Study Contract № 07-0402/2005/414388/MAR/B4

Study on impacts of possible measures to manage articles or materials treated with biocides - in particular when imported

Final Report for Tasks 2.1 & 2.2

- Quantitative analysis with regard to the most significant materials treated with biocides that are placed on the market
- Identification and quantification of biocidal active substances used to treat the materials

Submitted to
European Commission
DG Environment
Unit B4 “Biotechnology and Pesticides”
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Draft originally submitted: 7 March 2006
Date of submission: 6 October 2006
This report has been prepared by the Consortium formed by Milieu Ltd. and DTC under contract to the European Commission’s DG Environment (Study Contract № 07-0402/2005/414388/MAR/B4). Tony Zamparutti of Milieu led the work on these tasks of the project. The views expressed herein are those of the consultants alone and do not represent the official views of the European Commission. The report is based on information gathered from a variety of sources, including questionnaires sent to EU industry, interviews with industry representatives and government officials as well as literature research.

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1. Introduction

In September 2005, DG Environment placed a contract for a “Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported” (Contract No 07-0402/ 2005/414388/MAR/B4) with Milieu Ltd, in consortium with the Danish Toxicology Centre (DTC).

This document contains the reports for Task 2.1, “Quantitative analysis with regard to the most significant materials treated with biocides that are placed on the market”, and for Task 2.2, “Identification and quantification of biocidal active substances used to treat the materials” of the contract (as described in the Technical Annex to the Invitation to Tender). This document thus summarises the corresponding information gathered in Task 1, “Information gathering”.

The report is organised by treated article. The sections for each major treated article (water-based and fungi-resistant paints, water-based adhesives, treated wood, wool carpets and tanned leather) describe first the market analysis (responding to Task 2.1) and then the biocides used (responding to Task 2.2). In addition, sections on textiles and treated plastics and polymers provide descriptive overview information across these two broad areas of treated articles.

1.1 Preliminary list of significant treated articles and materials

The study focuses on articles treated with four of the biocidal product types listed in Annex V of the Biocidal Products Directive:

- Product-type 6: In-can preservatives
- Product-type 7: Film preservatives
- Product-type 8: Wood preservatives
- Product-type 9: Fibre, leather, rubber and polymerised materials preservatives

Moreover, the study focuses on articles that are treated with biocides for internal effect, i.e. “with the intention to control organisms harmful to the treated article/material itself (on the surface or inside)”. This contrasts with articles treated with biocides for external effect, where “the biocidal active substance is released from the treated article to control harmful organisms outside the treated article”. These definitions are based on the agreement between the European Commission and the Member States regarding the definition of internal and external effect (stated in the October 2003 guidance document on treated articles and materials and other scope issues as well as the December 2005 version of the Manual of Decisions). As noted below and in subsequent sections, in some cases industry representatives disagree with the distinction between internal and external effect, in particular with regard to textiles.

At the beginning of Task 1, the literature review and preliminary contacts with EU trade associations were used to identify a preliminary list of significant treated articles and materials consumed in the European Union. Interviews and further literature review helped to further define this list. Information has been sought on most of these articles.

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1 Technical Annex to the Invitation to Tender for the study
4 It should be noted that little overview information on this topic was found: only one broad study was identified: Lassen et al, Inventory of Biocides used in Denmark, Miljøstyrelsen (Danish Environmental Protection Agency), Environmental Project No. 585/2001, prepared by COWI, DTC and DHI.
Product Type 6: In-can preservatives
- water-based paints
- water-based cleaning products
- water-based adhesives

Water-based products containing certain polymers or other materials which may be subject to microbial degradation are commonly treated with biocides. Paints, cleaning products and adhesives appear to be the three main types of consumer articles in this category. Other treated articles and materials include water-based inks, though their consumption of biocides appears to be quite low.

This report contains information mainly on water-based paints, which are described in section 2, and adhesives industry (section 3) Water-based detergents have not been a priority for the study. One reason is that this industry does not appear to face significant import pressure, and in this respect is in a similar situation to the paint and adhesives industries. Moreover, the biocides used for in-can preservation of detergents are believed to be similar to those used for the other two industries.

Water-based fluids used in industry may also contain in-can preservatives. Examples can include fountain water for printing presses and spin finishes for yarn production, as well as fluids for coating paper products. In these cases, the preservatives are intended for the fluid and thus not for the final product, such as the yarn or the paper. These industrial fluids have not been included in the study, first because their production does not appear to face significant import pressures, and second because their use does not appear to result in significant levels of exposure to, or release of, biocides from the final articles.

Product Type 7: Film Preservatives
- fungi-resistant paints
- sealants and selected adhesives

According to the 2001 Inventory of Biocides used in Denmark, fungi-resistant paints appear to consume by far the largest share of PT7 biocides. Information on these paints is presented in Section 2, along with water-based paints. The two types of paints are presented together, as they are produced by the same industry. Moreover, there is an overlap between the two categories: many fungi-resistant paints are also water-based paints, although it appears that the fungi-resistant paints typically are treated with only one type of biocide (i.e. they do not contain both PT6 and PT7 biocides).

Only a very small share of sealants and fillers (about 1 to 2% of those consumed in Denmark) appear to contain biocides. Finally, there does not appear to be an EU-wide trade association for the sealants industry, which created an obstacle in terms of obtaining EU-wide information on these articles. A few types of adhesives use film preservatives, but this use appears to be quite minor.

Annex V of the Biocidal Products Directive identifies, among the uses of film preservatives, materials or objects such as plastics, papers and art works. Plastics have been addressed under PT9. No information was found on papers treated with film preservatives.

Product Type 8: Wood preservatives
- pressure- and vacuum-treated wood for various applications, notably:
  - construction timber
  - garden furniture timber
  - utility poles and other outdoor poles
  - fences and noise barriers
  - railroad ties
  - marine timber, such as for boat landings
- non-pressure treated wood
Treated wood is an important type of treated article. Information on pressure-treated wood, which appears to account for the greatest use of biocides, including those of concern such as copper chromium arsenic and creosote, is found in Section 4 of the next version of this report.

Product Type 9: Fibre, leather, rubber and polymerised materials preservatives
- Wool carpets treated against moths and beetles
- Outdoor textiles
- Selected home textiles, such as some wall coverings and curtains
- Tanned Leather (an intermediate product for leather manufacture)
- Soft PVC plastics used in humid conditions, or in contact with soil

It should be noted that several other types of finished textiles are treated with biocides. Clothing, for example, can be treated with biocides to reduce odour. Both synthetic and natural-fibre carpets can be treated to suppress dust mites. Mattress ticking can also be treated against insects. These uses, however, are not to protect the fabric itself, and thus appear to be for external effect according to the definition in the 2003 guidance document on treated articles and materials.

Of the uses of biocides for internal effect in textiles, anti-moth treatment of wool carpets appears to be the most important. While outdoor fabrics made of natural fibres will need biocides, preliminary information indicates that these articles are increasingly made of synthetic fibres. The use of biocides in textiles is reviewed in Section 5, and Section 6 describes the treatment of wool carpets.

For leather, biocides are used at specific stages of the tanning process and to protect tanned leather, an intermediate good, in shipment and storage. Trace amounts of biocides used in leather tanning and in storage of tanned leather remain in finished leather goods. Section 8 describes the leather tanning industry and the biocides used.

Several categories of plastics are treated with biocides for internal effect, notably articles of soft PVC such as swimming pool liners and shower curtains. In some cases, polyurethane is also be treated. In addition, a great variety of plastic articles are treated with biocides for external effect. Section 7 reviews the main types of treated plastics.

Information on the use of biocides in one specific type of synthetic rubber, EPDM, was found (see section 7). A few references were noted to the use of biocides in water-based latex solutions, an intermediate product for various applications, including carpets. These uses appear to be classified as in-can preservatives.

Annex V of the BPD also mentions the use of these biocides in paper. The European trade association for the paper industry, CEPI, stated that biocides are not used in paper products (see the section 1.2). In Denmark, home insulating materials of organic fibres (including paper and cellulose as well as wool and flax) are treated with biocides. This is relatively important use in Denmark; however, it was felt that these insulating materials are not common in other EU countries due to differences in home construction methods. As a result, these materials were not included.

1.2 Overview of data gathering

The major sources of data for the study have been the following:
- a literature search;
- data on Eurostat and other EC web sites;
- data provided by DG Enterprise;
- questionnaires to EU manufacturers of treated articles;
- interviews with EU trade associations, with manufacturers of biocides and with manufacturers of treated articles;
- data provided by the Biocides Information Service.
Literature search

In the literature search, the most useful study identified was prepared by one of the project partners, DTC, along with two other Danish consultancies: the Inventory of Biocides used in Denmark, 2001, for the Danish Environmental Protection Agency. The inventory identifies treated articles and materials across all product types sold on the Danish market, lists the active substances used for each and provides estimates of the amount of active substances (in tons) used for each type of article produced or consumed. As yet, it is the only comprehensive study on treated articles and materials found, and it has been a key source in identifying articles for this project. It is recognised, however, that the Danish economy represents only a small share of the EU total.

While this study is both useful and unique, the consumption of treated articles in Denmark may not be representative for the EU as a whole: for example, consumption of treated wood in home construction, adhesives for home flooring as well as of wool carpets vary from one Member State to another depending on traditions and preferences.

In addition to the Danish study, the best available techniques reference documents, coordinated by the EC Joint Research Centre (JRC) for industrial sectors regulated under Directive 96/61/EC on Integrated Pollution Prevention and Control, were important sources of information on both processes as well as biocides used for wool carpet as well as leather production. Emission Scenarios for biocides, available from the web site of the European Chemical Bureau (also part of JRC) provided information on many types of treated articles. In addition, the OECD emissions scenarios on wood treatment, leather and textiles provided supplemental information on these industries and on the biocides used.

It should be noted that the questionnaires to industry (see below) as well as those to Member States requested references to relevant studies. In only a few cases were any provided.

Eurostat and other Commission Services

Statistical data on EU production, import and export of products are available on Eurostat databases. The PRODCOM (Production Communautaire) database contains data on the production of goods in the EU25. However, detailed data are available on only a few products known to be treated: this is the case for water-based paints, a broad category in which essentially all types contain PT6 biocides. Unfortunately, the Eurostat classification does not include categories for many types of treated products, such as fungi-resistant paints. Moreover, in some cases the PRODCOM classification system has specific sub-categories for treated products – such as railroad sleepers and tanned leather – the database contains little data. In these cases, it appears that few Member States have provided the detailed data to PRODCOM.

Eurostat databases contain statistics on sector turnover and on the numbers of firms and employees, but only at higher levels of aggregation (for e.g. for paint and varnish manufacturing as a whole).

Eurostat’s COMEXT database contains detailed information on imports and exports. In fact, data for imports and exports of specific sub-categories – such as railroad sleepers and tanned leather – are more likely to be found than the corresponding PRODCOM data on their EU production.

DG Enterprise has studied several industrial sectors of relevance to the study, including wood, textiles, and leather. Documents available on the DG Enterprise web site provided a useful source of economic information, in particular for the leather sector.

Officials at DG Enterprise were also helpful in providing information on the reliability of Eurostat data, and in supplementing incomplete Eurostat data with estimates, for example for wool carpet production.
Questionnaire to industry

At the start of the project, a series of EU industry associations were contacted for assistance, in particular in distributing the questionnaire to member companies and to national member associations. Table 1.1 below provides an overview of the associations contacted.

In general, responses to the questionnaires were poor. Only the questionnaire to the paint industry provided a relatively large number of responses. In addition, responses from the CEFIC European Biocidal Products Forum, the trade association for manufacturers of biocides, represented a relatively large share of the Forum’s membership.

One problem may have been the length of the questionnaire. After poor results from an initial questionnaire sent via CEPE, the EU paint manufacturers association, a second questionnaire with only one page of questions (essentially just a table requesting information on biocides used) was sent, providing the stronger return presented in Table 1.1.

In most industries, the questionnaire was sent from the EU trade association to national trade association, and there to individual companies. Success depended on strong interest at both EU and national levels. The responses to the revised paint industry questionnaire were received from companies based in only six Member States.

One industry association, the Confederation of European Paper Industries, declined to participate in the study, asserting that biocides were not used in finished treated materials. While slimicides (Product Type 12) are commonly used in paper production, the only indications of biocide use in final products we were able to identify are specialty papers for medical industry.

<table>
<thead>
<tr>
<th>Treated Article/Material</th>
<th>Industry Association</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active biocidal substances</td>
<td>CEFIC/EBPF</td>
<td>Questionnaire sent to member companies. Nine responses received.</td>
</tr>
<tr>
<td>PT6 and PT7. Paint</td>
<td>European Council of the Paint, Printing Ink and Artists’ Colours Industry (CEPE)</td>
<td>Questionnaires sent to paint producers via national associations. 29 responses received to a second, abbreviated questionnaire.</td>
</tr>
<tr>
<td>PT6 and PT7. Adhesives and sealants</td>
<td>Association of European Adhesives Manufacturers (FEICA)</td>
<td>Questionnaire sent to manufacturers via national associations. Ten responses received</td>
</tr>
<tr>
<td>PT7. Plastics (primary production)</td>
<td>CEFIC/PlasticsEurope</td>
<td>No useful responses</td>
</tr>
<tr>
<td>PT8. Pressure-treated wood</td>
<td>The Western-European Institute for Wood Preservation (WEI-IEO)</td>
<td>Questionnaire sent to member companies. Six Responses received</td>
</tr>
<tr>
<td>PT9. Leather production</td>
<td>COTANCE - Confederation of National Associations of Tanners and Dressers of the European Community</td>
<td>Abbreviated questionnaire sent to member companies; COTANCE to send results.</td>
</tr>
<tr>
<td>PT9. Textiles</td>
<td>Euratex</td>
<td>Two responses, both from industry federations. Information on wool carpeting provided by sectoral and national associations</td>
</tr>
</tbody>
</table>

Table 1.1 Results of the Questionnaire to Industry
There were specific problems regarding the plastics industry. A questionnaire sent to members of the primary producer association, PlasticsEurope, did not provide any useful responses. Further contacts with PlasticsEurope determined that biocides are typically inserted in plastic materials not by the primary producers but in later stages of production, for example by plastics converters. Contacts with EUPC, the plastics converters association, started late and did not result in a strong interest in distributing the questionnaire.

Overall, it appears that only a small share of plastics contains biocides (and an even smaller share uses them for internal effect), factors that increase the difficulty of obtaining data.

Other contacts with industry

Considerable information, both on production of treated articles as well as the biocides used, was gathered through direct contacts with manufacturers and trade associations, many of whom were quite helpful. This turned out, however, to be a quite lengthy process. For specific types of treated plastics and polymers, industry associations such as ERFMI, the European Resilient Flooring Manufacturers Institute, and TEPPFA, the European Plastic Pipes and Fittings Association, provided some information.

Several industries used these contacts to communicate their specific concerns regarding the Biocidal Products Directive. This was the case in particular for the textiles industry and the leather industry.

A full list of contacts (not including questionnaire results) is provided in Annex V.

Questionnaire to NGOs

Questionnaires were sent to EU environmental and consumer groups, several such national groups, as well as EU trade unions. Out of 11 groups contacted, only two answers were received. Moreover, these did not yield information on specific issues for the study such as the biocides used in imported treated articles and materials.

Seeking information on biocides in imported treated articles and materials

Some information on biocides contained in imports of treated articles was obtained from questionnaire responses and also through interviews with EU manufacturers and trade associations.

Enquiries were also sent to trade associations and other sources in several major exporting countries, notably China and India. As yet, no replies have been received from these countries. On the other hand, the Turkish Industry and Business Association (TUSIAD) provided some information regarding wool carpets.

Data from the Biocides Information Service (BIS)

This subcontractor for the project was foreseen as a key source of data for the quantitative analysis of treated materials (Task 2.1), as well as a supplementary source of information on the active substances used (Task 2.2). Unfortunately, difficulties were encountered in working with BIS. While BIS produced some relevant information, they were not able to provide accurate EU-wide data on the production, import and export of treated materials and on marketing chains as expected. As a result, this information had to be gathered through the other sources described above, notably Eurostat and DG Enterprise, as well as through interviews with industry. The relationship with BIS was terminated at the end of 2005.

Using the data gathered for qualitative and quantitative analysis

The data gathered and presented in the following sections provide, for the four product types of biocides addressed, an overview of significant articles on the EU market treated for internal effect. For
the most part, however, the data does not appear to include sufficient detail for quantitative analysis in Task 2.3 (Description and quantification, where feasible, of potential risks) or Task 4 of the study (evaluation of impacts). Data gathering is continuing. The possibilities for quantitative analysis will need to be reviewed together with the choice of representative materials for Task 4.

1.3 Roadmap to the report

The core sections of this report provide the information to meet Task 2.1, “Quantitative analysis with regard to the most significant materials treated with biocides that are placed on the market”, and Task 2.2, “Identification and quantification of biocidal active substances used to treat the materials”. These sections are organised according to treated article.

Section 2 describes water-based paints, which use in-can preservatives, and fungi-resistant paints, which contain film preservatives.

Section 3 describes water-based adhesives, which contain in-can preservatives.

Section 4 discusses treated wood, including the reuse, recycling and disposal of treated wood waste.

Section 5 provides an overview of the use of biocides in textiles. Section 6 then describes wool carpets, which are treated against moths.

Section 7 presents an overview of the use of biocides in plastics and polymers.

Section 8 reviews tanned leather.

Section 9 provides an initial ranking of the most significant materials.
2. Water-based and fungi-resistant paints

There are two main uses of biocides in paint:

- Almost all water-based paints contain in-can preservatives (PT6) to ensure their shelf-life against microbiological deterioration.
- Many paints for outdoor application, as well as those for use in humid interiors, contain film preservatives (PT7) against fungus growth. Fungi-resistant paints can be either water or solvent based.  

While some anecdotal reports were received of imported goods such as outdoor furniture coated with paints containing PT7 biocides, specific details were not found. As a result, this section focuses on paints themselves.

2.1 Production, trade and marketing chain

Water-based paints: EU production, imports and exports (overview and trends)

Water-based paints are used primarily as decorative coatings for buildings, though there are also industrial uses.

Over 4.2 million tonnes of water-based paints were produced in the EU25 in 2003, with a value of almost €7 billion (see Table 2.1). Production data is divided into two categories of water-based paints: those containing acrylic and vinyl polymers, and others.

Germany is by far the largest producer of water-based paints, accounting for almost 30% of EU25 production (Table 2.2). The United Kingdom, Italy and France follow. The EU10 produce less than 4% of the total.

The EU is a net exporter of water-based paints: in total, about 10% of EU25 production by value was exported, while imports were valued at just over 1% of domestic production for acrylic and vinyl paints and just over 2% for other water-based paints (Table 2.1). The bulk of EU25 imports of water-based paints come from EFTA countries: Switzerland and Norway accounted for about half of these imports. Other major sources of imports include the United States, which accounts for a further 25% of the total, along with Japan, Thailand and Turkey.

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4 This section refers to paints containing PT7 biocides as “fungi-resistant”; in some cases, the PT7 biocide may be intended also or primarily to address other types of biological attack, such as algal growth. In addition, while the section refers to “paints”, this can include wood “coatings” that contain PT7 biocides to protect their surface against fungi or algal growth; these coatings generally do not protect the wood itself, and thus are not classified as PT8 (wood preservatives).

5 The EU industry association for paints, the Conseil Européen de l'Industrie des Peintures, des Encres d'Imprimerie et des Couleurs d'Art, or European Council of the Paint, Printing Ink and Artists’ Colours Industry, defines these as “Coatings that are applied to buildings, their trim and fittings, and associated structures for decorative, function and protective purposes” (Guidelines on the use of biocides in Decorative Coatings, 2002).

6 The 10 new Member States that joined the EU in May 2004.

7 European Free Trade Association: Iceland, Liechtenstein, Norway and Switzerland

8 Table 1 and Figure 1 are based on different Eurostat databases whose categories should match (for imports, CN category no. 24301150-Paints and varnishes; based on acrylic or vinyl polymers dispersed or dissolved in an aqueous medium (including enamels and lacquers)). There is, however, a discrepancy of about €20 million Euros in the level of imports.
Table 2.1 Water-based paints: EU25 Production, Exports and Imports, 2003
(Source: Eurostat)

<table>
<thead>
<tr>
<th></th>
<th>Water-based acrylic and vinyl paints¹</th>
<th>Other water-based paints²</th>
<th>Total, water-based paints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million tonnes</td>
<td>Million Euros</td>
<td>% of EU25 Prod. by value</td>
</tr>
<tr>
<td>EU25 Production³</td>
<td>3.41</td>
<td>5 084</td>
<td>100.0%</td>
</tr>
<tr>
<td>EU25 Exports</td>
<td>0.22</td>
<td>345</td>
<td>6.8%</td>
</tr>
<tr>
<td>EU25 Imports</td>
<td>0.04</td>
<td>61</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Notes:
1. Eurostat Prodcom No. 24301150-Paints and varnishes; based on acrylic or vinyl polymers dispersed or dissolved in an aqueous medium (including enamels and lacquers)
2. Eurostat Prodcom No 24301170-Other paints, varnishes dispersed or dissolved in an aqueous medium
3. For acrylic and vinyl paints, 2003 production data were not available from Lithuania, Luxembourg or Slovakia.

