticiser with a high chlorination level. Placing a limit on the chlorination level is, therefore, likely to make it impractical for conveyor belt manufacturers and dam sealant manufacturers to continue using SCCPs in the future. This would potentially affect the users of these products and would also result in lost sales of SCCPs for the manufacturers of the substance (though, these losses could be potentially offset by increased sales of MCCPs or LCCPs).

Overall, Option 1a would probably have a similar, if not same, effect as a full restriction on the manufacture and use of the substance. In other words, the impacts from Option 1a are likely to be equivalent to those of Option 2.

With regard to Option 2 and how it compares to Option 1, we note the following:

- **manufacturers of SCCPs**: as discussed in Section 6.3.1, it appears quite unlikely that production of SCCPs in the EU would continue after the implementation of the UN ECE restriction, exempting the two selected uses. The demand for the substance by EU manufacturers of conveyor belts and dam sealant manufacturers is likely to be too small to allow for continued production of SCCPs within the EU. In any case, even if manufacture of SCCPs were to continue, the difference in the impacts on turnover calculated for Option 1 and Option 2 would be very small (see grey cells in Tables 6.1 and 6.2).

  Overall, it is important to note that the costs calculated for manufacturers in this SEA, could prove to be purely academic; the sustained regulatory pressures on SCCPs (e.g. REACH and discussions under the Stockholm Convention) have already made many of the downstream users to investigate and switch to alternatives. Therefore, impacts on manufacturers of SCCPs arising from any of the Options (and attributable to the UN ECE decision) could be very limited in the context of other developments;

- **rubber industry**: theoretically, the difference in impacts between Options 1 and 2 would be those relating to manufacturers and users of SCCP-containing conveyor belts for underground mining. The calculations presented in Sections 6.3.3 and 6.5.3 indicate that, in comparison to Option 1, Option 2 would further impose the following costs:

  - on **manufacturers of rubber conveyor belts**: R&D costs of €0.038-0.15 million, an additional cost for alternative substances of up to €0.96 million, though at the low end, some cost savings of around €33,000 may accrue (present value over 5 years, depending on the SCCPs consumption tonnage assumed (122 or 146 tonnes)) or a potential increase of 30-40% to the cost of raw rubber material (if CR material is used to replace SCCP-based tuber such as nitrile); and

- on **users of rubber conveyor belts**: the cost increase from using products with alternative flame retardants has been calculated at €8.2 - €24 million (present value over 5 years). Costs may also arise as a result of the poorer longevity of PVC belts which might be used as a replacement to SCCP-containing PVG belts; and

- **sealant industry**: the costs to manufacturers of dam sealants has been calculated at up to €487,000, though at the low end, some cost savings of around €12,800 may accrue (present value over 5 years), depending on the tonnage of SCCPs used in dam sealants and the alternative plasticiser used. No additional R&D costs would be envisaged.

The additional costs to the manufacturers of conveyor belts and particularly the users of conveyor belts may appear significant. However, it is unlikely that they would materialise in real life. First, the manufacturers of conveyor belts appear to be already in the process of switching to alternatives (probably MCCPs) and it is reasonable to expect the switching to be completed before an UN ECE restriction is implemented across the EU. Second, manufacturers of conveyor belts currently face the task of potentially reformulating their conveyor belts for underground mining in order to meet the requirements of a new European fire safety standard (EN 14973:2006). Manufacturers would be able to undertake reformulation to replace SCCPs as part of the process of complying with the new standard. They would also be able to pass on any costs to the users of the belts so that it incorporates the cost increase resulting from the replacement of SCCPs even before the UN ECE restriction is implemented.

8. CONCLUSIONS

8.1 Overview of the market situation

Extensive consultation was undertaken; over 500 companies and 21 trade associations were approached and those organisations that made an input to this SEA have confirmed that the manufacture and consumption of SCCPs in the EU has greatly diminished over the last 15 years during which regulatory pressures on the substance intensified. At present, it is estimated that around 1,500 tonnes of SCCPs are produced by two EU-based manufacturers (soon to be reduced to just one) and around 530 tonnes are consumed within the EU-27 (i.e. 970 tonnes are assumed to be exported to non-EU customers).

Traditional applications such as in metalworking lubricants and leather fat liquors have been effectively eliminated, while the remaining uses have also declined considerably. Based on statistics provided by Eurochlor, it is estimated that the most important use of SCCPs in the EU currently is in sealants and adhesives (237 tonnes) followed by rubber (162 tonnes), paints (101 tonnes) and textiles (29 tonnes). A small level of consumption in metalworking lubricants appears to still take place (based on a read-off of Figures 3.1 and 3.2) despite the existing EU legislation. No clear explanation for this has been provided, apart from the suggestion that it may be a reporting error.

Efforts have been made to consult as extensively as possible with stakeholders in the four key industry sectors of concern, as well as with manufacturers and distributors of the substance in the EU. As a general observation, we would note that consultees have been reluctant to take part in this study. On the one hand, this reluctance could be related to 'fatigue' after several studies and regulatory interventions on SCCPs (under the Limitations Directive (now replaced by REACH), the UN ECE framework and the Stockholm Convention on POPs); an important recent intervention has been the inclusion of SCCPs on the candidate list of Substances of Very High Concern and the subsequent recommendation by ECHA for its inclusion in Annex XIV of the REACH Regulation (authorisation). This has significantly affected the prospects of registration and eventual authorisation of the substance. We are also mindful that the substance also appears on Annex XVII (restrictions) of REACH and the possibility of a wider restriction on it under REACH is a realistic possibility.

On the other hand, the reluctance could be related to the fact that use of SCCPs is now limited and many companies have moved or are in the process of moving to alternative substances, formulations and articles. Many of the companies that have responded to our requests for information have proved to be past users of SCCPs; the majority of these have moved to MCCPs. Key trade associations in the industry sectors of concern have also argued that SCCPs are no longer used in their sectors.

Further research and consultation, however, indicates that there is a minor discrepancy between assertions by industry associations (relating to non-use of SCCPs) and the facts on the ground (i.e. the reality of use of SCCPs in the EU). Some users of SCCPs have been identified in sectors where the industry associations have indicated no current use.

This discrepancy may, however, relate to the fact that SCCPs are normally used at low quantities in a very small number of products, probably accounting for small proportions of the portfolios of the relevant companies. Also, some current users may be located in countries that are not represented within the key EU-wide trade associations or they may be small companies which do not belong to any association, hence their continued use of SCCPs may go unnoticed.

8.2 Availability of alternatives

A review of the available literature (supplemented with some consultation) indicates that a variety of alternatives are available for each of the applications of concern. These are summarised in **Table 8.1**.

Table 8.1: Overview of Available Alternatives for SCCPs

Application area	Identified alternatives
Rubber	**Alternative substances**: MCCPs, LCCPs, diantimony trioxide, aluminium hydroxide, synthetic and natural esters, calcium sulphonates, alkyl phosphate esters, sulphonated fatty acid esters, and possibly brominated flame retardants (decaBDE) **Alternative materials**: PVC (as conveyor belt covers) and chloroprene rubber
Sealants and adhesives	**Alternative substances**: MCCPs, LCCPs, phthalates (e.g. isooctyl benzyl phthalate, benzyl butyl phthalate, 1-isobutyrate benzyl phthalate, diisoundecyl phthalate, di-2-ethylhexyl phthalate), alkyl sulphonic acid esters of phenol and/or cresol, adipates (di-2-ethylhexyl adipate), benzoates (dipropylene glycol dibenzoate, diethylene glycol dibenzoate, dipropylene glycol dibenzoate), hydrogenated terphenyls, phosphoric esters. glycolate esters, polymeric plasticisers **Alternative products**: Silicones
Paints and coatings	**Alternative substances**: MCCPs, LCCPs, inorganic flame retardants (inorganic salts based on phosphorous, boron, silicon and sulphur derivates), brominated flame retardants, organophosphate flame retardants, nitrogen-based flame retardants, polyalcohols, amines, acids and ester derivates used in intumescent paints, phthalate plasticisers (dioctyl phthalates, dicyclohexyl phthalates), polyacrylic ester plasticisers **Alternative products and methods**: For road marking paints, thermoplastic coatings and methyl methacrylate and 2-part hardened products. Also reformulation to achieve 'internal plasticisation' has been suggested as a possibility
Textiles	**Alternative substances**: MCCPs, LCCPs, brominated flame retardants, such as decaBDE, HBCDD and 1,2-bis(2,4,6-tribromophenoxy)ethane, organosphosphorus compounds, nitrogen compounds A specific mixture of MCCPs (5%) and decaBDE (8%) has been suggested as the most likely solution for replacing SCCPs in tentage, which has been suggested as the key remaining application for SCCPs

Among the various alternatives identified, the most well known are the longer-chain chlorinated paraffins, i.e. MCCPs and LCCPs, with MCCPs appearing to be the alternative of choice for the vast majority of users. MCCPs (and LCCPs) have characteristics that resemble those of SCCPs, hence users already have considerable general knowledge and experience regarding the advantages and disadvantages of these substances. An additional advantage would be that price per tonne of SCCPs appears to have now become marginally higher than that of MCCPs; hence, switching to MCCPs could result in savings in the raw material costs.

Nevertheless, the use of MCCPs is not without problems: they have a lower chlorine content and higher viscosity and, as such, impart lower water repellence and flame retardancy to formulations and products that contain them. The high viscosity makes formulation and application (for instance, use of sealants on-site) more difficult. The result of this is that MCCPs may need to be used at higher loadings than SCCPs and/or be used alongside a viscosity regulator (e.g. a solvent) or an additional flame retardant additive (for example, a brominated flame retardant). It is worth noting that while the use of MCCPs as alternatives to SCCPs in metalworking fluids has been a success with MCCPs possibly performing better than SCCPs when certain additives are used, a similar 'tweak' may not be possible for the current uses of SCCPs.