Table 2.2 EU25 Production of Water-Based Paints by Member State, 2003
(Source: Eurostat⁴)

<table>
<thead>
<tr>
<th>Country</th>
<th>Euros ( Millions)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>115</td>
<td>1.7%</td>
</tr>
<tr>
<td>Belgium</td>
<td>156</td>
<td>2.3%</td>
</tr>
<tr>
<td>Cyprus</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>25</td>
<td>0.4%</td>
</tr>
<tr>
<td>Denmark</td>
<td>139</td>
<td>2.1%</td>
</tr>
<tr>
<td>Estonia</td>
<td>11</td>
<td>0.2%</td>
</tr>
<tr>
<td>Finland</td>
<td>90</td>
<td>1.3%</td>
</tr>
<tr>
<td>France</td>
<td>749</td>
<td>11.1%</td>
</tr>
<tr>
<td>Germany</td>
<td>1 956</td>
<td>29.1%</td>
</tr>
<tr>
<td>Greece</td>
<td>109</td>
<td>1.6%</td>
</tr>
<tr>
<td>Hungary</td>
<td>36</td>
<td>0.5%</td>
</tr>
<tr>
<td>Iceland</td>
<td>9</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ireland</td>
<td>56</td>
<td>0.8%</td>
</tr>
<tr>
<td>Italy</td>
<td>1 082</td>
<td>16.1%</td>
</tr>
<tr>
<td>Latvia</td>
<td>4</td>
<td>0.1%</td>
</tr>
<tr>
<td>Lituania</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Malta</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>180</td>
<td>2.7%</td>
</tr>
<tr>
<td>Poland</td>
<td>162</td>
<td>2.4%</td>
</tr>
<tr>
<td>Portugal</td>
<td>179</td>
<td>2.7%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>4</td>
<td>0.1%</td>
</tr>
<tr>
<td>Spain</td>
<td>497</td>
<td>7.4%</td>
</tr>
<tr>
<td>Sweden</td>
<td>44</td>
<td>0.7%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1 119</td>
<td>16.6%</td>
</tr>
</tbody>
</table>

Notes:
1. Total for PRODCOM categories 24301150 and 24301170
2. 2000 data used for United Kingdom

Milieu/DTC
October 2006
Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/ 14
While EU imports of water-based paints are small compared to EU25 production, they nonetheless have increased steadily over the based decade (Figure 2.1).

**Production of fungi-resistant paints**

All the paints containing PT7 biocides identified through the questionnaire are decorative coatings, i.e. used for buildings and their fittings.

While Eurostat databases include statistics on water-based paint, there is no category for paint containing anti-fungal biocides as film preservatives. Thus, this category has to be estimated.

The *Inventory of Biocides used in Denmark* estimated that 5-15% of decorative paints contain anti-fungal biocides. According to CEPE, decorative paints – a category largely but not entirely comprised by water-based paints – account for approximately €9 billion of sales in the EU15 plus Hungary, Norway and Switzerland. Total sales in all EU25 should be slightly higher. Sales of decorative paints by weight in this area are approximately 3.4 million tonnes.

Based on these data, the amount of paint containing PT7 biocides produced yearly in the EU ranges between 170 000 and 510 000 tonnes, with a value between € 450 million and €1.35 billion. While these data include two non-Member States, Norway and Switzerland, and only one EU10 country, Hungary, they cover the main EU paint producers, and thus should be roughly accurate.

**The Marketing Chain**

According to CEPE, over 2500 EU15 companies manufacture paints and coatings. A large share of the total number (more than 1500) is made up of small enterprises operating especially in the south of Europe. In contrast, the paint industry in northern Europe is dominated by large and medium-sized manufacturers.

At the same time, there are several large EU companies in paint production, including ICI Paints, Bayer and Akzo Nobel, and a broad range of medium-sized manufacturers. The largest manufacturers, such as ICI and Akzo Nobel, have production sites across many different countries, both within and outside the EU.

All paint manufacture employs about 125 000 workers in the EU15.
The manufacture of paint requires a large number of substances, all of which are produced by the chemical industry. The Figure 2 below provides a schematic overview of the marketing chain for biocides used in paint manufacture.

The manufacture of both active substances and formulated biocidal products used in paints is a consolidated market (the import of active substances is also consolidated). Large paint manufacturers commonly purchase biocides directly from active substance manufacturers. Both formulators and distributors supply small and medium-sized enterprises, often along with other substances needed for paint manufacturer. Formulators are a consolidated market, while distribution is more fragmented.9

![Marketing Chain for Paint Biocides](image)

**Figure 2. Marketing Chain for Paint Biocides**

**Source:** BIS

**Marketing chain for water-based paints**

The great majority of water-based paints are decorative coatings. According to CEPE, approximately half of decorative coatings are used by construction firms, painting firms and painting professionals. These are purchased largely through wholesalers and distributors, though in some cases they may be purchased directly from the paint manufacturer.

The other half of decorative paints is consumed directly by households, purchased from retail stores. Large retail stores in the EU commonly obtain their paints directly from manufacturers, while smaller stores obtain them through wholesale distributors.

Water-based paints are also used in several industrial applications, including automobile and furniture paints and coil coatings. EU air pollution policy and related legislation encourage the substitution of solvent-based paints with water-based paints to reduce air emissions of volatile organic compounds (VOCs). As a result of this process to replace solvent-based paints, industrial demand for water-based paints is expected to increase, and thus also the use of in-can preservatives for these paints.

**Marketing chain for fungi-resistant paints**

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9 Source: BIS. Consolidated refers to a market dominated by a small number of large firms (typically 10 or so), while a fragmented market is made up of a large number (more than 1000) of mostly small and medium enterprises.
Essentially all fungi-resistant paints are decorative coatings. As for water-based decorative coatings, approximately half should be used in construction and by painting professionals, and the other half directly by consumers.

2.2 Biocides used in paint

To identify the specific PT6 and PT7 biocides currently used in paint across Europe, a questionnaire was prepared and sent to paint manufacturers across the Europe. The questionnaire was distributed by CEPE to its member associations, which in turn were requested to distribute it to manufacturers. The box presents an overview of the responses received.

Box 1. Survey of paint manufacturers: overview of responses

The EU trade association for the paint and ink industry, CEPE, distributed two questionnaires for the project to its national member associations. The first, long questionnaire received only two responses, both from large multinational paint producers.

The second questionnaire received a total of 29 responses from paint manufacturers, and the list of biocides in Annexes I and II is based on these responses.

The respondents include 11 mostly medium-sized manufacturers based in Austria, Denmark, Germany, Sweden, and the UK, as well as one medium-sized manufacturer in Norway. Two multinational paint manufacturers, with plants in several EU countries, responded to the second questionnaire as well as the first. Finally, 16 responses were received from Spain, mostly small and medium-sized companies (The Spanish responses arrived from the national trade association; not all Spanish respondents wished to identify themselves.)

No responses were received from Italy, the third Member States in the EU25 in terms of production of water-based paints. No responses were received from the EU10. It is suspected that in some of these countries, national trade associations did not distribute the questionnaire to their member companies.

Identification and quantification of PT6 biocides

The questionnaire asked respondents to list the active substances (providing CAS numbers) and biocidal products. The 29 responses provided this information for over 50 different water-based paints. A compilation of the survey responses is presented in Annex I.

An initial review of the CAS numbers indicated that 8 of the 51 paints contain in-can preservatives with active substances that have not been notified under the Biocidal Products Directive; however, for three paints the CAS numbers for a common active substance appear to be misreported. Nonetheless, it appears that five out of 51 paints in the survey, or about 10% of the sample, were not notified (see Annex I). As responses have been received from only a few Member States, this sample does not appear strong enough to make generalisations, other than the fact that non-notified active substances continued to be used in late 2005 and early 2006.

The questionnaire also asked for the amount of active substances in paints. The reported results vary significantly, from <15 ppm to a maximum of 1%. It appears in fact that some respondents provided the concentration of the active substance and others the concentration of the biocidal product: a

10 2-Methyl-2H-isothiazol-3-one (CAS No. 2682-20-4).
comparison with the findings of the Danish Inventory confirms this for several common PT6 active substances\(^\text{11}\) whose concentrations are usually low: under 0.1% and often under 0.01%.

While some responses had these low levels, others listed a higher order of magnitude for the same active substance, typically over 0.1%. It was assumed that the higher values referred to the biocidal product, and the lower values to the active substance. The higher values (ranging from 0.1% to 0.4%) were then removed from the data set.

For other active substances, such as Bronopol (CAS 52-51-7), the value listed by two respondents (0.2%) corresponds to the range in the Danish Inventory (0-0.5%). These data were not excluded from the set. Nor were data for other biocides.

The resulting restricted data set has an average of 0.067% and a median of 0.05%. The total production of water-based paints is 4.26 million tonnes. If half of the median is used as a minimum of the true average concentration, the amount of active substances is at least 1 065 tonnes. These estimates are highly uncertain, as they depend very much on the shares of active substances used in higher concentration. Moreover, they are based on responses from only a small sample of companies based in six Member States.

A comparison with the Danish data suggests that this initial figure is not an overestimate: scaling up Danish consumption to EU production levels would indicate that the amount of active substances lies between 3 500 and 14 500 tonnes. The Danish Inventory is heavily weighted by their estimates of active substances such as Bronopol that are used in higher concentrations. Bronopol were less common in the questionnaire responses received. A more secure estimate will depend on better data.

**Identification and quantification of PT7 biocides**

Respondents described the active substances and biocidal products in 60 different fungi-resistant paints. A compilation of survey responses for PT7 biocides is presented in Annex II.

It appears that six of these paint products contain active substances that have not been notified. Three of these were produced by manufacturers in Spain.

The concentration of PT7 biocides starts from a minimum of 0.004% (Annex II). Here too, some respondents appear to have provided levels of biocidal products rather than active substances, and thus values an order of magnitude or more higher than the lowest values were excluded from the data set. Moreover, where a single response provided a range of concentrations, the lower level was used. This approach provides a minimum estimate of the amount of biocides used. This is only for the purpose of market study, to establish a minimum level of the cost of biocides (the approach for health and environmental risk assessment, as in the report for Task 2.3 of this Study, is normally quite different). Using this approach, the average concentration for the data set is estimated as 0.33%, and the median as 0.3%.

The current estimate of the total amount of paint containing PT7 biocides has a broad range. Using the minimum production of 170 000 tonnes, and as a minimum average concentration of active substances one-half the median of the questionnaire responses, the amount of active substances used in the EU is at least 255 tonnes. Scaling up from the Danish Inventory to EU production levels provides a much higher number, over 3 000 tonnes, suggesting that the estimate of 255 tonnes is not an overestimate.

\(^{11}\) BIT, 1,2-Benzisothiazol-3(2H)-one (CAS No. 2634-33-5); CMIT, 5-Chlor-2-methyl-2H-isothiazol-3-one (CAS No. 26172-55-4); and MIT 2-Methyl-2H-isothiazol-3-one (CAS No. 2682-20-4)
Share of biocides in product cost

Telephone interviews were carried out with four manufacturers. These manufacturers reported that PT6 biocides represented less than 1% of the costs of materials for their water-based paints.

In contrast, the respondents reported that the cost of PT7 biocides is significantly higher. Most reported a range between 5 and 10% of costs of materials, though one reported 33% for a specific paint. This significant difference suggests that fungi-resistant paints may be more easily affected by import competition if there are changes in the cost of biocides.

The cost of switching biocides

Manufacturers contacted by telephone did not wish to provide a cost estimate for switching biocides. Nonetheless, two medium-sized companies reported that the cost of switching biocides was significant, as it includes lengthy efficacy tests. For example, for PT6 biocides, this includes tests that last the duration of the planned shelf life for the products, which can easily exceed a year. Manufacturers emphasised the importance of these tests, as microbial degradation can discolour paint: one manufacturer cited the case of a competitor that had to undertake a costly recall of water-based paints due to a poorly working biocide.

One medium-sized manufacturer reported their intention to end production of a fungi-resistant paint, as the biocide currently used has not been notified and will be withdrawn from the market. Two other medium-sized manufacturers who used biocides that are notified said that they would consider ending product lines rather than switch in the event a biocide had to be withdrawn from the market.

2.3 Issues regarding imports of treated articles

Within the EU, the withdrawal of some PT6 and PT7 biocides from the market is likely to have an impact in particular on small and medium-sized producers. CEPE notes that the paint industries in southern Europe in particular have a large number of such companies. In some cases, companies may end production of paints rather than face the cost of switching biocides.

At present, imports of paints into the European Union are quite low compared to domestic production. Due to this fact, it is likely that any paint withdrawn from production – for example, due to the cost of switching from non-notified biocides – will be replaced by other paints produced within the EU.

Overall, it is likely that small EU paint manufacturers will have greater difficulty meeting the costs of switching biocides, and thus will be more likely to end production lines. As a result, the market share of smaller manufacturers is likely to decrease vis-à-vis larger manufacturers that are better able to face the costs of switching biocides.

For fungi-resistant paints, the cost of the biocide can be a relatively important share of total substances. The cost of the biocides, at least for the small set of manufacturers contacted by telephone, is currently under 10% of the total cost of materials used in fungi-resistant paints. Active substance manufacturers have warned that the cost of biocides will increase as active substances are withdrawn from the market, reflecting the cost of authorisation and possibly also due to reduced competition in a market with fewer products. This would increase the weight of biocides in the cost of materials for fungi-resistant paints.

In this situation, imports of fungi-resistant paints, including those containing unauthorised active substances, may become more competitive with articles produced in the EU. While paint is a relatively heavy product compared to its value, current imports of paints from the US, Japan and Thailand indicate that transport costs are not an insurmountable obstacle to an increase in imports.
One manufacturer of active substances and biocidal products contended that the experience of the Netherlands demonstrates the risks that the EU as a whole will face if few active substances or biocidal products for treated articles are approved. An important share of the manufacture of paints – and in particular fungi-resistant paints – has moved out of the Netherlands to neighbouring Member States, as few biocidal products have been registered for use in the Netherlands. Information was not found on the dimensions of this shift. Moreover, it should be noted that in this case transportation costs are relatively minor.

Nonetheless, there is a risk that in the longer term, the withdrawal of biocides from the EU market could result in higher biocide prices that might provide an advantage to the import of treated paints, including those with biocides not notified or authorised within the EU. This risk would appear relatively small for water-based paints containing PT6 biocides: the in-can preservatives represent a small share of the cost of paints. In contrast, the long-term risk appears greater for paints containing PT7 biocides.

12 The web site of the Netherlands Board for the Authorisation of Pesticides (CTB) lists only one authorised biocidal product under film preservatives (http://www.ctb.agro.nl/).
3. Water-based adhesives

Overview

Adhesives bond two items together. There are many different types of adhesives: according to FEICA, the industry association, over 250,000 adhesive products are produced in the EU, many for quite specialised uses.\textsuperscript{13} For example, one small enterprise with approximately 15 employees based in Germany is the EU market leader for envelope adhesives.\textsuperscript{14} As in this case, most adhesives are intermediate products for production of finished articles.

Just over half of all adhesives consumed in Europe (by weight) are water-based: essentially all of these contain in-can preservatives. (In addition to water-based adhesives, the other major categories include solvent-based adhesives and chemical curing ones, which work through a chemical reaction).

Information on adhesives was obtained through a questionnaire distributed by FEICA, through interviews with selected respondents as well as with data provided by FEICA itself. Some adhesives manufacturers also provided data related to sealants. However, much less information was available on these products. In particular, there does not appear to be a European association for this product (FEICA focuses entirely on adhesives).

3.1 EU Production, Imports and Exports (overview and trends)

EU production and consumption levels

Eurostat’s PRODCOM and COMEXT databases appear not to provide accurate data on adhesives production, imports and exports. The PRODCOM database has one relevant category, “prepared glues and adhesives”.\textsuperscript{15} Unfortunately, it appears that this category contains only some of the adhesives produced in the EU. (The others may be included under other categories, such as those for specialty chemicals products.) Due to this statistical difficulty, data from FEICA is used as the base for the data presentation in this section. In addition, a series of assumptions, described in the following paragraphs, have also had to be made to obtain estimates specifically on water-based adhesives.

A total of about 2.5 million tonnes of adhesives, with a value over €7.5 billion, were sold in 2004 in the EU15 plus the Czech Republic, Hungary, Poland, Slovakia and Switzerland, according to FEICA. EU production was approximately 15% higher, as the adhesives industry is a net exporter.

Approximately 52% of adhesives are water-based and thus contain in-can preservatives. These include polymer dispersion adhesives, as well as glues based on casein and other animal and plant products.

Table 3.1 provides estimates for consumption and production of water-based adhesives for selected EU and EFTA countries, based on FEICA data. FEICA’s categories aggregate some Member States, such as Portugal and Spain. The “Nordic” category includes Denmark, Finland, Norway, and Sweden.

This table uses a number of assumptions: first, the Europe-wide share of water-based adhesives (52%) has been applied to total demand in each Member State. While the share of water-based glues will vary from country to country, this assumption should provide broadly accurate data. A further estimate was used to derive data for production. Exports account for approximately 23% of EU consumption;

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\textsuperscript{13} FEICA is the Fédération Européenne des Industries de Colles et d’Adhésives.

\textsuperscript{14} Jochen Beleke, Permanent Secretary, FEICA. Personal Communication. February 2006.

\textsuperscript{15} PRODCOM category number 24621095-Prepared glues and other prepared adhesives.
imports account for approximately 7-8%. The approximate difference, 15% was added to each country’s consumption data. Here too, exports outside the EU will vary from country to country. The table only provides production data by weight. Using these assumptions, the total value of EU production would be about €4.3 billion.

Both assumptions are likely to underestimate the share of production in Germany, the most important adhesives producer: for example, Germany accounts for one-third of all employment in the industry, as noted below.

<table>
<thead>
<tr>
<th></th>
<th>Consumption</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>Thousand Tonnes</td>
<td>Percent of total</td>
</tr>
<tr>
<td><strong>Selected EU15 and EFTA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>287</td>
<td>22.7%</td>
</tr>
<tr>
<td>Italy</td>
<td>227</td>
<td>17.9%</td>
</tr>
<tr>
<td>France</td>
<td>191</td>
<td>15.1%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>179</td>
<td>14.2%</td>
</tr>
<tr>
<td>Portugal + Spain</td>
<td>132</td>
<td>10.4%</td>
</tr>
<tr>
<td>Benelux</td>
<td>72</td>
<td>5.7%</td>
</tr>
<tr>
<td>Nordic countries</td>
<td>60</td>
<td>4.7%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>12</td>
<td>0.9%</td>
</tr>
<tr>
<td><strong>Selected EU10</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>66</td>
<td>5.2%</td>
</tr>
<tr>
<td>Hungary</td>
<td>11</td>
<td>0.9%</td>
</tr>
<tr>
<td>Czech Rep. &amp; Slovakia</td>
<td>30</td>
<td>2.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1 267</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 3.1 Estimated consumption and production of adhesives
(Source: FEICA)

Employment and structure of the EU adhesives industry

The EU adhesives industry has hundreds of companies, most of them small and medium-sized. According to Eurostat data, there are over 600 companies in the main EU. This data does not include some smaller Member States, and as other Eurostat data may only cover a part of the industry. The total number of companies manufacturing biocides should across all EU25 as well as EFTA countries may thus approach 1000.

There are eight large adhesives manufacturing companies in Europe with over €100 million in sales each, including Henkel of Germany, Bostik Findley of France and National Starch and Chemical of the UK. These eight large companies account for about 10% of EU production by weight. They typically have a large number of small and medium-sized factories across the EU, as they have grown through the acquisition of smaller companies. These eight large companies also have international manufacturing plants.

The spectrum of companies in the adhesives industry is nonetheless dominated by a great number of small firms: according to FEICA, about half of EU production comes from companies with less than €15 million in yearly sales.
According to FEICA, adhesives manufacturers employ about 31 000 employees; 11 000 of these, over one-third, work in Germany.

The Marketing Chain

The majority of adhesives are used in industry for the production of a variety of finished goods. The main industries that consume adhesives are:

- Construction, for example to lay flooring and for many other purposes;
- Paper and packaging, where the manufacturing of corrugated boxes is a major use;
- Woodworking and furniture production;

Other industries that consume adhesives include the production of footwear and other finished leather articles and automobile construction.

A small share – less than 4% of total production by volume, although up to 20% by value – is sold to the consumer market. Thus, consumers come into direct contact with only a small amount of all the adhesives containing in-can preservatives, implying that direct exposure is mainly to workers.

Table 3.2 presents estimates of the amount of water-based adhesives consumed by selected industries. This table uses data from different sources and makes several assumptions. Shares of consumption by sector were only found for Germany; these were used as rough estimates across the EU. The shares of water-based adhesives in the adhesives consumed by each sector were provided by FEICA. These estimated shares were multiplied by the total amount of adhesives consumed (about 2.5 million tonnes) to determine estimates of the total amount of water-based adhesives for each sector.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Share of total adhesives consumption</th>
<th>Share of water-based adhesives consumption</th>
<th>Estimated total consumption (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer market</td>
<td>4%</td>
<td>66%</td>
<td>64</td>
</tr>
<tr>
<td>Construction</td>
<td>30%</td>
<td>60%</td>
<td>439</td>
</tr>
<tr>
<td>Paper and packaging</td>
<td>35%</td>
<td>65%</td>
<td>554</td>
</tr>
<tr>
<td>Woodworking/furniture</td>
<td>15%</td>
<td>35%</td>
<td>128</td>
</tr>
<tr>
<td>Transportation</td>
<td>5%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Footwear and leather</td>
<td>3%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Other</td>
<td>8%</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Sources:
1. CITEPA, for Germany only
2. FEICA estimates

The amount of adhesives and the share of water-based adhesives used by each sector can vary from country to country. For example, in Nordic countries, adhesives are used for flooring in houses, while in the UK flooring is typically nailed in place. In Nordic countries, solvent-based adhesives are more commonly used, as flooring is laid early in house construction, in conditions where water-based adhesives may freeze and thus not be effective. In many other countries, however, water-based adhesives have largely replaced solvent-based adhesives in construction for worker health and safety considerations.
3.2 Identification and quantification of biocides used

Biocides Identified

The survey was sent to FEICA’s members via national association. Only 9 responses were received, from companies based in Denmark (three responses), France, Italy (two responses), Netherlands, Sweden and United Kingdom. One company in Denmark reported that no biocides were used.