Other available alternatives include substances such as phthalate plasticisers, brominated flame retardants, organophosphate flame retardants and phosphate plasticisers, inorganic flame retardants (e.g. aluminium trihydroxide) and several others. Some of these substances may perform better than SCCPs in certain ways (e.g. decaBDE is a more effective flame retardant than SCCPs and phthalates are generally better plasticisers than SCCPs); however, there is apparently no single substance (except perhaps MCCPs and to a lesser extent LCCPs) that can combine the performance characteristics of SCCPs. Several of these alternatives are several times more costly than SCCPs; indeed SCCPs may have been used in the past to ensure that the cost of formulation is kept low (for example, by partly replacing costly primary plasticisers such as phthalates).

In the course of consultation, we have been advised that a transition to alternatives may not be necessarily smooth and re-formulation could take a considerable time. This appears to be the case for all four application areas considered – several consultees indicated that they have been looking at alternatives for a considerable amount of time but still have not been able to complete the re-formulation process. On the other hand, companies have been identified in all four industry sectors that have now successfully moved to alternatives. This perhaps proves that transition from SCCPs to other substances/formulations or products is feasible but may come with performance issues and with a certain price tag. In the current regulatory climate (REACH requirements, POPs discussions and the UN ECE restriction), downstream users will have no option but reformulate or simply remove the relevant products from their product lines.

With particular regard to the two applications that are exempt from the UN ECE restriction (i.e. use as a flame retardant in conveyor belts for underground mining and as a plasticiser for dam sealants), mixed information has been collected. For conveyor belts, a major manufacturer has indicated that transition to MCCPs was smooth and low cost but two other companies are still working on alternatives. For dam sealants, none of the companies identified appears to offer dam sealants (we assume that waterproofing products for swimming pools and water reservoirs do not count as dam sealants). Some products identified on the Internet could fall under the description of a dam sealant but we were not able to obtain any information on whether these are still sold or have been reformulated. For other sealants, MCCPs generally appears to be the alternative of choice.

Overall, alternatives are available but, for some, their use could come at an increased price compared to SCCPs and could affect the performance of the relevant products. Importantly, concerted efforts to replace SCCPs have started well before the agreement on the UN ECE restriction and presumably will need to be completed with the REACH registration and authorisation deadlines in mind. Therefore, we do not believe that a UN ECE restriction would play a decisive role in encouraging users to switch to alternatives or indeed in selecting which alternative to switch to.

8.3 Impacts on stakeholders from UN ECE restriction

8.3.1 Introduction

The following paragraphs present the impacts to stakeholders from Option 1, which is the main restriction option considered in this SEA. The assessment of impacts on stakeholders has been based on several assumptions which were necessary as a result of the lack of specific information in key areas such as the price per tonne for SCCPs and alternatives, the number of companies using SCCPs at present and the split among different alternatives that current users may turn to once SCCPs become unavailable. Due to these assumptions and the inherent uncertainties surrounding them, the quantified impacts on different stakeholders should be considered as indicative and merely aiming to convey the likely magnitude of the implications of largely removing SCCPs from the EU market.

8.3.2 Manufacturers of SCCPs

For manufacturers of SCCPs, the loss of the EU markets for SCCPs would undoubtedly have an adverse effect. Whilst MCCPs (and to a lesser extent LCCPs) are the prime candidates to act as replacement for SCCPs, they are unlikely to perform as well as SCCPs and therefore, some downstream users may opt for different alternatives. The calculations made earlier in this SEA assume that the tonnage of SCCPs sold in the EU that may need to be replaced is 1,300-1,500 tonnes and that probably 50-75% of SCCPs currently sold would be replaced by MCCPs or LCCPs (mainly the former). This combination of assumptions results would result in a loss of turnover for manufacturers of SCCPs with a present value (over 5 years) of **€0.73-2.2 million**. This obviously is a calculation made at a given point in time for specific prices of products. Prices may well fluctuate and losses could be higher or lower.

It is not clear whether the substance will be duly registered and authorised – this will depend on the strategic outlook that each company takes and will also be influenced by the outcome of discussions in the framework of the Stockholm Convention. What is clear however is that the exempt uses would account for too low consumption to make the production of SCCPs in the EU profitable. EU manufacturer(s) of the substance might therefore be vulnerable to imports from non-EU countries (as will downstream users of SCCPs be vulnerable to imports of formulations and finished goods that will be plasticised or flame retarded with SCCPs by non-EU companies).

It is also worth noting that regulatory intervention has focused on SCCPs under specific EC/CAS numbers and specific molecular chain length distribution. It appears conceivable that imports of products of different distributions under separate EC/CAS numbers could be further undermine the position of EU-based manufacturers of chlorinated paraffins.

Finally, it should also be noted that MCCPs may contain up to 1% impurities of shorter-chain molecules. While a claim has been made that this impurity should not be considered to be an "SCCPs impurity" (SCCPs as a product cover a range of chain lengths rather than the C_{13} length only), it is possible that a low concentration limit introduced under an UN ECE restriction (or even a restriction under the EU POPs legislation) could have implications for the placing on the market of MCCPs grades that contain such impurities.

8.3.3 Rubber industry

For manufacturers of rubber products who currently use SCCPs, almost no information is available for the use of SCCPs in rubber products other than conveyor belts. We have assumed that there may be 10 companies in the EU which may still use the substance and which may wish to undertaken R&D work for the development of new formulations. We have also assumed that thee companies are aware of the regulatory pressures on SCCPs and have already completed at least 25% of their R&D work. With a cost of €75,000 per company for the entire R&D work, an overall cost of up to **€0.56 million** has been calculated. With regard to the costs of substitution, this would vary depending on the tonnage of SCCPs that would need to be replaced and the chosen alternative substance. For a current SCCPs consumption of 40 tonnes, we have calculated an additional cost of **up to €0.26 million,** though at the low end, some cost savings of around €11,000 may accrue (present value over 5 years), while for a current SCCPs consumption of 16 tonnes we have calculated an additional cost of **up to €0.105 million**, though at the low end, some cost savings of around €4,000 may accrue (present value over 5 years). The likely costs for users of rubber products that are currently flam retarded with SCCPs have not been possible to calculate.

8.3.4 Sealants and adhesives industry

For manufacturers of sealants and adhesives, we assume that work on reformulation has progressed significantly but further efforts need to be made. We have assumed a total of 20 EU manufacturers of sealants would need to undertake R&D work and that one third of the companies (i.e. 7 companies) have completed 25% of their research, another 7 have finished 50% of their research and another 6 have completed 75% of their research. The total cost of R&D work per company is assumed to be €50,000-100,000. Consequently, we have calculated an overall R&D cost of **€512,500-1,025,000**. With regard to the ongoing costs from the use of alternative substances, this would depend on the consumption of SCCPs in dam sealants (that would be exempt from the restriction) and the chosen alternative substance. This cost has been calculated at **up to €1.97 million**, though at the low end, some cost savings of around €61,000 may accrue (present value over 5 years). When less costly alternatives such as MCCPs are used, the costs could be much lower (using MCCPs only could perhaps result in a small cost saving but it is likely that MCCPs might be accompanied by further additives (e.g. viscosity regulators) which could add to the cost of the re-formulated product).

No specific information is available on the likely increase on the price that users of sealants and adhesives might experience. Literature suggests this could be at the level of 5%.

8.3.5 Paints and coatings industry

For manufacturers of paints and coatings, we have identified several applications of SCCP-containing formulation but the most critical one appears to be road marking paints. SCCPs are used in them as cheap plasticisers aimed at making the formulations more competitive. It is important to note that road marking paints may find wider use in Southern and Eastern EU Member States. In the rest of the EU, thermoplastic coatings appear to be more widely used due to the local climatic conditions and the apparently longevity which is longer than that of road marking paints plasticised with SCCPs. Alternative (but more costly) plasticisers and thermoplastics appear to be the obvious alternatives here. However, a manufacturer has argued that for cross-linkable polyester systems with peroxides for the production of long-term road markings, finding alternatives would be more difficult than in the case of solvent-based paints.

We have assumed that a total of 20 companies still use SCCPs in the manufacture of paints and coatings and are willing to engage in R&D work to develop SCCP-free formulations. We further assumed that, one third of the companies (i.e. 7 companies) have completed 25% of their research, another 7 have finished 50% of their research and another 6 have completed 75% of their research. The full cost of R&D in this sector has been assumed to be €20,000-75,000 per company. It has therefore been calculated that the overall R&D cost would be **€205,000 - €769,000**. Further, through a series of assumptions, we calculate an additional **€418,000 - €916,000** compliance cost. However, certifications (at least for road marking paints) are issued for a limited time only, therefore, even without reformulating these paints, manufacturers would still have to incur certain costs for re-certifying their SCCP-containing products (existing certifications will most likely expire before the implementation of the UN ECE restriction on SCCPs). With regard to the ongoing costs (benefits) from the use of alternative plasticisers/flame retardants, this has been calculated at **up to €220,000**, though at the low end, some cost savings of around €28,000 may accrue (present value over 5 years). However, this does not take into account the internal changes to the ingredients of paints or indeed the use of more than one replacement substance for SCCPs.

No information was made available from industry on the likely increase in the market price of the final product after reformulation to replace SCCPs. Literature suggests increases of 7% (for acrylic paints) and 10% (when phthalate plasticisers are used).