The list of biocides identified by the respondents is provided in Annex III.

Amount of biocides

The questionnaire asked for the quantity of active ingredient in adhesives. The range of responses is quite large, however: it appears that some respondents provided data on the amount of biocidal products present in their adhesives (in percent of weight or ppm), and others on the amount of active substances. Since only a small number of responses were received, no attempt was made to identify which figures might refer to biocidal products and which to active substances. The concentrations were instead determined using other sources.

According to FEICA, the amount of biocidal product (by weight) in water-based adhesives should vary between 0.1% and 0.5%. If the data in the questionnaires are divided in two (those above and those below 0.1%), this range corresponds to the higher data set. This implies that between 1300 tonnes and 6300 tonnes of biocidal products are consumed by in adhesives manufacture each year. The average value (0.3% concentration by weight) corresponds to approximately 3800 tonnes of biocidal products.

The amount of active substances used in a biocidal product can vary significantly: for the biocidal products used in Denmark, the range can vary between 0.005% and 10%, according to Danish Inventory (DEPA). Overall, this study estimated that active substances represented an average between 0.005% and 0.025% of the adhesives produced in Denmark. This corresponds to the lower set of responses to the survey, which are believed to refer to active substances. Using the range for the identified in the Danish study, the amount of active substances used in adhesives in Europe is between approximately 60 and 300 tonnes.

Finally, it should be noted that these represent the shares of in-can preservatives in packaged adhesives. When a water-based adhesive is used, its water content will evaporate, leaving only a trace of the biocide.

Share of biocides in product cost

According to two EU manufacturers of adhesives for the consumer market, in-can preservatives (PT6) represent 0.1 to 1% of the cost of all ingredients in their water-based adhesives, depending on the specific type of adhesive.

Cost of switching active substances

One large adhesives manufacturer reported that switching biocides in a product would involve at least half a working year in development and testing, plus at least half a working year to file regulatory papers where these are required. Testing itself would take at least half a year, and involve a three-month storage test.

The questionnaire responses appear to provide a broader range for specific active substances: this can range as low as 0.0001% (see Annex III).
This large manufacturer reported that it would be unlikely to withdraw an adhesive product instead of meeting these costs – but withdrawal would nonetheless be considered for specialty products with small markets.

**3.3 Further issues and information regarding biocides in adhesives**

Of the ten EU adhesives companies that responded to the study questionnaire, only two reported that imports from outside the EU were a significant source of competition, and only one reported that such imports had risen over the past five years.

According to FEICA, manufacturers in the most important Member States for adhesives production are aware that non-notified active substances will be withdrawn from the market in the September 2006. Moreover, in Germany at least, many important industrial customers as well as major retail chains are also aware of this deadline, and these issues are commonly raised in their quality assurance and environmental audits. In principle, manufacturers of biocidal products should also inform their customers, such as adhesives manufacturers, about any notified active substances that will not be supported.\(^{17}\)

Imports currently make up only a small share of the EU market, and biocides are not a major cost for the adhesives industry. These factors indicate that the import of biocides containing non-notified substances should be low.

A discussion with a major adhesives producer should be noted. For one product line, the manufacturer imports adhesive in bulk from Asia and then re-packages it under its own label. The manufacturer requested that the Asian producer only use biocidal products containing notified active substances, apparently not aware that imports of treated articles for internal effect are not currently regulated under the Biocidal Products Directive.

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\(^{17}\) Jochen Beleke and Ansgar van Halteren. FEICA. Personal communication. February 2006.
4. Treated Wood

Wood is treated for protection against fungus, micro-organisms and insects.

Scope of this section: types and uses of treated wood

Wood can be treated either for a preventive or a curative purpose. Curative treatment refers to end users such as households and building professionals who purchase retail wood preservatives to protect wood damaged by biological degradation. These end uses, though an important market for wood preservatives, are not covered by this study, which focuses rather on preventive uses of wood preservatives.\(^{18}\)

There are two main methods for the preventive treatment of wood. Pressure and vacuum equipment is used to inject preservatives into wood, typically at or just after the sawmill stage. Pressure and vacuum treated wood is used for several applications, in particular for where wood is in regular contact with water or soil. Wood can also be treated by surface methods, such as dipping or spraying. This section mainly presents information on pressure and vacuum treated wood, which appears to be the most important method for treated wood.

Box 4.1 Examples of applications for treated wood
(Source: OECD)

<table>
<thead>
<tr>
<th>Indoor</th>
<th>Outdoors</th>
</tr>
</thead>
<tbody>
<tr>
<td>various, roof trusses</td>
<td></td>
</tr>
<tr>
<td>house fronts (claddings)</td>
<td></td>
</tr>
<tr>
<td>roof tiles</td>
<td></td>
</tr>
<tr>
<td>window frames</td>
<td></td>
</tr>
<tr>
<td>playing tools</td>
<td></td>
</tr>
<tr>
<td>garden houses</td>
<td></td>
</tr>
<tr>
<td>Fences</td>
<td></td>
</tr>
<tr>
<td>landings, wharves</td>
<td></td>
</tr>
<tr>
<td>Bridges</td>
<td></td>
</tr>
<tr>
<td>river bank revetment</td>
<td></td>
</tr>
<tr>
<td>sound-proof barriers</td>
<td></td>
</tr>
<tr>
<td>railway sleepers</td>
<td></td>
</tr>
<tr>
<td>telephone poles</td>
<td></td>
</tr>
<tr>
<td>fence poles</td>
<td></td>
</tr>
<tr>
<td>car pools</td>
<td></td>
</tr>
<tr>
<td>wood in gardens</td>
<td></td>
</tr>
<tr>
<td>flood defences</td>
<td></td>
</tr>
</tbody>
</table>

Box 4.1 lists some applications of pressure and vacuum-treated wood. One other important application is the use of treated wood for industrial cooling towers.

It should be noted that Annex V of the Biocidal Products Directive species that wood preservatives are: “Products for the preservation of wood, from and including the saw-mill stage, or wood products by the control of wood-destroying or wood-disfiguring organisms”. Thus, treatment of wood before the sawmill stage (e.g. “sapstain” control carried out in the forest or in any case on raw timber) is not regulated under the BPD but rather under the Plant Protection Products Directive. In addition, anecdotal reports note that some shipments of imported timber are also sprayed with fungicide. If these occur before the sawmill stage, the Biocidal Products Directive may not apply to these.

Hazard classes

The type and strength of wood preservative needed depends on the hazard class of the specific application (see Box 4.2 on the following page). The European Committee for Standardization has approved a list of five hazard classes (as well as other documents related to the use of wood preservatives). The Committee’s work on this topic is referenced in the Directive on the

\(^{18}\) There is a distinction between preservatives to protect the wood itself and decorative wood coatings, which may themselves have PT7 biocides when intended for outdoor use. Manual of Decisions for Implementation of Directive 98/8/EC Concerning the Placing on the Market of Biocidal Products, 30 March 2005, p. 42.
Approximation of laws, regulations and administrative provisions of the Member States relating to construction products (89/106/EEC).

Wood in hazard class 1 is used in relatively benign environments, while hazard class 5 refers to marine environments that can quickly degrade untreated wood. In most cases, the wood preservatives of greatest concern for their environmental and health effects are those used in the higher hazard classes.

### Box 4.2 Hazard Classes for Treated Wood

**Hazard class 1**  
Wood or wood-based product under cover, fully protected from the weather and not exposed to wetting. (e.g. domestic roof timbers).

**Hazard class 2**  
Timbers not in ground contact, protected from the weather but where high environmental humidity can lead to occasional but not persistent wetting. (e.g. general building timbers).

**Hazard class 3**  
Timbers not in ground contact, either continually exposed to the weather or protected from the weather but subject to frequent wetting (e.g. fencing rails, joinery, cladding).

**Hazard class 4**  
Timbers in contact with the ground or fresh water and permanently exposed to wetting (e.g. fence posts, poles, silage walls, river jetties).

**Hazard class 5**  
Timbers in the marine environment exposed to salt water (e.g. marine piling, harbour jetties).

### Substances of concern regarding imports of treated wood

Several substances used in wood preservatives are of particular concern. All appear to be used for pressure or vacuum-treated wood.

Wood preservatives that use a combination of copper, chromium and arsenic (CCA) were widely used in the EU for wood treatment, in particular for hazard classes four and five. Neither CCA nor Arsenic has been notified under the Biocidal Products Directive. Thus, these preservatives can no longer be placed on the market after September 2006.

The marketing and use of arsenic compounds have been restricted under Directive 76/769, which limits their use to specific applications (16 March 2004 version):
- as structural timber in public and agricultural buildings, office buildings, and industrial premises,
- in bridges and bridgework,
- as constructional timber in freshwater areas and brackish waters e.g. jetties and bridges,
- as noise barriers,
- in avalanche control,
- in highway safety fencing and barriers,
- as debarked round conifer livestock fence posts,
- in earth retaining structures,
- as electric power transmission and telecommunications poles,
- as underground railway sleepers.
Thus, without further regulatory provisions, wood treated with CCA could be employed for these applications, but after September 2006 could not be treated within the EU and would be available exclusively from imports.

Another concern is chromium, which is used in combination with copper and other active substances in several wood preservatives, including those using arsenic (which has not been notified) and boron (boric acid has been notified and supported for PT8). Chromium, however, has not been notified as an active substance for PT8. The wood preservative industry has claimed that chromium is a fixative rather than an active substance. The decision will have an important influence on the formulated products for wood preservation that can be marketed and used in the EU.

Creosote is an active substance for wood preservation that has been notified under the Biocidal Products Directive. It is also regulated under Directive 76/769: wood treated with creosote may not be used inside buildings or for garden furniture, for example. Nonetheless, creosote continues to be used for outdoor applications such as aquatic applications as well as railroad sleepers. A specific formulation of creosote has been notified and supported for PT8. However, if this active substance is not approved for application in the EU, imports of wood treated with this active substance may take the place of domestically treated wood.

### 4.1 EU production and imports of treated wood

Essentially all EU firms producing treated wood are small and medium-sized. Many of these specialise in wood treatment, though in others, wood treatment is combined with either sawmill operations or with woodworking operations such as the production of garden furniture.

**EU Production of treated wood**

Little useful data were found on Eurostat databases on EU production, imports or exports of treated wood. There are limited data mainly on one category of treated wood, railroad sleepers (these are presented at the end of this section). As a result, this section chiefly uses data from a European industry association, the Western European Institute for Wood Preservation (WEI), as well as data from national industry associations that responded to requests for the study.

Table 4.1 presents the amount and value of wood treated by pressure and vacuum means in the EU15, plus EFTA countries. The data on volume of wood treated have been provided by WEI: these represent the most recent data submitted by the Institute’s national member associations (in most cases from 2001 to 2004).

<table>
<thead>
<tr>
<th></th>
<th>Volume (million m$^3$)</th>
<th>Value (million Euros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction timber</td>
<td>2.86</td>
<td>529</td>
</tr>
<tr>
<td>Garden timber</td>
<td>1.37</td>
<td>253</td>
</tr>
<tr>
<td>Small roundwood</td>
<td>0.98</td>
<td>224</td>
</tr>
<tr>
<td>Poles</td>
<td>0.91</td>
<td>168</td>
</tr>
<tr>
<td>Railroad sleepers</td>
<td>0.39</td>
<td>55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6.50</strong></td>
<td><strong>1 229</strong></td>
</tr>
</tbody>
</table>
The table presents rough estimates of the value of treated wood. These have been determined first using Eurostat data for exports of roundwood and railroad sleepers, the only two categories of treated wood found in the Eurostat COMEXT database. The values derived from Eurostat data (which provides total amount in cubic metres and total value in Euros) are: about €130/m³ for sleepers and about €230/m³ for roundwood. The average of these two values (€185/m³) was used for all other types of timber. The resulting total, €1.2 billion, provides a very approximate estimate for the total value of pressure and vacuum-treated wood produced in the EU.

**Treated wood production and consumption in selected Member States and EFTA countries**

More detailed information and data are available for several Member States. These are presented in Table 4.2. It should be noted that categories differ across these Member States, and thus are not always directly comparable.

**Table 4.2 Production of treated wood by application, selected Member States and Norway (m³)**

<table>
<thead>
<tr>
<th>Application</th>
<th>Denmark</th>
<th>Finland</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
<th>Norway</th>
<th>Sweden</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction timber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Buildings)</td>
<td>259 000</td>
<td></td>
<td>26 000</td>
<td>151 000</td>
<td>75 000</td>
<td></td>
<td></td>
<td>1 440 000</td>
</tr>
<tr>
<td>(Other)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sawn timber</td>
<td>121 555</td>
<td>214 000</td>
<td></td>
<td></td>
<td>306 306</td>
<td>831 862</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joinery</td>
<td>29 575</td>
<td></td>
<td></td>
<td></td>
<td>24 206</td>
<td>25 292</td>
<td>416 000</td>
<td></td>
</tr>
<tr>
<td>Small roundwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17 000</td>
<td>39 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poles</td>
<td>199</td>
<td>123 000</td>
<td>75 000</td>
<td>25 000</td>
<td>14 255</td>
<td>70 318</td>
<td>64 000</td>
<td></td>
</tr>
<tr>
<td>Railroad sleepers</td>
<td>18 000</td>
<td>500</td>
<td>30 000</td>
<td>4 000</td>
<td>15 961</td>
<td>64 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garden timber, fence posts, etc.</td>
<td>*</td>
<td>*</td>
<td>14 500</td>
<td>150 000</td>
<td>125 000</td>
<td>18 393</td>
<td>45 911</td>
<td>1 184 000**</td>
</tr>
<tr>
<td>Agricultural uses</td>
<td>40 000</td>
<td>(vineyard stakes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 000</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>8 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 000**</td>
</tr>
<tr>
<td>Total</td>
<td>151 329</td>
<td>355 000</td>
<td>421 000</td>
<td>373 000</td>
<td>243 000</td>
<td>363 160</td>
<td>989 344</td>
<td>3 200 000</td>
</tr>
</tbody>
</table>

Notes:
- * - included under sawn timber
- ** - includes treated wood for decking, landscaping and fencing (both household and agricultural)
- *** - for freshwater and marine uses

Sources:
Denmark, Finland, Norway, Sweden: Nordic Wood Preservation Council
France, Netherlands: WEI (Western European Institute for Wood Preservation), based on data from national associations
Germany: Holzschutzverband e.V.
United Kingdom: Estimates by Dr Chris Coggins, British Wood Preserving and Damp-proofing Association

The countries listed in Table 4.2 supply about 90% of EU15 and EFTA production of treated wood. The only other major producing country is Italy. Data were not found on the production of treated wood in southern Europe and also in the EU10. Nonetheless, these countries are not major sources of EU production, according to WEI, the European industry association. Among the EU10, only Poland...
is considered an important producer. In southern Europe, production is low and most wood treatment companies are said to be very small.

The remainder of this section provides some details on production in selected Member States.

**France**

For France, data provide detail on domestic production and consumption of treated wood for a series of specific applications (Table 4.3).

Based on this data, approximately half of all treated wood consumed in France is produced elsewhere, mainly in other EU Member States. This is the case in particular for wood used in building construction.

**Table 4.3 Production and consumption of treated wood in France (m³)**

(source: national data provided by WEI)

<table>
<thead>
<tr>
<th>Civil Engineering</th>
<th>Production</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility poles</td>
<td>75 000</td>
<td>75 000</td>
</tr>
<tr>
<td>Railroad sleepers</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Noise and safety barriers</td>
<td>13 000</td>
<td>13 000</td>
</tr>
<tr>
<td>Bridges and footbridges</td>
<td>4 000</td>
<td>4 000</td>
</tr>
<tr>
<td>Cooling towers</td>
<td>2 000</td>
<td>2 000</td>
</tr>
<tr>
<td>Jetties and landings</td>
<td>4 000</td>
<td>4 000</td>
</tr>
<tr>
<td>Riverbank protection</td>
<td>3 000</td>
<td>4 000</td>
</tr>
</tbody>
</table>

| Agriculture                            |            |             |
| Vineyard stakes                         | 40 000     | 90 000      |

| Building construction                   |            |             |
| Structural wood                         | 55 000     | 70 000      |
| Exterior wood                           | 75 000     | 85 000      |
| Balconies and shutters                  | 1 000      | 1 000       |
| External installations                  | 120 000    | 570 000     |
| Agricultural buildings                  | 8 000      | 8 000       |

| Outdoor furniture, etc.                 |            |             |
| Outdoor furniture                       | 5 000      | 20 000      |
| Playground equipment                    | 8 000      | 10 000      |
| Sports grounds                          | 1 500      | 1 500       |

| Miscellaneous                           |            |             |
|                                        | 8 000      | 8 000       |

| Total                                   | 423 000    | 966 000     |

**Sweden**

In 2001, Sweden had 96 installations for pressurised wood preservation. The industry, while fragmented, has been consolidating: since 1980, production has doubled while the total number of installations has fallen 60%. Less than half of Swedish production is consumed domestically. Most
production is consumed in other Member States. Some, however, is exported, such as treated utility poles exported to the Middle East and to developing countries.

**Netherlands**

The 21 wood-treatment firms in the Netherlands produced about 243,000 m$^3$ of pressure-treated wood. Domestic consumption reaches almost 750,000 m$^3$; the difference is mainly made up by wood produced in Nordic countries. Some Netherlands companies focus entirely on wood treatment; others combine this with other activities, such as the importation of treated and untreated wood and the production of garden furniture.

As can be seen in the Table 4.2, the main applications of treated wood are garden furniture and construction. This represents an important change over the past 10 years: previously, treated wood was used for lower value applications such as fences for agriculture and riverbank protection.

**The marketing chain for treated wood**

**Manufacture of wood preservatives**

The figure below covers the marketing chain for wood preservatives used both in industry, including pressure wood treatment, as well as those sold by retailers to household users.
The majority of active substances for wood preservation are sold via formulators, which prepare biocidal products. This route is widely use for industrial wood treatment, including pressure treatment.

Overview according to the major uses of treated wood

This section provides a brief overview of the markets for the major types of treated wood.

Construction timber

Consumption of construction timber varies significantly across Member States. For example, wood is main structural element for houses and other buildings in many Nordic countries, and most of this wood is treated. In the UK, in contrast, only 40% of new houses contain treated roof timbers. While the lifetime of untreated timbers is lower, the frequent changes in housing occupancy do not provide an incentive for the extra cost; nor do insurers require treated roof timbers in new houses. Termites are not a problem in the UK (nor in Scandinavia), reducing the need for treatment.

In southern France and many southern European countries, wood is used for roof timbers of houses, but rarely for other structural elements. In southern Europe, termite attack is an important risk for wood, and thus roof timbers are treated.

According to WEI, construction timber is a market in expansion in the EU. Import pressures do not appear to be strong, as construction companies often prefer to work with local wood treatment companies. In some cases, these companies buy untreated wood (either domestic or imported), which they send for treatment only after it has been cut to shape for current construction projects.

Garden furniture

The second largest application is for garden furniture (for some countries, this category can include treated wood for home fencing and landscaping). Garden furniture can be made of treated wood, of untreated tropical hardwoods and also of plastic. As an initial estimate, treated wood is used in up to €1 billion worth of garden furniture produced each year in the EU.

There are important differences among Member States: in the UK, treated softwood is little used for garden furniture as tropical hardwoods are preferred (treated softwood is however used for fences and other landscaping wood). In contrast, in the Netherlands, as indicated in Table 4.2, garden furniture is the most important use of domestically treated wood.

WEI reports that the use of treated wood for garden furniture is also a growth market. Nonetheless, imports are making inroads, in particular for garden furniture sold via large retailers. Softwood for garden furniture is usually treated with Category III or IV wood preservatives, which means water-based preservatives that commonly use copper. The older types of copper-based preservatives (including those using copper plus arsenic) have not been supported under the Biocidal Products Directive; newer types that have been supported are more expensive (see section 4.3, below). Thus, in this sector import pressures could become more important.

19 Dr Chris Coggins, BWPDA. Personal Communication. February 2006
20 The estimate is made considering that garden furniture represents about 3% of the EU furniture industry, which is valued at €80 billion in the EU15 and almost €10 billion in the EU10, and across the EU25 employed over 860 000 workers in 2003 (based on the European Furniture Manufacturers Association. Furniture in Europe, undated). Treated wood is estimate at about one-third of the garden furniture market.
21 Dr Chris Coggins, BWPDA. Personal Communication. February 2006
Utility poles

The main customers for treated poles are utilities. Here too, use varies by country: for example, in the Netherlands nearly all utility lines are placed underground, while in Italy, poles made of concrete and other materials are preferred to those made of treated wood. Thus, treated utility poles are little used in these two Member States.