8.3.6 Textile industry

In the textile finishing field, it appears that few companies still use SCCPs. Contrary to what was previously believed to be the case, expert opinion is that upholstery backcoating should not be considered to be an issue for SCCPs as replacement with MCCPs may have already been completed. More critical appears to be the use of SCCP-based compounds in the impregnation of tent textile, both for military uses and for commercial uses (marquees, lorry covers, etc.).

One major textile processor has been identified. The company has been working on alternatives but has faced performance and cost issues. Expert opinion is that the replacement of SCCPs (possibly with a mixture of MCCPs and decaBDE) could double the cost of impregnation of tentage with flame retarding compounds. Information on the likely cost of R&D is not available. This increase in impregnation cost would be unlikely to result in significant price increases for the users of the treated textiles; however, it appears common that long-term supply contracts are in place which could mitigate the possibility of passing to additional formulation costs to the user. Depending on the concentration of SCCPs in the flame retarding compound (assumed to range between 10% and 50%), the present value cost increase for textile (tentage) impregnators have been estimated at **€518,000 - €2.60 million** over 5 years (at a 4% discount).

8.3.7 Other stakeholders

Benefits for manufacturers of alternatives would arise but would likely be small. Similarly, impacts on public authorities would also be small.

It should be noted that our analysis of impacts has generally not attempted to monetise any impacts from loss of performance resulting from the replacement of SCCPs due to the lack of relevant information.

Table 8.2 summarises the costs estimates described above for the different stakeholder groups considered in this SEA.

Table 8.2: Summary of Estimated Costs/Savings to the Key Stakeholder Groups from the UN ECE Restriction on SCCPs					
Cost element	**SCCPs manufacturers**	**Rubber products**	**Sealants and adhesives**	**Paints and coatings**	**Textiles**
Users of the substance					
One-off R&D costs	Nil	Up to €563,000 (but probably much lower)	€0.5-1 million	€205,000 – 769,000	Unknown
One-off re-approval costs	Nil	Unknown	Negligible	€418,000 – €916,000 (but probably even lower)	Unknown
Cost of alternative substances	'Low' tonnage losses (1,300 t): €0.73 to €1.9 million	For a current SCCPs consumption of 34 tonnes: -€0.011 to €0.26 million (present value over 5 years)	-€0.44 to €1.06 million (present value over 5 years)	-€28,000 to €220,000 (present value over 5 years)	€518,000 to €2,595,000 (present value over 5 years)
	'High' tonnage losses (1,500 t): €0.84 to €2.2 million	For a current SCCPs consumption of 14 tonnes: -€0.004 to €0.105 million (present value over 5 years)			
Cost of alternative materials	Not applicable	Unknown	Unknown	Unknown	Not applicable
Users of formulations and articles					
Cost of using products with alternative substance	Not applicable	Unknown	Unknown; literature suggests 5% price increase	7% for acrylic paints (literature) 10-20% for road marking paints (consultation)	Limited
Cost of using alternative products		Unknown	Unknown	Unknown (but thermoplastic road markings could last longer than SCCP-containing road marking paints)	Unknown
Note: a negative sign (accompanied by red colour font) indicates a saving rather than a cost					

8.4 Commentary on estimated impacts

A restriction on the use (and manufacture) of SCCPs in the EU would undoubtedly have an adverse impact on industry stakeholders (with the exception of the manufacturers and suppliers of alternatives, who would experience increased sales). Textile finishing, paints and coatings and sealants and adhesives would probably suffer proportionally higher impacts as opposed to the rubber industry where the main application of SCCPs, in conveyor belting, would be exempt.

In monetary terms, impacts could well be significant for a small number of users who may still face difficulties with reformulating their products in a cost-effective way. Road marking paints and textile impregnation appear to be the key applications that may face particular difficulties. Concerns over the viability of reformulated sealants have also been expressed. It is, however, the case that, even in applications where concerns are raised regarding switching to alternatives, there have been companies that have already moved to viable alternatives. Moreover, the management of risks associated with the use of SCCPs has been a very protracted process which has definitely raised awareness within the relevant industry sectors and has allowed companies time to investigate and develop alternatives (at least a significant proportion of them). It is also worth noting that the production of formulations and articles that contain SCCPs accounts for a very small proportion of the EU markets for rubber, sealants/adhesives, paints and finished textiles.

Given the pre-existing frameworks within which risks from the use of SCCPs are being addressed, namely the OSPAR Convention, the EU Risk Assessment and Risk Management, the REACH authorisation process, discussions under the Stockholm Convention on POPs and now the UN ECE decision, it is clear that the replacement of SCCPs has been an ongoing process and, as such, any costs arising cannot be wholly attributed to the recently agreed UN ECE restriction. It should also be considered that even if the UN ECE is finalised, a certain time period would intervene between finalisation and implementation. It is likely that by the time the restriction is implemented action will have been taken under other regulatory frameworks (REACH, EU POPs Regulation) or the users will simply have completed he reformulation of their products. As a result, the socio-economic impact of the UN ECE decision itself should be considered to be very small.