The market for treated utility poles is fairly stable. In many Member States, utilities are still publicly owned and utility poles are purchased via open tender. Overall, import pressures are not strong, though WEI members have discovered a few cases where utilities purchased poles from importers.  

Small roundwood

This category includes wood used for several purposes, including outdoor fencing and stakes for vineyards and other agricultural uses. In general, these are low-cost applications. However, the wood may require some additional labour costs (such as cutting the pointed ends of small poles). WEI reports that some production has shifted from the EU15 to the EU10, such as Poland and the Baltic States, and a further shift towards Belarus and Ukraine has started.

Railroad sleepers

This market is also fairly stable – though over the long term (the past 25-50 years) it has declined significantly as railroads have shifted to concrete ties and have closed smaller railroad lines. Customers for sleepers include railroad companies, and to a lesser extent urban transport companies running tram lines. Essentially all railroad sleepers are treated with creosote.

While this is the smallest area of production of treated wood by volume, it is also the only one for which import data were found. These are described in the following section.

Data on EU imports of treated wood

Overall, imports of treated wood to the EU25 and EFTA countries appear to be relatively low compared to domestic production. Little data on the level of imports was found, however, as public import data appears to include most types of treated wood with untreated wood.

The Eurostat COMEXT database provides information for only one category of treated wood: railroad sleepers. Total imports of treated railroad sleepers into the EU25, from outside the EU – and not include imports from EFTA countries such as Norway and Switzerland – were about 60,000 m² in 2003. In comparison, WEI’s data for production in the EU15 and EFTA is 390,000 m². In other words imports for this category are approximately 15% of EU production. (Clearly, the categories do not match, as the domestic production data do not include the EU10; nonetheless, EU10 production is reportedly small, likely to be not larger than EU imports).

The countries that are the main sources of imports of treated railroad sleepers are in Eastern Europe: Belarus, the Russian Federation and Ukraine (Table 4.4). Indeed, imports from these three far exceed those of the three OECD countries that follow, the US, Australia and Canada. Other sources of imports include South Africa and countries in the Western Balkans.

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22 Although it has nothing to do with our study, De Jaeger said that one on occasion EBRD advertised an invitation to tender for utility poles in Croatia – to be treated with pentachlorophenol! When it was brought to their attention that this would be illegal within the EU, they said that it was a US consultant who prepared the specifications.

23 CN code number 4406 90 00.
Table 4.4 Main sources of imports of treated railroad sleepers, 2003
(Source: Eurostat)

<table>
<thead>
<tr>
<th>Country</th>
<th>Exports to the EU25 m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belarus</td>
<td>33 835</td>
</tr>
<tr>
<td>Russia</td>
<td>15 797</td>
</tr>
<tr>
<td>Ukraine</td>
<td>6 273</td>
</tr>
<tr>
<td>United States</td>
<td>1 212</td>
</tr>
<tr>
<td>Australia</td>
<td>727</td>
</tr>
<tr>
<td>Canada</td>
<td>550</td>
</tr>
</tbody>
</table>

This information only covers one category of treated wood, railroad sleepers. Patterns for other types of treated wood imports may differ. Nonetheless, this data indicate that Eastern European countries are important sources of imports. Moreover, in telephone interviews with managers at several timber treatment facilities in the EU, as well as representatives of trade associations, several respondents were concerned about growing exports of treated wood from Eastern Europe. One trade association official mentioned that some EU companies have started to shift production to Eastern European countries. A company official stated that there has been significant investment in new pressure treatment plants in Russia. Several interview and questionnaire respondents mentioned concerns about imports from Russia and neighbouring countries of wood treated with preservatives not notified in the EU (see section 4.3 below).

4.2 Reuse and recycling of treated wood waste

Treated wood, in particular from demolition, can make up a small but important share of waste streams. Moreover, EU waste management policies and directives and corresponding Member State strategies encourage the reuse, recycling and recovery of waste. As a result, recycled wood now makes up about 65% of the 1.4 million tonnes of wood panelling produced yearly in the UK, and up to 40% of the 2.2 million tonnes produced in Italy.\(^\text{24}\)

At the same time, there are concerns regarding the proper disposal of wood treated with preservatives that pose risks for health and the environment. For example, CCA, which was until recently widely used in the EU, is a wood preservative of specific concern. (The use of arsenic and CCA are restricted under Directive 76/769 on the Marketing and use of certain dangerous substances and preparations.)

There are several possible avenues for the management of used wood, including treated wood. These include:
- Reuse in other functions;
- recycling, in particular in wood panelling or wood chips;
- Incineration and energy recovery; and
- disposal in landfills.

Amount of treated wood waste

The extent and quality of statistics on wood waste vary significantly across Member States – and in particular there appear to be few reliable official or other statistics on the amounts or disposal methods

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for treated wood. Several estimates have been found in papers and presentations made for research programmes within the European Science Foundation’s COST Programme (European Cooperation in the field of Scientific and Technical Research). In addition, a UK government programme has recently made estimates of wood waste. Table 4.5 provides an overview of the data collected.

One specific problem is that definitions of treated wood waste appear to differ significantly among the sources for Table 4.5. In some cases, it appears that totals for treated wood waste include wood with coatings such as paint and varnish, in addition to wood treated against biological degradation. For example, the estimate for total UK treated waste is based on such a broader category.

For the specific category of CCA-treated waste, also presented in the table, there should not be this problem of definitions. Nonetheless, the data are largely estimates and all the sources emphasize the need for better data on wood waste.

The not very satisfactory data provided in Table 4.5 yields one or two basic conclusions. First, there does not appear to be any overall pattern in terms of reuse, recycling or disposal of treated wood. Second, it appears that in many Member States, the fate of treated wood follows patterns for used wood as a whole: in other words, in many Member States there are no efforts to differentiate treated wood waste due to specific hazards it creates, or based on the type of wood preservatives used and their risks.

Table 4.5 Estimates of annual treated wood waste in selected Member States and Norway (Tonnes)

<table>
<thead>
<tr>
<th></th>
<th>Belgium</th>
<th>Finland</th>
<th>Greece</th>
<th>Netherlands</th>
<th>Norway</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Treated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycling (e.g.</td>
<td>156 000</td>
<td>..</td>
<td>..</td>
<td>127 000</td>
<td>..</td>
<td>100 000</td>
</tr>
<tr>
<td>particle boards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landfill</td>
<td>..</td>
<td></td>
<td>5 000</td>
<td>0</td>
<td>30 000</td>
<td>..</td>
</tr>
<tr>
<td>Energy</td>
<td>..</td>
<td>10 000</td>
<td>2 000</td>
<td>1 200</td>
<td>70 000</td>
<td>164 000</td>
</tr>
<tr>
<td>production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>..</td>
<td>10 000</td>
<td>10 000</td>
<td>400 000</td>
<td>100 000</td>
<td>Up to 1 million</td>
</tr>
<tr>
<td><strong>CCA-treated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reuse and</td>
<td>..</td>
<td>n.a.</td>
<td>..</td>
<td>..</td>
<td>..</td>
<td>40 000</td>
</tr>
<tr>
<td>recycling (e.g.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>particle boards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landfill</td>
<td>..</td>
<td>0</td>
<td>..</td>
<td>..</td>
<td>..</td>
<td>40 000</td>
</tr>
<tr>
<td>Energy</td>
<td>..</td>
<td>9 000</td>
<td>..</td>
<td>..</td>
<td>..</td>
<td>*</td>
</tr>
<tr>
<td>production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>200 000</td>
<td>9 000</td>
<td>1 000</td>
<td>40 000</td>
<td>15 000</td>
<td>300 000</td>
</tr>
</tbody>
</table>

Notes:
* Reportedly sent to Sweden for incineration

Sources:
• For Belgium, Finland, Greece, Netherlands and Norway: Peek (2004)
• For UK: Estimates based on data from UK WRAP (various publication)

Further notes on treated wood waste in selected Member States and Norway

At the same time, it should be noted that several Member States have started to address the issue of treated wood reuse and disposal. Some Member States have focused on incineration and energy recovery for treated wood, and in particular for wood treated with preservatives of concern such as CCA. This appears to be the case for Sweden. In Germany, an “Ordinance on the requirements for the
recycling and disposal of waste wood” came into force in 2003. In the United Kingdom, a government programme has made several studies into the amounts and fate of treated wood waste.

**Denmark**

An estimated 2.7 million tonnes of treated wood will end up as waste in Denmark in the coming years. In 2010, 100 000 tonnes of treated wood waste are estimated, and a significant portion will contain CCA or creosote. Wood treated with arsenic, creosote or PCP is considered a hazardous waste in Denmark. For CCA-treated waste wood, incineration is not currently allowed due to arsenic emissions (methods to remove the arsenic content from the wood and to treat incineration emissions are being evaluated). As a result, CCA-treated waste wood must be sent to a landfill. Few possibilities are allowed for the reuse of CCA-treated wood: while these can include reusing poles in other locations and in marine environments, permission from the Danish EPA is required.

**Finland**

Finland has an estimated stock of 10 million m³ of wood treated with CCA, of which about half is in the form of utility poles. The reuse of waste wood treated with CCA for agricultural applications, bridges and fencing was allowed in 2003. Finland has a total stock of up to 10 million utility poles. Between 250 000 and 300 000 of these are discarded each year, and an estimated 80% of these are suitable for reuse. The cost of used poles for agricultural and other uses is about €17 each. In contrast, the cost for incineration (the main option for disposal) is about €22 per pole.

**Netherlands**

In the Netherlands, the use of CCA-treated wood was banned in 2000. There is, however, a large stock of this treated wood currently in use in buildings and other applications. A 1999 study indicated that the amount of wood waste treated with CCA is expected to increase steadily from about 40 000 tonnes per year in the early part of this decade to up to 110 000 tonnes in 2011. After this date, the amount of such waste will decline steadily until 2050, when wood treated with CCA will no longer be in use.

These results indicate that for the EU as a whole, the amount of wood waste treated with CCA should grow steadily for some years to come.

**Norway**

In 2003, Norway classified wood waste treated with CCA, creosote and PCP as hazardous. Already in 2002, the reuse of CCA-treated wood waste was banned. Following the classification, registered disposal facilities were given an initial dispensation to handle limited amounts of this waste; in practice, it is reported that treated wood waste was sent to Sweden for incineration.

**United Kingdom**

The UK government’s Waste Resources and Action Programme (WRAP) has made several studies of the amount of treated wood waste. For example, the Programme estimates that about railroad sleepers treated with creosote account for 35 000 tonnes a year of waste.

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26 Denmark banned the use of arsenic in treated wood in 1993. In 1996, a voluntary agreement with domestic treatment firms led to a halt in the use of chromium in wood preservatives, though wood can still be imported with chromium-containing preservatives.


29 TAUW bv and Stichting Hout Research, CCA-hout duurzaam verwijderd? For VROM. 1999.

In addition, a study for WRAP showed that some wood waste sent to landfills is treated with CCA: laboratory testing of samples indicate that over 10% of household wood waste taken to landfills and about 15% of construction and demolition wood waste contain CCA. A further 1.5% of household wood waste samples (but no construction and demolition waste) were treated with creosote.

In the UK at least, treated wood waste is still mixed with other construction, demolition and ordinary household waste. It is likely that the situation is similar in many other Member States.

4.3 Biocides used for wood treatment

Main categories of wood preservatives

Wood preservatives are commonly divided into three major categories:

- Water-based
- Solvent-based
- Emulsions
- Petroleum distillates, notably creosote.

Water-based preservatives include formulations that use inorganic substances, including CCA and other preservatives that use copper, such as copper chromium boron and copper carbonate. Quaternary ammonium compounds are also included in this category. Water-based preservatives are typically applied at high pressure, in facilities that also have a vacuum cycle to remove excess preservative from the treated wood.

Water-based preservatives are employed for many applications of treated wood in the higher hazard classes, including utility poles, riverbank protection and marine uses. They are used in over 70% of the pressure and vacuum-treated wood produced in the EU (see Table 4.6).

Solvent-based preservatives can use many types of active substances, including mixtures of azoles such as propiconazole and tebuconazole with permethrin or cypermethrin. (Dossiers have been submitted for these four substances under the BPD.) Solvent-based preservatives are usually applied in low-pressure equipment, which might also include a vacuum cycle to remove excess. (These types of preservatives are also applied in non-pressure methods, such as dipping.) This category accounts for about 18% of EU pressure and vacuum-treated wood.

OECD reports that: “In the last decade many of the treatments previously using LOSPs have changed to emulsion formulations using combinations of azoles, IPBC, quaternary ammonium compounds, cypermethrin and permethrin using water as the carrier” (OECD, 2003).

The main petroleum distillate used is creosote, which accounts for 11% of EU production. Creosote is typically applied under high pressure, often after being heated to reduce its viscosity.

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31 These definitions and following discussion are based in particular on the OECD Emissions Scenario.
32 The category of solvent-based wood preservatives also includes several substances that have not been notified, some of which are restricted and believed no longer in use in the EU, such as pentachlorophenol and lindane.
Table 4.6 Treated wood by type of preservative (m³)

<table>
<thead>
<tr>
<th></th>
<th>EU15 and EFTA</th>
<th>Netherlands</th>
<th>Sweden</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water-based</td>
<td>4 615 000</td>
<td>225 000</td>
<td>929 500</td>
<td>1 700 000</td>
</tr>
<tr>
<td>Solvent-based</td>
<td>1 170 000</td>
<td>0</td>
<td>31 900</td>
<td>300 000</td>
</tr>
<tr>
<td>Emulsions</td>
<td>..</td>
<td>..</td>
<td>..</td>
<td>1 200 000</td>
</tr>
<tr>
<td>Creosote</td>
<td>715 000</td>
<td>18 000</td>
<td>89 200</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>6 500 000</td>
<td>243 000</td>
<td>1 050 600</td>
<td>3 200 000</td>
</tr>
</tbody>
</table>

Notes: 2002 data for the Netherlands (WEI), 2004 data for Sweden (WEI), 2004 estimates for the UK (BWPDA).

Use of specific active substances

The project sought information on biocides currently used for wood treatment via three methods:
- Literature search
- A questionnaire send to member companies and associations of the Western European Institute for Wood Preservation (WEI);
- Telephone interviews with selected companies and trade associations;

The research has yielded some information on current use of wood preservatives. Unfortunately, the results are not complete. Notably, only six wood treatment companies replied to the questionnaire. Managers at these responding companies were willing to provide further information over the telephone. Nonetheless, these results only cover a very small sample of an industry made of many small and medium-sized companies.

The literature search and further telephone interviews provided additional information, notably on the use of biocides in Nordic countries and in the UK. Unfortunately, these efforts provided little information on current use of biocides in southern European Member States, nor in the EU10.

Questionnaire results: use of water-based biocides

Table 4.7 provides an overview of the questionnaire responses. All these responses referred to water-based preservatives. One notable result from the questionnaire is that at least one company continues to use a wood preservative containing CCA, an active ingredient that has not been notified.

Table 4.7 Wood Preservatives used by Pressure Treatment Companies Responding to the Questionnaire

<table>
<thead>
<tr>
<th>Biocidal product</th>
<th>Active substance</th>
<th>Type of treated wood articles/materials</th>
<th>Application Rates</th>
<th>Country</th>
<th>Notified/Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creosote oil</td>
<td>Creosote oil</td>
<td>Utility poles</td>
<td>115 kg/m³</td>
<td>NO, SE</td>
<td>Yes</td>
</tr>
<tr>
<td>Creosote oil</td>
<td>Creosote oil</td>
<td>Poles</td>
<td>180 Kg/m³</td>
<td>FR</td>
<td>Yes</td>
</tr>
<tr>
<td>CCA Type C</td>
<td>CuO, CrO₃, As₂O₅</td>
<td>Poles and structural woods</td>
<td>16/20 Kg/m³</td>
<td>FR</td>
<td>No</td>
</tr>
<tr>
<td>Celcure Ac 800</td>
<td>Copper Carbonate, Benzalkonium chloride</td>
<td>Stakes and other woods</td>
<td>18/20 Kg/m³</td>
<td>FR</td>
<td>CC – Yes Benz. Chloride - No</td>
</tr>
<tr>
<td>Tanalith E (3499)</td>
<td>Copper(II)carbonate</td>
<td>Poles, construction wood, fences</td>
<td>6,05 kg/m³</td>
<td>BE</td>
<td>Yes</td>
</tr>
<tr>
<td>Creosote Oil</td>
<td>Creosote oil</td>
<td>Poles / Sleepers</td>
<td>70 kg/m³</td>
<td>DK</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Information from trade associations

According to interviews with representatives of wood treatment associations for the UK and Nordic countries, in both these regions wood treatment facilities have largely substituted wood preservatives containing non-notified active substances.

For example, in Sweden, over 80% of all wood using water-based preservatives in 1991 were treated with CCA. By 2004, CCA accounted for only about 2% of this category, and its use has now been essentially stopped.\(^{33}\)

As similar trend is seen in the UK, where in 2000 CCA accounted for nearly all 1.5 m\(^3\) of wood treated with copper-based preservatives. By 2004, less than 200 000 m\(^3\) of wood were treated with CCA. Moreover, about 80% of high-pressure treatment now uses copper-based active substances that have been notified and supported, and most others use copper-based wood preservatives that include chromium (which has not been supported and whose classification under the BPD as an active substance or a fixative has not yet been decided).\(^{34}\)

**Total amounts of active substances consumed**

An estimate of the total amount of active substances has to take into consideration the considerable differences in application rates among wood preservatives, even of the same type.

For example, for water-based preservatives in the small set of survey results above, the amount of copper-based preservatives varies from 6 to 20 kg/m\(^3\). Moreover, the Danish *Inventory* reports that the concentration of active substances varies from 2% to 10% of the formulated preservatives. Using the WEI’s estimate of the total amount of wood treated with water-based preservatives, 4 615 000 tonnes, and a more restricted range between 10 and 20 kg/m\(^3\) of preservatives applied, the amount of active substances lies between 920 tonnes and 9 200 tonnes.

The survey results did not provide any information on solvent-based preservatives, so the Danish *Inventory* is used. This study notes that the percent of these active substances in treated wood varies from about 0.2% to about 1% by weight. As 1 m\(^3\) of wood weight about 0.55 tonnes, the total amount of these active substances used annually in the EU15 and EFTA countries range from about 1 300 tonnes to about 6 500 tonnes.

Creosote appears to be a special case in that there is not a distinction between the active substance and the biocidal product. Moreover, relatively high amounts are used in wood preservation: the survey responses provide a range between 70 and 180 kg/m\(^3\). A different estimate provides a slightly lower average: the ratio between the amount of creosote sold in Sweden\(^ {35}\) and national production of creosote-impregnated wood (provided by WEI) is about 63 kg/m\(^3\). This estimate may be influenced by stockpiling of creosote from one year to the next.

Usually a low estimate of 60 kg/m\(^3\) as a minimum and WEI’s estimate for the production of creosote-treated wood, at least 45 000 tonnes of creosote are consumed in the EU15 and EFTA yearly.

**Cost of biocides in materials costs**

In the UK, the average treatment cost is about 15% of the cost of the treated softwood. The cost depends in particular on the type of use. Treated wood used in more challenging environments such as in ground contact (hazard class 4) or in marine water (hazard class 5) require more preservatives. The cost of preservatives could reach as high as 25% of the cost of the treated article. The treatment cost

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\(^{33}\) Swedish Wood Preservation Institute.

\(^{34}\) Dr Chris Coggins, BWPDA.

includes labour and other costs for the treatment facility: the wood preservatives themselves will make up approximately 30-40% of the total treatment cost.\textsuperscript{36}

In the UK, the cost of the biocidal product is thus an average of about 4.5% of the cost of the treated wood.

Several industry sources reported that the cost of wood preservatives that have not been supported under the BPD – notably CCA – is lower than that of the more recent copper-based preservatives that have now largely replaced CCA in the UK and Nordic countries. This difference in cost could give an advantage to imports of wood treated with non-supported preservatives.

**Costs of switching biocides**

According to two sources, the main cost of switching biocides in pressure equipment is the need for extensive cleaning to remove nearly all traces of the old biocide. This may take a couple of days, and requires professional services. Moreover, waste products from the cleaning and other items will have to be disposed as hazardous waste.

In the UK, such cleaning and disposal could cost up to €10 000 for a small treatment facility and up to €30 000 for a larger facility.\textsuperscript{37}

Nonetheless, switching from one type of biocide to another within the same class (e.g. from CCA to other water-based copper wood preservatives) does not appear to involve major investment costs.

**Wood Preservatives in imports of treated wood**

The questionnaire and phone interviews revealed several anecdotal reports of imported wood treated with substances not supported in the review of biocides. For example, a questionnaire respondent in Finland reported imports of CCA-treated poles from Russia.

Another respondent provided a list of anecdotal reports of imports containing substances that have not been notified or submitted these are listed in Table 4.8

<table>
<thead>
<tr>
<th>Treated wood article/material</th>
<th>Active substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of treated wood products</td>
<td>Combination of Arsenic Pentoxide, Chromium Trioxide, and Copper Oxide (CCA)</td>
</tr>
<tr>
<td>Joinery</td>
<td>Tributyl tin oxide</td>
</tr>
<tr>
<td>Range of treated wood products</td>
<td>Pentachlorophenol</td>
</tr>
<tr>
<td>Range of treated wood products</td>
<td>Lindane</td>
</tr>
</tbody>
</table>

**Wood treatment in third countries**

It should be noted that several countries outside the EU are major producers of treated wood. Information is provided here on Canada, South Africa and the US. Despite a search (in both English

\textsuperscript{36} Dr Chris Coggins, BWPDA. Personal Communication, March 2006.

\textsuperscript{37} Dr Chris Coggins, BWPDA. Personal Communication, March 2006.
and Russian), similar data were not found for Eastern European countries such as Belarus, Russia or Ukraine.

**United States**

The most recent data found refers to 1997, when about 20.6 million m$^3$ of treated wood were produced in the US, significantly more than current EU production. Data on production by type of preservative were not found. From 2004, however, wood treated with CCA is only used for industrial purposes.  

**Canada**

The two most widely used preservatives in the Canadian pressure treating industry are alkaline copper quaternary (ACQ) and copper azole (CA). Other commonly used preservatives in commercial use in the early years of this decade include chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), pentachlorophenol and creosote.

From January 2004, wood treated with CCA can no longer be used for residential purposes. This wood is still produced for industrial uses, including utility poles, road signs, bridge ties and marine timber. Pentachlorophenol is also used for utility poles, bridge construction and marine timber. Creosote is used almost exclusively to treat railway sleepers.

**South Africa**

Almost 200 wood treatment plants operated in South Africa in 2004, and its production of treated wood is at least equal to that of Sweden. The main preservative used is CCA, which is applied in over 130 plants, followed by creosote. Other wood preservatives used include boron, tributyltinoxide and Lindane. PCP is not longer used for environmental concerns.

Table 4.9 presents the total sales by South African producers of treated sawn wood and poles in 2004. (Information on other categories of treated wood, such as railroad sleepers, was not found.)

<table>
<thead>
<tr>
<th></th>
<th>CCA</th>
<th>Creosote</th>
<th>Boron</th>
<th>TBTO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn Wood</td>
<td>360</td>
<td>0</td>
<td>1</td>
<td>14</td>
<td>375</td>
</tr>
<tr>
<td>Utility Poles</td>
<td>338</td>
<td>209</td>
<td>3</td>
<td>0</td>
<td>550</td>
</tr>
<tr>
<td>Total</td>
<td>698</td>
<td>209</td>
<td>4</td>
<td>14</td>
<td>925</td>
</tr>
</tbody>
</table>

Source: South African Wood Preservers Association

**Competition for export markets**

According to Eurostat statistics, the EU exported about 300 000 m$^3$ of treated railroad sleepers in 2003, and about half of that amount in 2004. While it is not clear if these data are accurate, for this category at least, exports outside of the EU are a significant share of production. Telephone interviews indicate that the EU and EFTA also export treated wood utility poles, in particular to the Middle East. Exports of sleepers and utility poles were treated with CCA or creosote.

In a telephone interview, a manufacturer of treated utility poles discussed competition in export markets. In particular, utility poles treated with CCA (and with forms of creosote no longer approved...
in the EU under Directive 76/769) exported to the Middle East and other markets compete with exports of third countries. According to this manufacturer and exporter, among the third countries producing poles treated with CCA are Israel, Ghana, and Tanzania; among those producing creosote-treated poles are Canada, South Africa, Turkey.

If current EU export markets prefer wood treated with substances that have not been notified or supported under the BPD, notably CCA, it appears that other countries could replace EU exports. In addition to current competitors, countries in Eastern European countries such as Russia, which is reportedly increasing its production of treated wood, might increase their exports.

### 4.4 Issues regarding wood preservatives and imports of treated wood

It appears that the treated wood industries in Nordic Member States, as well as in the UK and Germany, have already taken steps to replace preservatives that have not been notified. As a result, these countries should not face great difficulties coping with the withdrawal of wood preservatives from the EU market. Their production for EU markets should not be significantly affected.

It is possible, however, that they will face increased competition in export markets from producers in countries such as Canada and South Africa that are subject to fewer restrictions in the preservatives for us, including the use of CCA.

Less information has been found on the market structure or wood preservatives used in other Member States, in particular southern Member States. While overall production volumes are low, there is a stronger possibility that producers in these Members States will focus on difficulties in switching biocides, for example identifying appropriate wood preservatives for their needs. Moreover, these producers may be less prepared and more sensitive to economic factors, such as the cost of testing new preservatives as well as the potentially higher costs of wood preservatives after September 2006.

In general, a rise in imports of treated wood can be expected after September 2006. This will be true in particular for wood treated with CCA: under Directive 76/769, this can only be employed for specific uses. As CCA has not been notified, EU customers that wish to continue using wood treated with CCA for uses such as utility poles, cooling towers or railway sleepers will have to import this wood.

It can be expected that over the medium term of 5 years or longer, EU producers of imported wood will face stronger competition from countries such as Russia and Ukraine, which today export mainly raw timber: a shift to higher value-added products is quite likely.

Moreover, imported timber may easily be treated with preservatives that have not been supported and (in the future) not authorised. Copper-based preservatives that have not been supported, such as CCA, typically cost less than the substitutes. In interviews, one respondent noted that a simple visual check probably will not be able to distinguish among different types of copper-based treatment.
Milieu/DTC Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported October 2006
5. Textiles treated with biocides: overview

5.1 Overview

A variety of different types of textile products are treated with biocides. Biocides are used “to control bacteria, fungi, mould, mildew, and algae and the problems of deterioration, staining, odours (anti odour finishing), and health concerns that they cause”, a list that includes uses both for internal effect (to protect the articles themselves) and for external effect. This brief section reviews some of the uses and seeks to identify key uses for internal effect, as these are the focus of the current study.

Natural fibres, rather than synthetic ones, are the main ones subject to deterioration by microorganisms or insects: both can attack animal fibres such as wool and silk. Cellulose fibres such as cotton and linen “are susceptible to attack by micro-organisms but not insects”. The same is true for viscose, a fibre that is manufactured from natural cellulose. Thus, natural fibres may need biocidal protection for internal effect.

Several types of textile articles are commonly treated with biocides. These include:
- Textiles for health and sanitary use
- Sportswear, underwear and other clothes treated against odour
- Fabrics for outdoor use
- Carpets

The following sections review textile articles, in particular to identify which ones are treated for internal effect.

Textiles treated for internal effect

The most clear and unambiguous example of a textile article treated for internal effect is wool carpeting. Wool carpets are typically treated against attack by moths and moth larvae, and sometimes against beetle larvae. Moreover, the production of wool carpeting is an important but declining industry in the EU. Thus, wool carpeting has been selected for review in this study: it is covered in section 6.

It can be argued that several types of fabrics for outdoor use are treated with biocides that have an internal effect. Outdoor fabrics such as awnings are treated with biocides against fungal attack. This is a concern in particular for natural fibres. The Danish Inventory reports that at least in this Member State, cotton fabrics in deck chairs and awnings have largely been replaced by synthetic fibres. A further concern could be the presence of soft PVC, either for outdoor fabrics or for waterproof coatings (see section 7 on soft PVC). It appears, however, that treated outdoor fabrics are not a large market for biocides.

A number of home textile articles, such as curtains and fabric wall coverings (essentially, fabric equivalents of wall paper) may be treated to prevent fungal stains that could develop in the presence of humidity (for example in the space between curtains and windows). Furniture upholstery may also be treated with biocides for this reason. This could be considered treatment for internal effect. The market shares of such treated articles appear to be relatively small, and further information has not been sought.

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42 OECD, 2004
Textiles treated for external effect

It appears that the share of textiles treated for external effect is much larger than the share treated for internal effect.

Here it should be noted that representatives of Euratex, the European Apparel and Textile Organisation, questioned whether the distinction between internal and external effect can be clearly determined for many textiles in interviews for the study. In a meeting with a manufacturer of mattress ticking and a major formulator of biocidal products for textiles, both also expressed this opinion. A representative of a Euratex member association, the International Rayon and Synthetic Fibres Committee (CIRFS), also expressed concern and indicated that a sector position on the topic would be prepared in the course of 2006.

The terms of reference of this study do not include a review of the distinction between treatment for internal and treatment for external effect. At the same time, the industry comments highlight a regulatory question: there are a great number of treated textile articles, and authorising each one as a biocidal delivery system may pose important costs both for the industry as well as regulators.

Many clothing articles are treated with biocides to prevent odour, including socks, underwear, and sports clothes. The guidance document on treated articles specifically identifies “socks treated with a biocidal active substance intended to have a biocidal action on the foot” as an example of articles treated for external effect. Some home textiles, including some lines of sheets and towels, are treated with biocides. Here manufacturers and retailers appear to claim human health benefits of the biocidal treatment, which would indicate an external effect.

One article commonly treated for external effect is mattress ticking (the fabric used in mattresses). The guidance document lists “mattress covers that are labeled as anti mite for use in prevention of the action of house mites outside the cover (i.e. within the mattress)” as an example of an article treated for external effect.

A final example of textiles treated for external effect is that of carpets treated against dust mites. According to a formulator of biocidal products for this market, consumer demand for these types of treated textiles is growing in many EU countries.

It should also be noted that many of these textiles products, such as socks treated against odour, are considered as treated for internal effect in the United States.

There is a further category of textiles that may be treated, which are those specifically for health and sanitary use. In these cases (e.g. bandages and surgical fabrics), there is clearly an external effect. Moreover, the active substances, biocidal products and the articles themselves would not be considered PT9 biocides but rather under PT2, private and public health area disinfectants.

44 Mr Josef Spijkers. CIRFS. Brussels. Personal communication. February 2006.
45 As an example, several types of blankets sold on the web site www.redoute.be have claims such as “anti-bactérien , anti-microbien et anti-moisissures”.
46 In the US, new carpeting for office buildings reportedly is treated with fungicides: to speed construction the carpeting is laid before the concrete underneath is completely dry.
47 Mr Curzio Marconi, Sanitized AG, Switzerland, personal communication, February 2006. One EU market where consumers are resistant to such treated articles is Germany.
5.2 Other uses of biocides in the textile sector

Auxiliary chemicals for textile manufacturing such as spinning solution additives and preparation agents are often sold in water-based solutions that contain in-can preservatives (PT6) to extend their storage life. These biocides are almost entirely removed in processing and are released into the textile plant’s wastewater. 48

Some questionnaire responses and interviews cited anecdotal reports that biocides may be applied both in the storage and transport of intermediate products, such as yarns and fabrics and finished textile products. This may be the case in particular for long voyages such as transport by ship from Asia to the EU. OECD reports that PCP appears to be used as a biocide for this purpose in some Asian countries.49 These reports have only been anecdotal. Moreover, containers may be sprayed as a requirement by the importing country (including the EU) for phytosanitary purposes, such as to prevent the spreading of plant pathogens.

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Milieu/DTC
October 2006

Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/
6. Wool carpets

The EU carpet industry mainly produces carpets made of synthetic fibres: wool and other natural fibers account for only a small share of the total: under 10%, according to the estimates provided in Table 6.1 below.

Natural-fibre carpets, and in particular most wool carpets, are impregnated with biocides to protect against moths (the treatment also protects wool carpets against consumption by beetle larvae, which are found especially in southern Europe).

6.1 Production, trade and marketing chain

EU production of wool carpets

For the EU carpet industry as a whole, including both natural and synthetic fibres, the main carpet-producing countries are Belgium and the Netherlands, which together account for approximately 60% of EU production. Moreover, carpet manufacture is quite important in both countries, representing 25% of the turnover of the Belgium textile industry, and 40% of in the Netherlands (IFM, 2004). Other major carpet-producing countries are Germany and the UK. The Czech Republic, Denmark and Switzerland are also important carpet-producing countries.

Unfortunately, data on the production of wool carpets has been difficult to obtain. Eurostat production statistics classify carpets first by production method: knotted, woven, tufted or needle-felt. Needle-felt carpets are produced using machines with a barbed needle. For tufted carpets, individual strands of fabric are inserted into a lattice. They are sealed into place by a backing, typically latex (the liquid latex for the backing may contain an in-can preservative).

The type of fibre used (synthetic, wool, or other) is a secondary level of statistics; however, the Eurostat PRODCOM database currently does not have data at this level of detail. As a result, the amount of wool carpeting produced in the EU must be estimated. The table below presents two estimates of the total amount of wool consumed in the production of wool carpeting. These estimates were provided by, respectively, DG Enterprise and GUT, an industry association.

<table>
<thead>
<tr>
<th>Type of carpet</th>
<th>DG Enterprise/Eurostat estimates</th>
<th>GUT estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EU25 Production: all fibres</td>
<td>EU25 Production: wool (tonnes)</td>
</tr>
<tr>
<td>Knotted</td>
<td>5 300</td>
<td>3 900</td>
</tr>
<tr>
<td>Woven</td>
<td>199 900</td>
<td>28 400</td>
</tr>
<tr>
<td>Tufted</td>
<td>975 400</td>
<td>48 800</td>
</tr>
<tr>
<td>Needle-felt and other</td>
<td>155 400</td>
<td>21 500</td>
</tr>
<tr>
<td>Total</td>
<td>1 336 000</td>
<td>102 600</td>
</tr>
</tbody>
</table>

Table 6.1 Consumption of wool in EU carpet manufacture (2003)

The DG Enterprise figures are estimated from Eurostat data on the total production of wool carpets in each category. The amount specifically for wool carpets are estimated based on shares of wool carpets treated with biocides – in particular when imported.
in EU25 exports (export and import data does have detail on exports by type of fibre for each production method category).

The GUT estimates are calculated based on data from a private consultancy, Intercontuft. These estimates focus on the EU15. Nonetheless, production of wool carpets in the new Member States is believed to be relatively small compared to the EU15.

The two estimates are roughly similar for woven and tufted carpets, but diverge widely for knotted and needle-felt carpets.

A third source of data suggests that these estimates nonetheless fall within the likely boundaries for the amount of wool carpeting produced: according to Wools of New Zealand, the largest supplier of raw wool, approximately 100 000 tonnes of raw wool are used in carpet production each year. Of this amount, between 20-40% of the weight of raw wool is washed out in the scouring phase, suggesting that 60 000 to 80 000 tonnes of wool are used in EU carpet manufacture.\(^5\)

**Value of EU production**

Estimates of the value of EU production were made using the prices for woven and tufted wool carpets exported from the EU. These prices were found in Eurostat’s COMEXT database, and are €13 500/tonne and €6 850/tonne respectively, based on average values from 2002 to 2004.

Based on these prices, the value of woven wool carpets produced in the EU in 2003 is estimated between €307 million (using the GUT estimate for production levels) and €385 million (using the DG Enterprise estimate). The value of tufted wool carpets was between €240 million and €335 million. The production of these two types is thus worth between €547 million and €720 million. (Knotted and needle-felt carpets have been left out of the calculations due to the great divergence in their production estimates.)

**Trends in EU25 Production**

EU production of all carpets, as well as EU production of wool carpets, has been declining in recent years. Estimates prepared by DG Enterprise indicate that production of woven wool carpets declined by 30% from 2000 to 2004, while production of tufted wool carpets declined by 20%. Figure 6.1 below (left side) shows the total combined trend for both types of wool carpets (only data for woven and tufted carpets are included in the estimate of EU25 Production, due to the discrepancies for knotted, needle-felt and other carpets).\(^6\)

![Estimated EU Production and EU Imports of wool carpets](image)

**Figure 6.1 EU25 Production and imports of wool carpets**

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\(^5\) Most wool carpets contain 100% wool fibres, but some contain 80% wool and 20% synthetic fibres.

\(^6\) Estimates provided by GUT do not include a time series, so only DG Enterprise estimates are presented.
EU25 import of wool carpets

While domestic production has fallen, imports of wool carpets have risen from just over 12 000 tonnes in 1999 to almost 17 000 tonnes in 2004, an increase of 41% in 5 years (see Figure 1, right side). The 2004 imports of wool carpets were valued at €98 million. Imports thus represent at least 25% of estimated EU production by weight and at least 13% of EU production by value.

These data are based on Eurostat import database (COMEXT), which includes data for the specific subcategories of wool carpets, data which instead is not available for EU production data. For this reason, the import data includes not only woven and tufted carpets, but also knotted and needle-felt carpets and those made using other types of production methods. Overall, tufted carpets account for three-quarters of the weight and two-thirds of the value of imported wool carpets.

Import competition

Import competition is growing for the EU wool carpet industry. Moreover, import competition appears to be stronger than for synthetic carpets.

One reason is that an important share of wool carpets (at least one third) are produced as rugs (i.e. carpets of fixed size), and this is a major category of imported wool carpets.

In contrast, EU production of wall-to-wall carpets, which are largely made of synthetic fibres, faces less import competition (indeed, the industry exports these types of carpets to North America and East Asia). Moreover, the use and preferred styles of wall-to-wall carpeting differ strongly according to national market, a factor that helps insulates EU manufacturers from import competition.

The main countries that export wool carpets to the EU are in East Asia, along with India, Egypt, Turkey and in the Middle East. Overall, carpets appear to make up a small share of most of these countries’ textile and clothing exports: for example, an estimated 2.5% of Turkey’s exports, according to a 2004 study for DG Enterprise.52

EU imports of all carpets are expected to expand. There are reports of new carpet manufacturing plants in China, though these appear to focus on the manufacture of synthetic-fibre carpets. In addition, in several recent cases when UK carpet manufactures have closed their plants, the equipment has been bought by manufacturers in South Asia and the Middle East.53

The Manufacturing and Marketing Chain

The textile industry overall has a complicated manufacturing chain, with many small and medium-sized enterprises.

The manufacturing chain appears to be somewhat simpler for the carpet industry in Belgium and Netherlands, where the industry is dominated by a small number of producers. In the UK, in contrast, there is broader range of small and medium-sized enterprises involved in carpet production.

Raw wool for carpets

The wool for carpets is largely imported. About 35% to 40% of wool used in carpets manufactured in the EU comes from New Zealand. Other important sources of imports include South Africa, Uruguay

52 IFM and partners.
53 Mr David Whitefoot, Technical Director, Carpet Foundation, UK. Personal communication.
and Argentina. The UK, followed by Germany and the Netherlands, are the main Member States supplying wool for carpet manufacture.\textsuperscript{54}

Approximately 100 000 tonnes of raw wool are used each year in EU carpet manufacture (out of a total world production of raw wool of approximately 1.3 million tonnes). The price of raw wool ranges up to €2.50 per kilogramme.\textsuperscript{55} Assuming an average price of up to €2 per kilogramme, the value of the raw wool used in carpets is as high as €200 million. This is a significant share of the estimated total value of wool carpets produced in the EU, €547 to €720 million.

\textit{Scouring and spinning the wool}

Raw wool is scoured (washed) and spun into yarn. Once dirt, dried perspiration and grease are removed, the clean wool is typically 60 to 80\% of the weight of the raw wool. Scouring also removes substances from Veterinary Medicinal Products used to protect the sheep from parasites.\textsuperscript{56}

Scouring and spinning may be done at the same location or in different plants. One large plant in Germany and one smaller one in Belgium are major sources of scoured wool for carpeting in Belgium, Netherlands and Germany. In contrast, there about a dozen scouring companies in the UK, some of which are also carpet manufacturers (EC, 2003b).

In Belgium, Netherlands and Germany, the PT9 biocides used to protect the final product are applied to the carpet wool yarn when it is spun, and not during carpet manufacture itself. The spinner companies typically work on several different types of the wool market; in particular most wool yarn spun in the EU is used in clothing.

\textit{Carpet manufacturers}

Outside the UK, only a few companies exclusively manufacture wool carpets in the EU. There is one company each in the Netherlands, Germany and Belgium (the latter also with plants in France). In addition, two companies in Belgium and one in Switzerland manufacture both synthetic and wool carpets.\textsuperscript{57}

The situation is more complex in the UK, where about 25 small and medium-sized companies produce wool carpets. The sector is under pressure, both from less expensive synthetic carpets produced elsewhere in the EU as well as from imports of wool carpets from outside the EU. At least six wool carpet manufacturers have closed in the UK since 1999.

In terms of final consumption, 70 to 80\% of wool carpeting is sold to households. The major commercial consumers are hotels. There are a few other commercial segments that purchase carpets, including some offices as well as a few niche markets such as commercial aircraft.\textsuperscript{58}

\textbf{6.2 Biocides used in wool carpets}

The main active substance used in the EU to treat wool carpets against moths is permethrin\textsuperscript{59}, a synthetic pyrethroid. According to the IPPC BREF for the textiles industry, permethrin accounts for 90\% of the anti-moth treatment in carpets manufactured in the EU.

\begin{footnotesize}\textsuperscript{54} Mr Klaus Steiman, Wools of New Zealand, and Mr Edmund VanKann, GUT. Personal communications.  \\
\textsuperscript{55} Mr Klaus Steiman, Wools of New Zealand. Personal communication.  \\
\textsuperscript{57} Mr Edmund VanKann, GUT. Personal communication.  \\
\textsuperscript{58} Most office carpeting is synthetic. Information from both Mr Steiman and Mr VanKann.\end{footnotesize}
The BREF notes that a small minority of EU manufacturers use cyfluthrin, also synthetic pyrethroid, and sulcofuron (a halogenated diphenylurea derivative). Cyfluthrin appears to be used only in the UK, while sulcofuron-based products are currently not used to any significant degree in the EU. (EC, 2003b)

**Permethrin**

An industry association, GUT, has developed standards for environmental and consumer protection in carpet manufacture, including for the use of permethrin in wool carpets. GUT’s standards set a maximum application of 250 mg/kg of permethrin in the wool of tufted carpets. The actual application rate of manufacturers in Belgium, France Germany, and the Netherlands, based on GUT’s testing, ranges between 90 to 150 mg/kg, or 0.009% to 0.015% by weight.\(^{60}\)

According to GUT, approximately 80% of the wool used in EU carpet manufacture is treated. Based on the organisation’s estimate for the total production of wool carpeting (presented in Table 1 above), just under 60 000 tonnes, the 80% figure, and an estimated average application rate, GUT calculates that between 5 and 6 tonnes of permethrin are used each year to treat wool carpets.