8.5 Results of uncertainty analysis

It is acknowledged that the analysis presented in this SEA is hindered by uncertainty relating to several key parameters (for example, the actual tonnage of SCCPs used in each of the applications of concern, the actual number of companies using SCCPs in each sector, the extent to which R&D work to develop alternative formulations has been undertaken and is now completed, etc.). To address this, we have tried, where possible to make reasonable assumptions, develop scenarios and use value ranges (e.g. for the cost of R&D per company, the number of companies using SCCPs, the split in tonnages etc.).

The quantified impacts on stakeholders that result under different scenarios have been presented in the earlier sections of this document and are not repeated here.

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A.2 DATA COLLECTION APPROACH

A2.1 Overview

RPA undertook extensive consultation with manufacturers, distributors and users of SCCPs in the EU (including some companies located outside the EU). Information collected from consultation was complemented by information identified in literature. As will be explained later in this report, only a few stakeholders have provided specific (cost) information, therefore, our analysis partly relies on information documented in literature sources.

A2.2 Consultation Overview

The types of organisations contacted by RPA between 12 January 2010 and 30 April 2010 can be summarised as follows:

- **EU-wide trade associations**, including:
  - the association representing the manufacturers of chlorinated paraffins (Eurochlor); and
  - the top-level trade associations in the key sectors of concern (rubber, sealants/adhesives, paints/coatings and textiles);
- certain **national trade associations**, including:
  - the chemical industry associations in ten of the 'new' EU Member States[20];
  - some specific trade associations in key areas, for instance, the British Coatings Federation, the Association of Paint Manufacturers of the Czech Republic, the Asociacion Española de Fabricantes de Pinturas y Tintas de Imprimir (Spain), the UK Road Safety Markings Association, TEGEWA in Germany, and the Confederation of British Wool Textiles;
- **individual companies involved in the manufacture, distribution and use of short-chain chlorinated paraffins (SCCPs) in the EU**, including:
  - manufacturers of chlorinated paraffins – six EU-based companies plus another two located outside the EU (in Turkey and the USA);
  - distributors of chlorinated paraffins – 27 companies;
  - numerous potential users of SCCPs, including:

[20] Associations in Cyprus and Malta were not contacted; past experience suggests that the chemicals sectors in these countries are very small. Also, email communication with the Association of Latvian Chemical and Pharmaceutical Industry (LAKIFA) has not been possible due to email problems with the Association's system.

  - 143 manufacturers of rubber products (with an emphasis on conveyor belt manufacturers) and 11 companies potentially involved in the recycling of rubber products;
  - 89 manufacturers of sealants/adhesives;
  - 100 manufacturers of paints, inks and coatings;
  - 129 companies potentially involved in textile finishing;
  - 1 manufacturer of lava lamps; and
  - 9 manufacturers and/or suppliers of lubricant/metalworking formulations; and

- a small number of national administrative **departments responsible for the maintenance of national road networks and other national experts** (17 organisations).

In total, 534 companies and 21 trade associations were approached. As of 30 April 2010, a total of 142 organisations contacted RPA with some input (even if only to confirm that SCCPs are of no relevance to their operations).

A2.3 How Stakeholders were Identified

We have generally followed a two-fold approach in identifying relevant stakeholders: through trade associations and through direct consultation with individual companies; this was considered appropriate given the generally limited time available for consultation and the potentially large number of companies that would need to be approached.

We originally approached Eurochlor to introduce the study and request for help with approaching EU-based manufacturers of SCCPs. On Eurochlor's advice, we proceeded to approach individual manufacturers directly.

With regard to downstream users, we initially approached the top-level EU-wide associations representing companies that may potentially use SCCPs in their products or processes. We explained to them that, due to the short timeframe of this study, we would, in parallel, approach companies to ensure the maximum possible participation of companies in our consultation exercise. This was also considered important as many companies (especially in the 'new' EU Member States) may not be members of such EU-wide trade associations.

We were familiar with the relevant EU-level trade associations and the relevant contact persons from past chemicals policy work; however, we confirmed the relevant contact details with a quick visit at the associations' websites. For the contact details of the chemical industry associations in the 'new' EU Member States, we visited the CEFIC Internet site[21] where a detailed list of names and contact details of associated national bodies is provided.

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[21] Details available at this link: http://www.cefic.be/en/associated-federations.html

In our communication with these trade associations, we asked that they forward our request for information to their members. In some cases, the direct members could be national trade associations; in other cases, the direct members were individual companies. The results of communication with trade associations have not been encouraging; especially at the EU-wide level, associations have little evidence that SCCPs are still used in their sectors, although information from third parties would confirm that SCCPs still find (limited) use.