**Cyfluthrin**

According to the UK Carpet Foundation, cyfluthrin apparently is still used by some manufacturers. The continued use may be related to waste water requirements: the Carpet Foundation reports that in Worcestershire, where a number of producers are located, permethrin is not allowed in industrial effluents. This is a problem for manufacturers that treat yarn with a biocide in the hank dyeing process, with the yarn in a coiled form, as this produces effluent (this process is used mainly for woven carpets). While the hank dyeing stage has been the traditional point for applying biocide, more modern processes allow the recovery and reuse of excess biocide. By applying the biocide at other stages – either in spinning, through a “mini-ball” applicator, or in the surface finishing of the carpet itself – it is possible to recover and reuse excess biocide applied and thus avoid its discharge into wastewaters.\(^{61}\)

Cyfluthrin has not been notified for PT9, so the UK manufacturers will have to switch biocides or cease treated their wool carpets by September 2006.

**Cost of switching active substances**

UK carpet manufacturers that use cyfluthrin will have to cease its use by September 2006, as this biocide has not been notified for product type 9. These manufacturers face two choices: either not to treat their carpets, or to use permethrin.

While up to 20% of EU carpet production is not treated, industry sources contend that this is a risky strategy for producers, both for possible claims as well as market reputation.

Switching to permethrin will involve mainly new capital costs, according to the UK Carpet Foundation. For example, equipment to apply the biocide in the surface finish process will cost about €250 000 for each factory. This equipment should recover unused product, avoiding permethrin in the

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\(^{59}\) m-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate; EC No. 258-067-9; CAS No. 52645-53-1

\(^{60}\) Edmund VanKann, GUT, personal communication.

\(^{61}\) Mr David Whitefoot, Technical Director, Carpet Foundation, UK. Personal communication.
plant effluent. While this may represent an important investment for a small manufacturer, it should not be one that so large as to force any manufacturers to go out of business.\textsuperscript{62}

It should be noted that in the Netherlands, the application of permethrin to wool fibre has been blocked, as the government has not received required information from active substance producers to authorise the biocide. As a result, spinners in the Netherlands are no longer able to use permethrin to treat wool fibre for carpets. The Netherlands carpet industry instead imports treated wool from spinner and scouring companies in the other EU countries. (Vankann) Further information has been requested on this situation, in particular whether this had economic costs within the Netherlands.

**Biocides in raw materials**

Raw wool contains ectoparasiticides: substances used in veterinary medicinal products to protect sheep against parasites such as blowfly. These substances are washed out during scouring into plant waste water. Active substances that are commonly found include:

*Organochlorine insecticides (OCs)*
- γ-Hexachlorocyclohexane (lindane)
- Dieldrin
- DDT

*Organophosphorous insecticides (OPs)*
- Diazinon
- Propetamphos
- Chlorfenvinphos
- Chlorpyriphos
- Dichlorfenthion

*Synthetic pyrethroids insecticides (SPs)*
- Cypermethrin
- Deltamethrin
- Fenvalerate
- Flumethrin
- Cyhalothrin

*Insect growth regulators (IGRs)*
- Cyromazine
- Dicyclanil
- Diflubenzuron
- Triflumuron

Although all major source countries for raw wool have banned organochlorine insecticides, these have been found in some raw wool imported from countries of the former Soviet Union and from South America.\textsuperscript{63}

Spin finishes and other chemicals used in processing wool may contain in-can preservatives. In principle, these are washed out in processing. Finally, processed latex used for the backing of tufted carpets may also in-can preservatives.

\[62\] Mr David Whitefoot, Technical Director, Carpet Foundation, UK. Personal communication.

Biocides in imported wool carpets

No direct information has been found on the use of biocides in countries that export wool carpets. The Turkish Industry and Business Association (TUSIAD) reports that preservatives are not used in carpets exported from Turkey to the EU.64

6.3 Notes on possible developments related to wool carpets

In recent years, new synthetic fibres developed for carpets have the look and feel of wool. These synthetic fibres – in both EU produced and imported carpets – are placing pressure on EU production of wool carpets. At the same time, in the UK at least, the production of wool carpets is decreasing and old production equipment has been sold to manufacturers outside the EU. These factors suggest that EU wool production will decrease in the coming years. While EU production of synthetic carpets will replace some wool production, imports are likely to increase.

Preliminary information indicates that permethrin is not a major cost for the production of wool carpets. Thus, the cost of the biocide in itself should not much influence the industry’s future.

If permethrin is not authorised under the Biocidal Products Directive as an active substance for the treatment of wool carpets, EU industry would not be able to produce treated carpets. EU production of untreated wool carpets might then face further competition from imported, treated carpets.

64 Mr Meltem Cakir, TUSIAD. Personal communication, February 2006.
Milieu/DTC
October 2006
Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/
7. Treated plastics and polymers: overview

7.1 Overview: use of biocides in plastics

It appears that only a small share of plastic products produced or consumed in the European Union are treated with biocides: according to BIS, only about 1% of the products in the €43 billion plastics market. This suggests a market of approximately €400 million per year.

While most plastic polymers themselves do not need treatment against microbial or fungal action, additives to plastics, such as softeners, may need such protection. Articles made of soft PVC, of polyurethane and of EPDM, a synthetic rubber, are treated for *internal effect*.

Soft PVC

One of the main types of treated polymers is soft PVC used outdoors and in humid areas. The biocides are needed to protect the plasticizers and other additives from microbial attack, which first may create stains but will eventually break down the material. Examples of articles containing soft PVC that may be treated against biocides include:

- shower curtains
- other membranes, such as roof, swimming pool, tarpaulins and ditch liners;
- gaskets and seals for water pipes;
- outdoor fabrics including tents with a soft PVC coating (large commercial tent systems are typically made of synthetic fibres that do not need biocidal protection; they may have a waterproof coating of soft PVC that will require biocides);
- conveyer belt components used in the food processing industry;
- components of outdoor furniture, such as artificial leather, coatings or cords.

Thermoplastic PVC waterproofing membranes for flat roofing may contain biocides. In general, only soft PVC membranes that are fixed with ballast to a roof (e.g. with a layer of gravel above the membrane) are commonly treated with biocides: these account for about one-third of all soft PVC roof membranes. According to an estimate made by the European Single ply Waterproofing Association (ESWA), a total of between 4 to 8 tonnes of biocidal products are used annually in EU Member States and EFTA countries in the production of PVC waterproofing for flat roofs.

Waterproofing geomembranes made of soft PVC may contain biocides. (Waterproofing membranes are used in applications such as landfills, to cover waste, and for hydraulic works, tunnels and other civil engineering works.) Only about one-third of these membranes are made of soft PVC, as polyolefin membranes are more commonly used. The European Geomembranes Association (EGMA) estimates that in the EU and EFTA, between 2.5 and 5 tonnes of biocidal products are used annually in the production of geomembranes made of soft PVC.

Shower curtains made of soft PVC may contain biocides. Information on the biocides used or the level of EU production and consumption was not found. In general, however, a large number of small and medium-sized enterprises, most based in southern Europe, produce PVC shower curtains. These are the most inexpensive type of shower curtains, and imports make up a significant share of this market.

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65 Pitched roofs do not use waterproofing made of soft PVC. Moreover, the majority of flat roofing in the EU uses bitumen rather than soft PVC membranes for waterproofing.
66 Dr Water Claes of EuPC, EGMA and ESWA. Personal communication, July 2005
67 Dr Water Claes of EuPC, EGMA and ESWA. Personal communication, July 2005
Other major uses of soft PVC do not need biocides. For example, vinyl flooring made of soft PVC is rarely treated with biocides: treatment for internal effect is needed only if the flooring is in regular contact with a humid surface, such as floor not properly insulated from the ground. In some cases, vinyl flooring may be treated for external effect, for example for flooring used in hospitals. (A small share of flooring sold for residential use contains biocides for external effect; while this may provide a marketing advantage, most vinyl flooring is sold as a low cost material, and thus there is little commercial advantage for treatment.)

Biocides are not used in plastic pipe systems made of PVC, according to the European Plastic Pipes and Fittings Association. Such pipes are made of hard PVC, which does not contain plasticizers subject to microbial attack, though as noted above, gaskets and seals made of soft PVC may be treated for internal effect.

**Polyurethane**

Polyurethane (in particular polyester polyurethane) may also be treated with biocides, as microbes may attack the polymer itself. Polyester polyurethane used for shoe soles is sometimes treated: the biocides protect against fungus gathered from contact with the earth. In these cases, as for treated soft PVC, the articles are clearly treated for internal effect. This use, which appears relatively minor, is described in section 7.3 below.

Some uses of polyurethane foam are treated with biocides, including household sponges and mattress foam. In principle, the biocides may assist in protecting the foam, whose structure could be degraded by microbial attack. In practice, the main goal of such treatment appears to be odour control, and thus is for external effect.

**EPDM (synthetic rubber)**

New formulations of EPDM (ethylene propylene diene monomer), which is sold as a synthetic rubber, may need biocidal protection. Older formulations contain vulcanisers that also act as a biocide. The newer formulations that do not contain these vulcanisers (reducing risks to health and environment) can be degraded by microbes. For example, sports surfaces made of new EPDM may need protection against microbial attack, in particular for outdoor locations such as tennis courts. EPDM is occasionally used to waterproof flat roofs and this application may need biocides: this is reportedly a common application in the US but rare in most EU Member States. Newer forms of EPDM are occasionally used for other applications, such as gaskets, that will need microbial protection.

**Other plastics**

Several other types of plastics are treated against microbial attack.

Clear plastics used for outdoor signs as well as windows often contain fungicides to avoid growths that would cloud the surface. According to one large manufacturer of household and industrial products, most airplane inner windows contain fungicides for this reason. This can also be, arguably, treatment for internal effect.

Some uses of polypropylene may also be treated with biocides. This is the case for artificial grass used as a sports surface (and in some cases for home use). While the polypropylene itself is not subject to microbial decay, biocides may be used to reduce bacterial growth on the surface, as this makes it slippery. It might be claimed that is also treatment for internal effect, though this is not clear.

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68 Ton Pluijmert, European Resilient Flooring Manufacturers Institute, personal communication.
70 Source: Curzio Marconi and colleagues, Sanitized AG, Switzerland, personal communication, February 2006.
71 Source: Curzio Marconi and colleagues, Sanitized AG, Switzerland, personal communication, February 2006.
7.2 Household plastics treated for external effect

A great number of other plastic articles may be treated with biocides, in particular a variety of household items. A communication with a major household product manufacturer as well as the web sites of large formulators of biocides for plastics together indicate that biocides are in some cases used in the following types of products:

- acrylic bathroom and kitchen fixtures
- plastic work surfaces for bathrooms and kitchens
- plastic food storage containers
- sponges (as noted above) and other cleaning implements

Based on the presentations on the web sites, it would appear that in these cases biocides are applied for external effect, and thus are not comprised under this study.

Other treated plastic articles can include air filters used in home and automobile air conditioners. The goal of this application is to reduce microbes in the conditioned air, and thus is also for external effect.

7.3 Notes on EU Production and the consumption of biocidal products

**EU Production**

The very rough estimate provided by BIS – that 1% of the €43 billion of plastic goods sold in the EU contain biocides – would indicate that approximately €400 million of treated plastics. The €43 billion of plastic goods weigh about 60 million tonnes, suggesting that roughly 600 000 tonnes of treated plastic goods are sold in the EU each year. These estimates are very rough, however.

**The Marketing Chain**

![Marketing chain for active substances used in plastics](image)

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72 Susan Price, Senior Regulatory Specialist, 3M Corp., USA
74 Food storage containers should be subject to Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC.
Manufacturers of active biocidal substances sell about 40% of biocides used in plastics directly to the plastics manufacturers, usually in the form of biocidal products, according to BIS. About 25% of biocides are sold to formulators, 20% to distributors, and 15% to producers of masterbatches (compounds with high concentrations of additives).

Active substance manufacture, formulation and masterbatch production are all consolidated markets in the EU, according to BIS, while the manufacturers of plastic products are a fragmented market.\(^{75}\)

Masterbatches can be used in a great variety of final products: for example, a masterbatch of polypropylene beads containing a biocide could be used to produce a dish tray or turned into a fibre for the production of a garment.

**Consumption of biocides**

According to one manufacturer of biocidal products, approximately 8000 tonnes of biocidal products are used to treat plastic articles and materials in the EU. The monetary value of these biocidal products is about €65 million. About 60% of the biocidal products are used in soft PVC applications; the remainder across a broad spectrum of other types of plastics.\(^{76}\)

**Biocides used in soft PVC roof membranes**

According to ESWA, five biocides are commonly used in roof membranes made of soft PVC:

- OIT: 2-\(n\)-octyl-4-isothiazolin-3-one (also named Octhilinone; CAS 26530-20-1)
- Dichloro-octyl-isothiazoline
- 10, 10’ – Oxybisphenoxarsine
- Trichlorophenoxyphenol
- 3-Iod-2-propinylbustylcarbamet

Information on biocides used in other soft PVC products was not found.

**Biocides used Polyurethane shoe soles**\(^{77}\)

According to a manager at a major EU manufacturer of polyurethane, the use of biocides to protect polyurethane shoe soles appears to be relatively minor. While polyester-polyurethane is prone to attack by microbes, biocides are needed only in soles for working shoes used in high-risk applications, such as agricultural areas with a high potential for contact with soil and other microbes. Due to the high cost of the biocides and strong price competition in the footwear industry, the use of biocides is not likely for other types of shoes.

The manufacturer estimated that specialty shoe soles that contain biocides account for less than 10,000 tonnes of the EU15’s 3.35 million tonnes of polyurethane production (2002 level). Total consumption of active substances should be less than 5 tonnes. Biocides used for polyurethane shoe soles are typically based on Arsine (As) or contain isothiazolinon formations. Among the active substances are 10,10’-Oxy-Bis-Phoxy-Arsine (CAS 58-36-6) and n-Butyl-1,2-benz-isothiazolin-3-on (CAS 4299-07-4).

\(^{75}\) Consolidated indicates on the order of 10 or so main companies active in the EU market; fragmented on the order 100 or more.

\(^{76}\) Curzio Marconi. Sanitized AG. Personal communication. February 2006.

\(^{77}\) Dr Eckehard Weigand, Bayer MaterialScience AG, personal communication, 25 January 2006, based on data from ISOPA.
7.4 Concluding notes

A wide variety of plastic and polymer articles are treated with biocides. It appears that the great majority of these are treated for *external effect*, and thus are outside the scope of this study.

Further information is needed on plastic and polymer items that are treated for *internal effect*, such as soft PVC membranes. Based on initial information, EU production of these articles currently faces little pressure from imports. Nonetheless, one manufacturer of active substances and biocidal products warned that these products may face more significant pressures in the future: due to their low cost, the price of biocides may influence their competitiveness. In particular, producers in exporting countries might benefit from access to biocides that are much cheaper than those in the EU, including products not notified under the BPD.
8. Leather tanning

The EU leather tanning industry had a turnover of over €8 billion in 2003. The industry is, however, in decline: its 2003 turnover was 20% less than the 2001 level. Most EU firms are small and medium-sized, based mainly in southern Europe: over half of EU turnover comes from firms in Italy, and Spain follows as the second largest producer in the EU.

Biocides are used in the production of tanned leather, an intermediate good used to produce finished leather products. The IPPC BREF for the industry, while noting that leather manufacturing chain can vary, identifies four main stages:

1. Hide and skin storage and beamhouse operations
2. tannery operations
3. post-tanning operations, and
4. finishing operations

Biocides are used mainly in the first and second stages. Bactericides are commonly used in soaking hides and skins in the first stage.

Fungicides are typically used in the tanning process (second stage). Semi-processed leather produced by tannery operations is a tradable intermediate good (semi-processed leather is called wet-blue when it is tanned with chrome, and wet-white when the less common chrome-free tanning, for example using aldehyde, is used). This tanned leather is usually stored and transported in a humid condition that preserves its qualities for later working. The process soak contains fungicides that protect the leather during shipment and storage. The fungicides are washed out in the subsequent, post-tanning stage, but trace amounts remain in finished leather as well as in final consumer articles made of leather.

A complex international production chain

The products of each stage of manufacturing are tradable intermediate goods, most with significant international trade flows. Thus, depending on the needs, tanneries in the EU import raw hides and skins, and these are also exported from the EU (raw hides and skins are usually preserved in salt, though lower quality ones are sometimes shipped in a dried form). Tanneries also import wet-blue (having likely been submitted to a fungicide-containing soak) for post-tanning and finishing operations, operations where EU tanneries have a competitive edge in terms of quality. The EU imports significant quantities of wet-blue.

The product of post-tanning operations, the third stage of manufacturing, called crust, can also be imported. Crust may be imported by tannery firms undertaking finishing operations, the fourth stage. At the same time, downstream manufacturers of leather articles may import crust and perform the

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80 The original raw hides or skins may be “split”, i.e. cut, into two or more different layers. The upper layer, containing the grain pattern of the hide or skin, is the most valuable. Splitting may take place at different stages in the process. In addition, uneven elements are removed from the flesh side to make a uniform thickness: these excess products may be sold to various industries ranging from pet food to cosmetics as long as they are not tanned. Splitting compounds a statistical problem in comparing production at different stages: data on hides and wet-blue are usually expressed in terms of weight, while data on crust and finished leather are expressed in terms of area (e.g. square metres).
finishing operations themselves. EU imports of crust and finished leather are relatively small compared to those of wet-blue.

Finished leather produced by the fourth stage of processing is the end product of the tanning industry and a tradable intermediate good used to produce final consumer products such as shoes, clothing, bags, other small leather goods, furniture and automobile as well as aircraft seats. The EU is a net exporter of finished leather to countries producing final leather goods. Imports and exports of crust, finished leather and consumer articles made of leather can contain traces of the fungicide used in tanning.

Trade flows in the tanning and leather goods industry can be complex. As an example, a raw hide may be imported from Brazil (preserved in salted condition) for tanning, post-tanning and finishing in the EU; pieces of the finished leather may then be exported to, as an example, China, for the production of leather garments. The leather garments are then exported to consumer markets around the globe.

Global trade in all these products – including hides and skins, semi-processed and final leather and leather consumer products – is over €35 billion and is thus a leading commodity sector in world trade. The EU accounts for almost 20% of global sales of finished, tanned leather (though, this figured includes leather produced from imported hides or wet-blue).

8.1 Production and marketing chain

EU Production of tanned leather

Most tanneries are small to medium-sized companies: in 2003, the almost 2500 firms in the EU leather tanning industry had approximately 50 000 employees (see Table 1). Indeed, in all EU countries except Austria, the average size was under 100 employees per company.

Italy dominates the EU leather tanning industry, mostly through small enterprises located in districts (manufacturing clusters): Italian companies in the tanning sector had an average of 15 employees each. Overall, three-fifths of EU employment in the sector, four-fifths of the companies and two thirds of turnover are in Italy. While data is only available for two EU10 Member States, Hungary and Slovenia, only one other, Poland, has a significant tanning sector. Poland’s production is estimated to be roughly similar to that of Portugal. Among the current and potential Candidate Countries, leather and leather processing is significant in Romania and Turkey.

According to 2003 Eurostat data, the number of firms in the leather, leather goods and footwear sectors amount to about 41 000 in EU 25. Employment in these sectors reaches some 450 000 people. These figures do not take into account the manufacturing of leather garments, leather furniture and leather automobile and aircraft seats.

The industry is in steady decline. There is pressure from imports, which across the different intermediate goods account reach up to 60% of domestic production. According to COTANCE, the EU tanning industry association, tariff and non-tariff barriers reduce the export potential of EU leather on foreign markets. Moreover, the EU industries that produce finished consumer articles made of leather, in particular the shoe and garment industries, are themselves declining in the face of imports: as a result, demand for finished leather within the EU is falling. This has been offset, but only

81 FAO, World Statistical compendium for raw hides and skins, leather and leather footwear 1986-2004, Rome, 2005 (FAO uses the figure US$ 46 billion)
82 Statistics from COTANCE, the Confederation of National Associations of Tanners and Dressers of the European Community, are used in this section, as they appear to provide greater detail that Eurostat data. Found on www.euroleather.com.
83 Mr Gonzalez-Quijano. COTANCE. Personal Communication. February 2006.
partially, by increased exports of finished leather to markets such as China, where it is used to produce final consumer products.