For the identification of individual companies, we further used the following sources:

- for manufacturers of chlorinated paraffins, we visited the relevant pages of the Eurochlor website[22] and also consulted reports recently prepared for the European Chemicals Agency (ECHA)[23];

- for distributors of SCCPs, we conducted web searches, mostly through the Google search engine. Key words used include the name of the substance, its acronym, its CAS number, key trade names and variations of these in different languages (French, German, Italian, Spanish, Danish, Dutch, Greek). Such searches produced links to the Internet sites of several companies that still display SCCPs or chlorinated paraffins in general as being among their product portfolio;

- for downstream users of SCCPs, we conducted web searches through the Google search engine with key terms in several different European languages. Such key terms included “rubber”, “conveyor belt”, “sealant”, “adhesive”, “paint”, “textile finish” and several others (for instance, the chemical types of sealants that may contain SCCPs – as shown in ECHA reports). Some business directories used included Thomas Global (www.thomasglobal.com), Kelly Search (www.kellysearch.co.uk), Kompass (www.kompass.com) and others; and

- we conducted searches with different translations of the name of the substance and its CAS number and this has also allowed us to identify specific companies which manufacture or supply products (mostly sealants, adhesives, paints, lubricants and metalworking fluids) that contain SCCPs and which publish relevant Safety Data Sheets (SDSs) on their Internet sites. We have used these SDSs to find contact details of relevant companies which we contacted to enquire as to whether these products still contain SCCPs and whether they are still being marketed in the EU.

Finally, we have also requested the assistance of manufacturers and distributors of SCCPs in identifying and contacting their customers. Unfortunately, for reasons of commercial confidentiality (and as there is no regulatory pressure), the results of these efforts were generally poor.

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22 The Chlorinated Paraffins Sector Group: http://www.eurochlor.org/aboutparaffins

23 Background paper available from the ECHA Internet site: http://echa.europa.eu/doc/consultations/recommendations/tech_reports/tech_rep_alkanes_chloro.pdf

A2.4 Consultation Tools Utilised

Two questionnaires were prepared in collaboration with RIVM and VROM. One was aimed at manufacturers of chlorinated paraffins; the other was aimed at downstream users. These included an original deadline of 19 February and were used as Word documents. The deadline was extended were necessary.

We initially approached consultees by email, normally with the relevant questionnaire attached. In later stages of the consultation process (and to avoid our emails potentially being marked as 'spam'), we uploaded the downstream users questionnaire to our website and we provided the link to it in our emails. We also considered that the presence of the questionnaire in an unsolicited request for assistance might also put consultees off. This could be particularly true for companies which would normally be able to make a small contribution (for example, past users of SCCPs who may currently have little interest in the current study) but, if faced with a multi-page questionnaire, would be unwilling to invest the time in responding to any of our questions.

Where information was received from consultees, we followed this up with additional questions by email, or on the telephone, if necessary. Even where companies responded that they do not use SCCPs, further questions were asked with regard to past usage, and the cost and technical implications of switching to alternatives.

On specific occasions, other approaches were followed:

- **meetings**: we consistently requested that we meet with stakeholders, if possible in the presence of RIVM representatives. Due to the apparently low use of SCCPs and their replacement with alternatives that is currently ongoing across the EU, very few companies were willing to meet with us. Only three meetings have been held to date: one with the UK-based manufacturer of SCCPs, one with a Czech paint manufacturer (in the presence of a representative of the Czech Ministry of Environment) and one with a Polish manufacturer of rubber conveyor belts;

- **faxes**: we are aware that emails could be a quick means of communication but they can be easily ignored or intercepted by 'spam' filters and may never reach their intended recipient. Moreover, if an email is received by a person in an administrative position (often the case when emails are sent to generic addresses such as info@company.com), it may not be given sufficient attention or the reader may not understand what the purpose of the email really is. Therefore, in selected cases, we opted for sending fax messages to individual companies. A fax produces a physical result which ensures that someone will indeed take a look at and hopefully will forward to a knowledgeable person within the organisation. Sending faxes has produced some good results in the form of quick reactions from companies that otherwise had not responded to our electronic communication;

- **use of languages other than English**: we have used the language skills of RPA staff to translate emails into French, German, Hungarian, Polish, Czech and Greek. We have also communicated in other languages on the phone. With particular regard to the Romanian manufacturer of chlorinated paraffins, we prepared a letter which was professionally translated into Romanian language and which was sent by fax. A quick response was received soon after, while repeated earlier attempts to contact them by email and telephone had produced no result; and

- **support from RIVM**: RIVM conducted direct consultation with Member State Competent Authorities. Also, members of the RIVM study team kindly used their language skills to communicate with authorities and a key industry stakeholder in Italy.