Table 1. The EU Leather Tanning Industry, 2003  
(Data for the EU15, Hungary and Slovenia)

<table>
<thead>
<tr>
<th></th>
<th>Employment</th>
<th>Companies</th>
<th>Turnover (000 Euros)</th>
<th>Production (000 m²)</th>
<th>bovine</th>
<th>sheep/goat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>131</td>
<td>2</td>
<td>23 903</td>
<td>452.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>2 019</td>
<td>74</td>
<td>274 000</td>
<td>4 200</td>
<td>3 800</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>3 000</td>
<td>40</td>
<td>575 000</td>
<td>15 000</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>30 563</td>
<td>2 051</td>
<td>5343795</td>
<td>133 824</td>
<td>33 353</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>500</td>
<td>21</td>
<td>3 900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>6 156</td>
<td>187</td>
<td>1 086 603</td>
<td>27 473</td>
<td>16 742</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>2 781</td>
<td>68</td>
<td>219 062</td>
<td>6 670</td>
<td>1 470</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>2 800</td>
<td>33</td>
<td>480 000</td>
<td>9 100</td>
<td>2 400</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>425</td>
<td>4</td>
<td>89 000</td>
<td>2 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>2 257</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EU-15</strong></td>
<td><strong>50 632</strong></td>
<td><strong>2 488</strong></td>
<td><strong>8 091 363</strong></td>
<td><strong>203 019</strong></td>
<td><strong>58 265</strong></td>
<td></td>
</tr>
</tbody>
</table>

|                |            |           |                      |                     |        |             |
| Norway         |            |           |                      |                     |        |             |
| Switzerland    |            |           |                      |                     |        |             |
| Hungary        | 207        | 3         | 13 449               | 179                 | 1 300  |             |
| Slovenia       | 430        | 6         | 92 000               | 53                  | 4 339  |             |

*Source: COTANCE*

Table 2. EU15 Leather Tanning Industry: Trends 2001-2003

<table>
<thead>
<tr>
<th></th>
<th>Employment</th>
<th>Number of Companies</th>
<th>Turnover (million Euros)</th>
<th>Production: bovine leather (000 m²)</th>
<th>Production: sheep/goat leather (000 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>53 739</td>
<td>3 004</td>
<td>10 219</td>
<td>203 019</td>
<td>58 265</td>
</tr>
<tr>
<td>2002</td>
<td>51 873</td>
<td>2 787</td>
<td>9 404</td>
<td>211 836</td>
<td>66 350</td>
</tr>
<tr>
<td>2003</td>
<td>50 632</td>
<td>2 488</td>
<td>8 091</td>
<td>250 134</td>
<td>82 325</td>
</tr>
<tr>
<td>Change: 2001 to 2003</td>
<td>5.8%</td>
<td>-17.2%</td>
<td>-20.8%</td>
<td>-18.8%</td>
<td>-29.3%</td>
</tr>
</tbody>
</table>

*Source: COTANCE*
As a result of these pressures, EU employment in leather tanning fell by over 5% between 2001 and 2003, while turnover fell over 20% (see Table 2.). The sector declined over this period in almost all EU15 except for Austria, which saw a small increase, and Netherlands, where employment remained steady. In two countries, Denmark and Ireland, remaining tanneries closed between 2001 and 2003.

Total EU15 production in 2003 was over 200 million m$^2$ of tanned bovine leather and almost 60 million m$^2$ of tanned sheep and goat leather.

**Imports and exports of tanned leather**

As has been noted, the EU tanning industry imports and exports products at several different stages in the production process, including raw hides produced by beamhouse operations, tanned leather produced by tannery operations, and semi-finished leather produced by post-tanning operations.

This analysis looks first on imports of tanned leather hides and skins. Products in this category have been treated with fungicides in the tanning process, and in the case of *wet-blue* are shipped in a humid condition incorporating part of the tanning solution containing these fungicides. The tanning solution is washed off in the next stages of work, which is carried out within the EU, and thus contributes to the industry’s effluents. Traces of the fungicides, however, remain in the leather.

**Table 3. EU25 imports and exports of “wet-blue” tanned leather, 2003**

<table>
<thead>
<tr>
<th></th>
<th>Bovine tanned leather$^1$</th>
<th>Other tanned leather$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tonnes</td>
<td>Euros (millions)</td>
</tr>
<tr>
<td>Imports</td>
<td>471 077</td>
<td>1 115</td>
</tr>
<tr>
<td>Exports</td>
<td>150 626</td>
<td>253</td>
</tr>
</tbody>
</table>

Source: Eurostat

Notes:
1. Sum of CN codes 410411 - Tanned or crust hides and skins of bovine (including buffalo) or equine animals, without hair on, whether or not split, but not further prepared: In the wet state (including wet-blue): Full grains, unsplit; grain splits: and 410419 (wet state/other).
2. CN code 4105 10 - Tanned or crust skins of sheep or lambs, without wool on, whether or not split, but not further prepared: In the wet state (including wet-blue)

Tables 3 presents EU25 imports and exports of “wet-blue” tanned leather, divided into bovine leather (the largest category) and all other types. Leather from sheep and goats predominates in the “other” category. Total EU25 imports were just over €1.1 billion in 2003, according to Eurostat data. In comparison, total EU25 exports of *wet-blue* leather hides and skins were valued at about €250 million. The EU leather tanning industry exports much greater levels of the higher value-added products of subsequent stages the manufacturing chain, crust and notably finished leather.

**Major countries exporting bovine tanned leather to the EU**

The main countries exporting bovine “wet-blue” tanned leather to the EU25 are listed in Table 4. Brazil is by far the largest supplier. The countries that follow include Australia, the Russian Federation, and the United States, Colombia and Ukraine. Exports from the US are reportedly focused on higher-valued products, such as leather for use in furniture and automobile interiors.
### Table 3. Most important countries exporting bovine tanned leather ("wet-blue") to the EU25, 2003

<table>
<thead>
<tr>
<th>Country</th>
<th>Exports to EU25 (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>1 116 142</td>
</tr>
<tr>
<td>Australia</td>
<td>502 380</td>
</tr>
<tr>
<td>Russia</td>
<td>454 543</td>
</tr>
<tr>
<td>United States</td>
<td>426 535</td>
</tr>
<tr>
<td>Colombia</td>
<td>301 798</td>
</tr>
<tr>
<td>Ukraine</td>
<td>241 786</td>
</tr>
<tr>
<td>New Zealand</td>
<td>238 881</td>
</tr>
<tr>
<td>Venezuela</td>
<td>220 900</td>
</tr>
<tr>
<td>Argentina</td>
<td>185 863</td>
</tr>
<tr>
<td>Egypt</td>
<td>159 708</td>
</tr>
<tr>
<td>South Africa</td>
<td>147 033</td>
</tr>
<tr>
<td>Paraguay</td>
<td>103 658</td>
</tr>
</tbody>
</table>

Import trends (bovine leather)

The figure below shows trends in EU25 imports of bovine tanned leather (this includes both "wet-blue" and subsequent stages of production, crust and finished leather\(^8^4\)). These imports increased 26% between 1997 and 2003, and in particular after 1999. In contrast, imports of bovine raw hides and skins – raw materials for second stage of tanning – decreased since 2000. According to COTANCE, this is due to the growth of export restrictions in countries, a trade measure that encourages development of their domestic tanning production. As a result, wet blue is increasingly replacing raw hides and skins as a traded material for tanneries in global trade.

![Figure 1. Trends in imports of bovine tanned leather, and bovine raw hides and skins](Source: Eurostat)

Major exporting countries: other types of tanned leather

A quite different set of countries exports tanned leather made of sheep, goat and other animals. The largest exporter is Syria (just under 10 000 tonnes exported in 2003), followed by Saudi Arabia and

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\(^{84}\) Time-series data for specific categories such as "wet-blue" are not available for the EU25.
Algeria (under 3 000 tonnes each). Other major exporting countries are from the Middle East or Africa, with the exception of New Zealand.

**Imports of finished leather**

In 2005, downstream sectors that manufacture final leather goods in the EU imported some 53.3 million m² of finished bovine leather (equivalent to about 25% of EU production); 5.3 million m² of finished calf leather; 7.4 million m² of finished sheep leather and 17.7 million m² of finished goat leather (thus about half of EU production); and some 4.6 million pieces of chamois leather.

**Table 5. EU25 imports of selected consumer articles made of leather (tonnes)**

<table>
<thead>
<tr>
<th></th>
<th>Bags</th>
<th>Garments</th>
<th>Shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>37 949</td>
<td>103 700</td>
<td>393 490</td>
</tr>
<tr>
<td>2004</td>
<td>45 587</td>
<td>105 400</td>
<td>433 100</td>
</tr>
<tr>
<td>2005</td>
<td>59 342</td>
<td>120 700</td>
<td>537 500</td>
</tr>
</tbody>
</table>

Notes:
- a. HS codes 420211, 420221, 420231 and 420291
- b. HS code 4203: Articles of apparel and clothing accessories, of leather or of composition leather
- c. HS code 6403: Footwear with outer soles of rubber, plastics, leather or composition leather and uppers of leather

**Imports of consumer articles made of leather**

Finished consumer articles made of leather are imported from a great variety of countries. Indeed, several countries with low labour costs and large manufacturing industries export mainly finished leather articles. This is the case in particular of China and India.

Shoes are imported to the EU25 from Brazil, China and India as well as more recent sources of production such as Vietnam. Leather garments are produced in Brazil, South Asian countries including India and Pakistan, as well as in North Africa and the Middle East. Among the countries that are sources of leather furniture are Brazil, India and Thailand; leather car sets are imported from South America, Central America, notably Mexico, and South Africa.

Table 5, above, provides an overview of EU25 imports of three key types of finished products made of leather: shoes, bags and clothing. The data show, first of all, the rapid increase in imports for all three areas.

**Characteristics of the production chain**

**Manufacturers of active substances for biocides**

The manufacture of active biocidal substances for leather is a consolidated market in the EU and at global scale. There are a few large companies, notably Buckman Laboratories (headquartered in the US) and Lanxess (a spin-off of Bayer Chemical) and TFL, both with headquarters in Germany. In contrast, the formulators and distributors are a relatively fragmented market, with a much larger number of companies that mostly range from small to medium-sized.
Downstream industries that use finished leather

Finished leather is used by a variety of industries, including shoe, bag, clothing and furniture manufacture. Some producers in these industries will purchase crust rather than finished leather and perform the finishing themselves.

According to DG Enterprise’s report on the tanning industry (prepared before EU10 accession):

“Footwear remains overall the most important outlet for EU tanner’s production with a share of 50% of the EU tanner’s output, followed by the clothing industry (20%), furniture and upholstery (17%) and the leather goods sector (13%). There are variations throughout the Member States of the EU. In particular, northern Member States produce much more upholstery and automotive leather (+/- 80%).”

Recent estimates by COTANCE largely confirm these data, except for the percentage of leather garments, which now represent not much more than 10% of the industry’s output. Moreover, EU production of footwear and leather clothing is decreasing rapidly in the face of inexpensive imports. Some of this production has shifted to the Candidate Countries, notably the manufacture of shoes in Romanian factories set up by in particular by Italian footwear producers. Both the leather show and garment industries in particular face strong pressures from imports outside the EU, a concern in particular for the finished leather industry in Italy and elsewhere in southern Europe, a major share of whose production is used in footwear and garments. About 50% of Spanish leather, for example, is used in the clothing industry. Exports of high quality consumer goods to foreign markets have somewhat compensated losses on the EU internal market.

In contrast, tanneries in northern European countries such as Germany and the Netherlands focus their production on finished leather for high-quality furniture and automotive interiors, industries whose import pressures, while strong, remain less than those for footwear and clothing.

Finally, it should be noted that the leather tanning and production process also yields by-products that are used variously in pet food, fine chemicals, fertilizers and other industries.

8.2 Biocides used in leather tanning

Biocides are used to prevent bacterial growth in the washing and soaking of skins in the first phase of leather production, called beamhouse operations. The biocides are in principle washed out from the product by the end of this stage.

This section focuses on the use of fungicides in the second stage of production, tannery operations. As was noted, fungicides are used in the production, shipping and storage of wet-blue semi-processed leather and traces may remain in leather throughout its subsequent product life cycle.

Fungicides used in leather tanning

A small number of active substances are found in almost all fungicides used in the tanning industry, both in the EU and worldwide.86

86 The list of main active substances is based on:

The three most-used active substances are:
- TCMTB: 2-thiocyanatomethylthiobenzothiazole (CAS 21564-17-0)
- OPP: ortho-phenylphenol (also named biphenyl-2-ol; CAS 90-43-7)
- PCMC: 4-chloro-3-methylphenol (also named chlorocresol; CAS 59-50-7 ?)

Two other active substances are used somewhat less frequently:
- OIT: 2-n-octyl-4-isothiazolin-3-one (also named Ochthilinone; CAS 26530-20-1)
- BCM: 2-benzimidazolyl-methylcarbamate (also called Carbendazim; CAS 10605-21-7)

These five substances have all been notified under the Biocidal Products Directive.

Some tanners regularly change biocidal product and active substances to ensure ongoing efficacy. Tanneries may use two or more active substances in combination. OECD reports that fungicides are applied in concentrations ranging from 0.01% to 0.5% of the mass of the pelt.\(^7\) The amount is usually increased depending on the length of storage for the “wet-blue”.

Several other active substances are used less frequently. These include:
- DIMTS: di-iodo-p-methyltolyl-sulfone
- tribromophenol (TBP)
- TCP: 2,4,6-trichlorophenol (CAS 88-06-2) \(\text{not notified}\)
- IPBC: 3-iodo-2-propynyl butyl carbamate (CAS 55406-53-6) \(\text{notified}\)
- 2-MBT: mercaptobenzothiazole

Tanneries often use more than one product at a time, and up to three active substances, in order to counter possible resistance.

**Fungicides used in leather production outside the EU**

According to a major producer of active substances and formulated products for leather, the five most important active substances cited above are used worldwide. The large US and EU-based producers of these active substances and biocidal products for leather tanneries have an important presence in the global market, including in the major developing countries producing leather such as Brazil, China and India.

Thus, most “wet-blue” imported into the EU is likely to have, in the humid solution in which it is shipped, one or more of the five active substances notified under the Biocidal Products Directive. (The active substances may be used in combination, in particular to extend their effectiveness beyond 1-2 months, a time period likely to be exceeded in shipping). This will be the case also for traces of active substances found in imported crust, finished leather and consumer leather goods.

While the five active substances are the most important on the world market, sources in the industry mentioned several other active substances that may be used in developing countries, including:
- Tribromophenyl
- Trichlorophenol
- Pentachlorophenol (controlled under Directive 76/769)

In early 2006, a reference to the last of these substances was found on the web site of the web site for an Indian footwear institute: “Pentachlorophenol is often used as biocide in leather”.\(^8\)

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\(^7\) OECD, June 2004.
\(^8\) Indian Footwear Design and Development Institute, [http://www.fddiindia.com/fddi/chemical_test.html](http://www.fddiindia.com/fddi/chemical_test.html). A request for further information has not been answered. A later version of the web site, viewed in June 2006, no longer contained this phrase and instead stated that the Institute could test for “…banned materials such as AZO...”
COTANCE’s 2002 *Sustainability Report* noted that “The use of some pesticides such as HCH, DDT and naphthalene is prohibited in Europe but they may be imported through raw hides, skins and leather from non-EU member states where their use is not banned”.

Thus, active substances that are not notified under the BPD, including some little or not used in the EU, remain in use in some developing countries. It is possible that tanned leather, crust, finished leather and consumer articles imported into the EU may be treated with these substances, including substances that are restricted under Directive 76/769 such as PCP. COTANCE, for example, has indicated that testing laboratories reported the presence of PCP beyond accepted limit values in finished leather goods such as clothing and footwear imported into the EU.

At the same time, it should be noted that limits on residues of pentachlorophenol (PCP) in finished leather articles, introduced by Germany and then included, slightly differently, under Directive 76/769 in 1989, have forced considerable change on the use of this chemical in developing country suppliers and notably in India, which launched a major programme to change its use of biocides and other chemicals.  

**Share of biocides in product cost**

According to one manufacturer of active substances, biocidal products and other chemicals for leather tanning, the cost of all chemicals represents about 10 to 15% of the total cost of *wet-blue* (OECD estimates about 10%). Another manufacturer estimated that biocides will cost 10 to 20% of the cost of chemicals used directly in tanning. These figures suggest, as a very rough estimate, that biocides represent 1 to 3% of the cost of *wet-blue*.

Several respondents noted that substances banned in the EU, such as PCP, or not notified under the Biocidal Products Directive, such as TCP, are typically less expensive that the five major biocides.

**Cost of switching active substances**

Leather tanneries frequently change or adjust the amount and mixture of fungicides they use, to guard against resistance and ensure longer protection for the storage and shipping of leather. For this reason, the cost of switching active substances among the five major biocides is not expected to be significant. Outside of the EU, where less expensive substitutes may be used, the cost of switching to the five major biocides – assuming that these will be the main ones approved under the Biocidal Products Directive – may be more significant. EU import restrictions on leather products containing biocides not registered for the use in leather could reduce the process cost differential between EU and extra-EU operators.

**Amount of fungicide used in domestic and imported “wet-blue”**

It has not been possible to estimate the amount of fungicides used in leather production in the EU. OECD reports that this varies from 0.01% to 0.5% of the pelt weight, a wide range that depends greatly on the active substance employed. Further information, and in particular the amount of *wet blue* produced in the EU, was requested from the EU tanning industry, but not obtained.

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**Wet-blue** that is stored or shipped – the case in particular when it is imported – will contain biocides in the humid solution. Data on the amounts used, however, were not found. The solution will be washed out before further processing. Here, if wet-blue imported for further processing in the EU contains biocides not authorised under the BPD, as these will enter the waste stream.

According to Eurostat, EU tanneries import approximately 500,000 tonnes of wet blue per year. This figure refers to both the pelt and the solution in which it is shipped. The range of biocide concentrations reported by OECD (0.01% to 0.5%) yields an estimate between 50 and 2500 tonnes of active substances. Both extremes are unlikely. As an initial estimate, it is assumed that the concentration of biocides in imports is 0.1%, implying that about 500 tonnes of active substances are contained in imported wet blue in solution. Nearly all of these active substances will be washed away into the effluent streams of EU tanneries.

**Traces of biocides in finished leather products**

The most important concern for human health relates to the traces of biocide in consumer goods such as leather bags and garments sold to the consumer market.

Two estimates were found of biocide concentrations in consumer goods. The Danish Inventory cites a study that reports average concentrations of 200-300 ppm of active substances found in imported leather goods. A German researcher refers to 100 ppm of PCP found in leather sofas.91

These levels can be used to produce a rough estimate of the amount of biocides in imported consumer goods. The data in Table 4 show that over 700,000 tonnes of consumer goods made of leather were imported into the EU25 in 2005. (While this figure overestimates the amount of leather, as these goods will contain other materials, it does not include other articles containing leather, such as furniture.) If a range of 100 to 300 ppm is used for the trace concentration of active substances in finished leather products, this indicates that current EU25 imports contain between 70 and 215 tonnes of active substances.

### 8.3 Further notes related to potential economic and trade impacts

**Tanned leather**

The EU leather tanning industry is in decline due in particular to the erosion of its international competitiveness. Sectors manufacturing downstream leather articles are declining even faster due to their higher labour intensity and exposure to cheap imports from low cost countries. As a result, imports of leather into the EU as such, or in consumer products made of leather, will probably continue to increase.

Both in the EU and in most other countries, five active substances account for most of the market for fungicides in leather tanning. If one of these five major fungicides is not authorised, the EU tanning industry may face some difficulties and greater costs in terms of controlling bacterial and fungal attack in production. The cost of biocides – estimated here as about 3% of the cost of wet-blue – does not appear to be a major factor at present, although it is likely that these costs will increase as the small set of manufacturers of active substances pass on EU regulatory costs to their EU customers. Leather tanning industries outside the EU will not face these costs.

At the same time, if the five most commonly used active substances are approved under the BPD, it is likely that most imports of semi-processed tanned leather will contain fungicides that have been

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notified, as these active substances are widely used outside the EU. Without regulation of biocides found in imported leather and leather products, however, this can not be assured for all imports. Already, a small share of tanned leather may be treated with fungicides that have not been notified, including some substances (such as PCP) that are restricted under Directive 76/769.

**Imports of finished leather articles**

As fungicides may be absorbed into leather, finished leather articles may contain trace amounts of biocides not notified under the BPD. This may be a risk in particular for lower priced articles, including those shipped from developing countries entering the international market for finished leather articles.

In addition, shipments of finished leather articles may be treated with biocides for their preservation during shipment (see section 9). Identifying the presence of such biocides in finished articles would require monitoring and inspection programmes.

**Development of new biocides**

Producers of biocides have contended that the regulatory costs of the Biocidal Products Directive will inhibit innovation, possibly shifting the development of new active substances for the leather tanning industry to developing countries. Markets for biocidal products used by tanneries are expanding in countries such as Argentina, Brazil, India, Pakistan and China. As a result, these markets are more interesting for the manufacturers of active substances than the EU, which is in decline. Thus, in the future it is possible that new active substances will be introduced in tanneries outside the EU (and the US). These may then be found on finished products sold in the EU. Nonetheless, they will not have received the environmental and health reviews required under the BPD.
Report for Tasks 2.1 & 2.2

Milieu/DTC Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/ 74
9. The use of biocides in shipping and storage of imported articles

Several sources in industry, including questionnaire respondents as well as representatives interviewed, mentioned the use of biocides in containers of textiles, leather goods and other shipments arriving from developing countries to protect the imported articles from fungal and microbial attack during shipment.