A.3 ORGANISATIONS CONSULTED

Organisation	Country
Aalbrog Gummivarefabrik	DK
ACR Czech s.r.o.	CZ
Actega	DE
Adshead Ratcliffe & Co. Ltd	UK
Alfabelt Sarl	FR
J Allcock and Sons Ltd	UK
Ammeraal Beltech Holding BV	NL
Amonn Fire	IT
Asociacion Española de Fabricantes de Pinturas y Tintas de Imprimir	ES
Association of Chemical and Pharmaceutical Industry of the Slovak Republic	SK
Association of European Sealant and Adhesives Manufacturers	EU
Association of Lithuanian Chemical Industry Enterprises	LT
Association of Paint Manufacturers of the Czech Republic	CZ
Avocet Dye & Chemical Co. Ltd	UK
Banyan Recycling	DE
BCH Bruehl – Chemikalien	DE
Bornit	DE
Boss Paints	BE
BREC	UK
Brenntag	NL
British Coatings Federation	UK
British Standards Institution	UK
Belgian Road Research Centre	BE
Caffaro	IT
Carboline	NL
CDV BRNO (Czech Transport Research Centre)	CZ
CHT	DE
Clubshop	SE
CM Sealants	UK
Coatings Research Institute	BE
Cobra Europe sp. z o.o.	FR/PL
Colorlak	CZ
Confederation of British Wool Textiles	UK
ContiTech Conveyor Belt Group	DE
CTF 2000	BE
Danish Ministry of Transport	DK
Debrigum	BE
Den Braven	NL
Detecha	CZ

Organisation	Country
DGE	NL
Don & Low Ltd Nonwovens	UK
Dow Corning	DE
EGO Hauptverwaltung	DE
Envirograf	UK
Envirostik	UK
EOC	BE
Eurochlor	EU
European Apparel and Textile Organisation	EU
European Tyre & Rubber Manufacturers’ Association	EU
Fabryka Taśm Transporterowych Wolbrom S.A.	PL
FAPLISA	ES
Fenner Dunlop	UK
FICAP Montagne	FR
Finish Road Administration	FI
Fire Safe Palosuojaus	FI
Firwood Paints	UK
Flame Retardant Textiles Network	UK
Fortafix	UK
Fosroc	UK
Greek Road Federation	EL
Greene, Tweed & Co., Limited	UK
H & G Barbry	FR
H&C Whitehead	UK
Henkel Consumer Adhesives	UK
Hercorub	BE
Highways Agency	UK
HMG Paints	UK
Holdsworth Fabrics Ltd	UK
Holzbecher, spol. s r. o.	CZ
Hornett Bros	UK
Hoverdale	UK
Huntsman	CH
Huntsman Textile Effects	UK
ICC Chemol Kft	HU
ICI-Akzo Nobel (Hammerite)	UK
IMCD France	FR
Ineos Chlor	UK
JB Broadley	UK
Jotun A/S	NO/ES
Knuchel Farben AG	CH

Organisation	Country
Koruma	TR
Lab Central Ponts et Chauseés	FR
Laboratorio Nacional de Engenharia Civil	PT
Leuna Tenside	DE
Limburger Lackfabrik GmbH	DE
Liquichem Handelsgesellschaft mbH	DE
LKF	DK
Manufactures Cusell	ES
Materis Peintures France	FR
MES International	UK
New Tech Lubes	UK
Novachem Corporation Ltd	IE
Novacke Chemicke Zavody	SK
Orka d.o.o.	SI
Pafra Adhesives	UK
Paints, Printing Inks and Artists' Colours in Europe	EU
Panaz	UK
Panbex	CZ
Penpet	DE
Perstorp	NL/SE
Phoenix Conveyor Belts	DE
Pulcra Chemicals GmbH	DE
Quaron	NL
Quimica del Cinca	ES
Ramsauer	AT
Raytech	IT
Rembrandtin	AT
Rentokil Initial	UK
Revol & Sonier	FR
Rigas Laku un Krasu Rupnica	LV
Road Safety Markings Association	UK
Robbialac	PT
Rubber Resources BV	NL
Rust-Oleum UK Ltd	UK
Sadolin Paints	CY
Schill + Seilacher	DE
Schulte-Strathaus	DE
SC Oltquino	RO
Sealock Ltd	UK
Sempertrans	FR
Siga	CZ

Organisation	Country
Sigma Kalon Paints	UK
Snoline SpA	IT
Sonneborn & Rieck Ltd	UK
Swedish National Road Administration	SE
Synthomer	UK
TEGEWA	DE
Teluria	CZ
Temati	NL
Tencate	NL
Tennants Distribution	UK
Textiles F.R. Limited	UK
TFB Vago	IT
Tintas Marcol	PT
Tomatex Otrokovice, a.s.	CZ
Univar	SE
Vanmarcke	BE
Viochrom	CY
Vires	IT
Vivechrom	EL
Vulcan UK Ltd	UK
Western International	NO
Wilckens	DE
Zrunek	AT