In general, shipping containers are treated with chemicals for two reasons:
- To meet phytosanitary requirements, notably to prevent the spreading of plant pathogens; or
- To protect the cargo itself against insects or other biological degradation.

When the container itself is fumigated or otherwise treated, it should be labelled. This is not a requirement if the contents are treated before being loaded.

9.1 Netherlands studies on the treatment of shipping containers

The Inspectorate of the Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM) has published two studies on the presence of potentially hazardous gases in shipping containers. Both noted that many containers contained such gases, and the second study analysed emissions from articles found in treated containers.

The 2004 study noted that: “import containers are being treated with gaseous pesticides, even when there is no legal requirement to do so”.

The results of these studies are presented in Annex IV.

9.2 Other reports on treatment of goods in shipping

Several other sources have indicated that goods may be treated for shipping. This includes an OECD Emissions Scenario for textiles, which refers to the use of PCP to protect shipments of yarn and finished textile products (OECD, 2004). PCP is regulated under Directive 76/769. COTANCE, the EU tanning industry association, has cited reports of the use of PCP in shipments of leather goods.

Overall, these anecdotal reports, together with VROM’s studies, do not provide a clear picture whether or not imported finished articles such as textiles or leather goods are regularly treated with biocides for their own protection in shipping or storage. While this is not a core question for the current study, the issue bears further attention.

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92 Mr Alan Dirks, Port of Rotterdam. Personal communication. March 2006.
Milieu/DTC
October 2006

Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/ 76
10. Overview of the significant treated articles and materials

This section presents an overview of the six significant articles and materials treated with biocides for internal effect analysed in the previous sections (Table 10.1). The overview focuses on three indicators:

- the quantity of active substances used in production of the treated article;
- the size of EU production for the treated article; and
- the potential for substitution of EU production with imported articles.

### Table 10.1 Significant articles and materials treated with biocides for internal effect

<table>
<thead>
<tr>
<th>Article Type</th>
<th>EU Annual Production of the Treated Article (Euros)</th>
<th>Potential for Substitution byImported Articles</th>
<th>Quantity of Active Substances in Treated Article (tonnes/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT6 Water-based paints</td>
<td>€7 billion</td>
<td>low</td>
<td>&gt; 1 065</td>
</tr>
<tr>
<td>Water-based adhesives</td>
<td>€4.3 billion</td>
<td>low</td>
<td>60 - 300</td>
</tr>
<tr>
<td>PT7 Fungi-resistant paints</td>
<td>≤ €1 billion</td>
<td>low</td>
<td>&gt; 255</td>
</tr>
<tr>
<td>PT8 Pressure- and vacuum-treated wood</td>
<td>€1 200 billion</td>
<td>medium</td>
<td>&gt; 2 000 *</td>
</tr>
<tr>
<td>PT9 Wool carpets</td>
<td>≤ €700 million</td>
<td>medium/high</td>
<td>5-6</td>
</tr>
<tr>
<td>Tanned leather</td>
<td>€ 8 billion ** high</td>
<td>500 *** 70 – 215 ****</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- * Not including creosote, estimated at over 45 000 tonnes/year
- ** Turnover of the EU leather industry
- *** Estimate of biocides in imported wet-blue (semi-processed tanned leather) and solution
- **** Estimate of biocides in imported finished products made of tanned leather

For all three criteria – EU production, import vulnerability and amount of active substances – the data provided are estimates.

For product type 6, water-based paints represent the most important market and the largest use of active biocidal substances. Fungi-resistant paints were the only significant article or materials analysed for product type 7. These use a significant amount of biocides, and in the longer term could be vulnerable to imports that use non-notified biocides.

For product type 8, not enough detail was found on the different articles of pressure and vacuum-treated wood to analyse these separately. Moreover, use of different articles appears to vary significantly across Member States. Overall, this category uses a high amount of active substances, even without counting creosote, for which there does not appear to be a distinction between the active substance and the formulated product.
In product type 9, wool carpets use a relatively small amount of biocides compared to other treated articles and materials: 5-6 tonnes per year. Tanned leather (specifically, “wet-blue” leather) is an intermediate good treated with biocides. Traces remain in the finished leather used to make consumer articles. Although the finished articles are not treated *per se*, the remaining traces of active substances in such articles placed on EU markets could be as high as 50 tonnes/years.

The indicators in this table bear review and likely revision before commencing Task 4 of this project. In order to determine the set of representative articles and materials for evaluation in Task 4, these results should be analysed in combination with the results from Task 2.3, on the description of potential risks posed by treated articles and materials.
References


Danish Environmental Protection Agency. *Inventory of Biocides used in Denmark*. Prepared by COWI, DTC and DHI. 2001.


Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/
## Annex I

### Questionnaire results: PT6 Biocides used in water-based paint

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of paint</th>
<th>Biocidal Product</th>
<th>Active Substance(s)</th>
<th>Concentration (% unless otherwise noted)</th>
<th>Notified</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>water-based exterior paint</td>
<td>Acticide fi</td>
<td>5350-50-6 ---&gt;50-00-0 Trimehtyl-urea--&gt;formaldehyde 55965-84-9 5-chloro-2-methyl-4-isothiazolin-3-one [EC No 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC No 220-239-6] (3:1)</td>
<td>0,05-0,13</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>water-based exterior coating</td>
<td>Acticide B20</td>
<td>2634-33-5 1,2-benz-isothiazol-3(2H)-one</td>
<td>0,05-0,1</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>water-based interior paint</td>
<td>Mergal K 9 N, Metacide 401, Acticide SPX, Metatin K 604</td>
<td>55965-84-9 5-chloro-2-methyl-4-isothiazolin-3-one [EC No 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC No 220-239-6] (3:1)</td>
<td>0,05-0,2</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating</td>
<td>Acticide fi</td>
<td>5350-50-6 ---&gt;50-00-0 Trimehtyl-urea--&gt;formaldehyde 55965-84-9 5-chloro-2-methyl-4-isothiazolin-3-one [EC No 247-500-7] and 2-methyl-4-isothiazolin-3-one [EC No 220-239-6] (3:1)</td>
<td>0,08-0,13</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating</td>
<td>Acticide B20</td>
<td>2634-33-5 1,2-benz-isothiazol-3(2H)-one</td>
<td>0,1-0,5</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating</td>
<td>densil P</td>
<td>2527-58-4 Dithio-2,2'-Bis-(Benzmethylamid)</td>
<td>0,05-0,15</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating</td>
<td>Proxel TN</td>
<td>2634-33-5 1,2-benz-isothiazol-3(2H)-one 4719-04-4 1,3,5-tris(2-hydroxyethyl)hexahydro-1,3,5-triazine</td>
<td>0,1-0,3</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>powder Stains</td>
<td>KONSERVIERUNGSMITTEL CA-24 E</td>
<td>Chloracetamid</td>
<td>&lt; 0,9%</td>
<td>Not found</td>
</tr>
<tr>
<td>DE</td>
<td>water-b. int/ext.floor paint</td>
<td>Acticide MBS</td>
<td>BIT 2634-33-5 MIT 12862-20-4</td>
<td>0,2</td>
<td>MIT (12862-20-4): mis-numbered?</td>
</tr>
<tr>
<td>DE</td>
<td>water-based int/ext.paint</td>
<td>Acticide MBS</td>
<td>BIT 2634-33-5 MIT 12862-20-4</td>
<td>0,2</td>
<td>MIT (12862-20-4): mis-numbered?</td>
</tr>
<tr>
<td>DE</td>
<td>water-based int/ext.primer</td>
<td>Acticide MBS</td>
<td>BIT 2634-33-5 MIT 12862-20-4</td>
<td>0,1</td>
<td>MIT (12862-20-4): mis-numbered?</td>
</tr>
<tr>
<td>DE</td>
<td>Waterborne interior</td>
<td>Different suppliers (typically)</td>
<td>1,2-Benzisothiazolin-3(2H)-one</td>
<td>typically 0.02%</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Type of paint</td>
<td>Biocidal Product</td>
<td>Active Substance(s)</td>
<td>Concentration (%) unless otherwise noted</td>
<td>Notified</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>-------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>DE</td>
<td>waterborne stains</td>
<td>RODUROL FL.</td>
<td>5-Chlor-2-methyl-4-isothiazolin-3-on und 2-Methyl-4-isothiazolin-3-on</td>
<td>&lt;0.5%</td>
<td>Not found</td>
</tr>
<tr>
<td>DE</td>
<td>wb interior + exterior paint</td>
<td>Acticide MBS 2530</td>
<td>1,2-Benzisothiazol-3(2H)-on (CAS 2634-33-5), 2-Methyl-2H-isothiazol-3-on (CAS 2682-20-4)</td>
<td>max. 200 ppm</td>
<td>CAS 26172-55-4: not notified</td>
</tr>
<tr>
<td>DE</td>
<td>wb interior + exterior paint</td>
<td>Acticide SPX</td>
<td>2-Methyl-2H-isothiazol-3-on (CAS 2682-20-4), 5-Chlor-2-methyl-4-isothiazolin-3-on (CAS 26172-55-4)</td>
<td>&lt; 15 ppm</td>
<td>CAS 26172-55-4: not notified</td>
</tr>
<tr>
<td>DE</td>
<td>wb interior + exterior paint</td>
<td>Acticide L10</td>
<td>1-Brom-2-nitropropan-1,3-diol (CAS 52-51-7)</td>
<td>150 ppm</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>wb varnish</td>
<td>Acticide MBS</td>
<td>1,2-Benzisothiazol-3(2H)-on (CAS 2634-33-5), 2-Methyl-2H-isothiazol-3-on (CAS 2682-20-4)</td>
<td>200 ppm</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>wb wood coating exterior</td>
<td>Acticide MBS 2530</td>
<td>1,2-Benzisothiazol-3(2H)-on (CAS 2634-33-5), 2-Methyl-2H-isothiazol-3-on (CAS 2682-20-4)</td>
<td>200 ppm</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>wb wood coating interior</td>
<td>Acticide MBS 2530</td>
<td>1,2-Benzisothiazol-3(2H)-on (CAS 2634-33-5), 2-Methyl-2H-isothiazol-3-on (CAS 2682-20-4)</td>
<td>200 ppm</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>BIT</td>
<td>1,2-Benzisothiazol-3(2H)-one CAS No. 2634-33-5</td>
<td>0.006 % by weight</td>
<td>CAS 26172-55-4: not notified</td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>CMIT</td>
<td>5-Chlor-2-methyl-2H-isothiazol-3-one CAS No. 26172-55-4</td>
<td>0.0009 % by weight</td>
<td>Not notified</td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>MIT</td>
<td>2-Methyl-2H-isothiazol-3-one CAS No. 2682-20-4</td>
<td>0.0003 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based impregnation concentrate</td>
<td>BIT</td>
<td>1,2-Benzisothiazol-3(2H)-one CAS No. 2634-33-5</td>
<td>0.016 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based impregnation ready for use</td>
<td>BIT</td>
<td>1,2-Benzisothiazol-3(2H)-one CAS No. 2634-33-5</td>
<td>0.0051 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>water-based interior paint</td>
<td>Dithio-2,2-bis(benzylaminid) (2527-58-4)</td>
<td>Dithio-2,2-bis(benzylaminid) (2527-58-4)</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>water-based interior paint</td>
<td>5-Chlor-2-methyl-2H-isothiazol-3-on and 2-methyl-2H-isothiazol-3-on (55965-84-9)</td>
<td>5-Chlor-2-methyl-2H-isothiazol-3-on and 2-methyl-2H-isothiazol-3-on (55965-84-9)</td>
<td>0.0015</td>
<td></td>
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<tr>
<td>DK</td>
<td>water-based interior paint</td>
<td>Bronopol (52-51-7)</td>
<td>Bronopol (52-51-7)</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>water-based interior paint</td>
<td>2-Methyl-2H-isothiazol-3-on (2682-20-4) and Bronopol (52-51-7)</td>
<td>2-Methyl-2H-isothiazol-3-on (2682-20-4) and Bronopol (52-51-7)</td>
<td>0.0075</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>water-based interior paint</td>
<td>Hydantoin derivates</td>
<td>Hydantoin derivates</td>
<td>1</td>
<td>Not found</td>
</tr>
<tr>
<td>DK</td>
<td>water-based interior paint</td>
<td>Aminopropanol compound (124-68-5)</td>
<td>Aminopropanol compound (124-68-5)</td>
<td>0.005</td>
<td>Not notified</td>
</tr>
<tr>
<td>ES</td>
<td>Water-based based paint</td>
<td>Acticide FI</td>
<td>50-00-0 &amp; 55965-84-9</td>
<td>0.15%</td>
<td></td>
</tr>
</tbody>
</table>

*Report for Tasks 2.1 & 2.2*

*Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported/82*
<table>
<thead>
<tr>
<th>Country</th>
<th>Type of paint</th>
<th>Biocidal Product</th>
<th>Active Substance(s)</th>
<th>Concentration</th>
<th>Notified</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES</td>
<td>Water-based exterior paint</td>
<td>MERGAL K-14</td>
<td>3586-55-8 &amp; 55965-84-9</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior</td>
<td>MERGAL K-14</td>
<td>CMIT 55965-84-9</td>
<td>0.1-0.3</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior paint</td>
<td>MERGAL K-14</td>
<td>3586-55-8 &amp; 55965-84-9</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior paint</td>
<td>MERGAL KM-200</td>
<td>4719-04-4</td>
<td>0.15%</td>
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</tr>
<tr>
<td>ES</td>
<td>Water-based interior/exterior paint</td>
<td>TRELIN P85</td>
<td>26172-55-4 &amp; 3586-55-8</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior/exterior paint</td>
<td>Preventol D-2</td>
<td>Bencitialcohol mono(poli)hemiformal 14548-60-8</td>
<td>0.15%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior/exterior paint</td>
<td>Preventol BIT-20</td>
<td>1,2-bencisotiazol-3(2H)-ona 58249-25-5</td>
<td>0.05%</td>
<td>Not found</td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior/exterior paint</td>
<td>ROCIMA 523</td>
<td>Bronopol 52-51-7 5-chloro—2-mrtil-2H-isotiazol-3-on 55965-84-9</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Distemper paint</td>
<td>Mirecide Temple Plus</td>
<td>Sodium dimethyldithiocarbamate 128-04-1</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Water-based interior</td>
<td>Acticide F (N)</td>
<td>Formaldehyde CAS 50-00-0</td>
<td>0.1% wt</td>
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<tr>
<td></td>
<td></td>
<td>Acticide MBS</td>
<td>Benzisothiazol -3-one Cas 2634-33-5 Methyl 2H- isothiazol-3-one CAS 2682-20-4</td>
<td>0.3% wt</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Water-based interior</td>
<td>Proxel BD 20</td>
<td>Benzisothiazol -3-one Cas 2634-33-5 Benzosothiazol -3-one Cas 2634-33-5 Methyl 2H- isothiazol-3-one CAS 2682-20-4</td>
<td>0.1% wt</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acticide MBS</td>
<td>0.3% wt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Waterbased interior &amp; water-based wood coating</td>
<td>Rocima V189 or Acticide CHR0107</td>
<td>Bronopol 52-51-7 Isothiazolone 55965-84-9</td>
<td>ca 0.2%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Waterbased interior &amp; water-based wood coating</td>
<td>Acticide MBS</td>
<td>2-METHYL-4-ISOTHIAZOLIN-3-ONE 2682-20-4 BENZISOThIAZOLIN-3-ONE BIOCIDE 2634-33-5</td>
<td>0.4% max</td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>Water-based floorfinish</td>
<td></td>
<td>CMI/MI mixture mixed with Bronopol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>Waterbased interior emulsions matt &amp;</td>
<td>Acticide FS (N)</td>
<td>Mixture, containing 5-chloro-2-methyl-isothiazolin-3-one and 2-methyl-2h-isothiazol-3-one CAS:55965-84-9</td>
<td>0.1 - 0.3 % by wt</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>silk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>Waterbased glass lacquers</td>
<td>Acticide FS (N)</td>
<td>ditto</td>
<td>0.2% by Wt</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>wood etc. interior/exterior</td>
<td>Acticide FS (N)</td>
<td>ditto</td>
<td>0.1 -0.2% by wt</td>
<td></td>
</tr>
</tbody>
</table>
Milieu/DTC
October 2006

Study on the impacts of possible measures to manage articles or materials treated with biocides – in particular when imported
### Annex II

**Questionnaire results: PT7 biocides used in fungi-resistant paint**

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of paint</th>
<th>Biocidal Product</th>
<th>Active Substance(s)</th>
<th>Concentration</th>
<th>Notified</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>solvent based exterior</td>
<td>Preventol A9 D</td>
<td>dichloro fluoro-methane sulphenamide 731-27-1</td>
<td>1.5% wt</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>water based woods in can as above</td>
<td>Troyson polyphase A</td>
<td>iodo butyl carbamate 55406-53-6</td>
<td>1%wt</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>solvent based woodstains</td>
<td>Preventol A9 D</td>
<td>dichloro fluoro-methane sulphenamide 731-27-1</td>
<td>1.5% wt</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating</td>
<td>Mergal S 96</td>
<td>26530-20-1 2-Octyl-2H-isothiazol-3-one 10605-21-7 carbandazim(iso)</td>
<td>0.5-1.99</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating</td>
<td>Acticide CS</td>
<td>26530-20-1 2-Octyl-2H-isothiazol-3-one</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>wood coating solvent based</td>
<td>Wokosen TK 50</td>
<td>60207-90-1 1-(2-(2,4-Dichlorphenyl)-4-propyl-1,3-dioxolan-2-y)methyl)-1H-1,2,4-triazol (Propiconazol)</td>
<td>1.7-2</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>water-based masonry coating</td>
<td>Acticide CS</td>
<td>26530-20-1 2-Octyl-2H-isothiazol-3-one</td>
<td>0.1-1.5</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>water-based masonry coating</td>
<td>Acticide MKA</td>
<td>13463-41-7 Pyrithione zinc 28159-98-0 S-Triazin-compound 26530-20-1 2-Octyl-2H-isothiazol-3-one</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>water-based ext.woodpaint</td>
<td>Polyphase 710S</td>
<td>IPBC-55406-53-6 Terbutryn 886-50-0</td>
<td>0.6</td>
<td></td>
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<tr>
<td>DE</td>
<td>solvent b. ext.wood primer</td>
<td>Wocosen 50TK</td>
<td>Propiconazol 60207-90-1</td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>solvent-based ext.wood stain</td>
<td>Wocosen 50TK</td>
<td>Propiconazol 60207-90-1</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>water-based interior</td>
<td>DOICT</td>
<td>Propiconazole (60207-90-1)</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>Waterborne exterior (paint, oil, lacquer)</td>
<td>Different suppliers</td>
<td>3-Iodo-2-propynyl butylcarbamate (CAS no. 55406-53-6)</td>
<td>0.1-0.9% by weight</td>
<td>Intended</td>
</tr>
<tr>
<td>DE</td>
<td>Of perhaps future interest</td>
<td>Acticide MKA</td>
<td>Zinkpyritlion (CAS 13463-41-7), S-Triazin Derivat (CAS 28159-98-0), Zn-Oxid (CAS 1314-13-2), 2-Octyl-2H-isothiazol-3-on (CAS 26530-20-1)</td>
<td>350 ppm</td>
<td>CAS 1314-13-2: no</td>
</tr>
<tr>
<td>DE</td>
<td>wb exterior paint</td>
<td>Acticide MKC</td>
<td>Zinkpyritlion (CAS 13463-41-7), S-Triazin Derivat (CAS 28159-98-0), Zn-Oxid (CAS 1314-13-2), 2-Octyl-2H-isothiazol-3-on (CAS 26530-20-1)</td>
<td>350 ppm</td>
<td>CAS 1314-13-2: no</td>
</tr>
<tr>
<td>DE</td>
<td>wb interior paint</td>
<td>Acticide OTW 8</td>
<td>Octylisothiazolin-3-on (26530-20-1)</td>
<td>480 ppm</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Type of paint</td>
<td>Biocidal Product</td>
<td>Active Substance(s)</td>
<td>Concentration (% unless otherwise noted)</td>
<td>Notified</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------</td>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>DE</td>
<td>wb wood coating exterior</td>
<td>IPS 15 (IPBC)</td>
<td>3-Iod-2-propyl-butylcarbamat (IPBC; CAS 55406-53-6)</td>
<td>up to 7000 ppm</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>wb wood coating exterior</td>
<td>Polyphase 920 (IPBC)</td>
<td>3-Iod-2-propynylbutylcarbamat (CAS 55406-53-6)</td>
<td>up to 7000 ppm</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>wb wood coating exterior</td>
<td>Polyphase P 30 B (IPBC)</td>
<td>3-Iod-2-propynylbutylcarbamat (CAS 55406-53-6)</td>
<td>up to 7000 ppm</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based impregnation ready for use</td>
<td>IPBC</td>
<td>3-Iodopropargyl-N-butylcarbamate CAS-No. 55406-53-6</td>
<td>0.3 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based impregnation ready for use</td>
<td>Propiconazole</td>
<td>CAS-No. 60207-90-1</td>
<td>0.9 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based impregnation ready for use</td>
<td>IPBC</td>
<td>3-Iodopropargyl-N-butylcarbamate CAS-No. 55406-53-6</td>
<td>0.9 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based impregnation ready for use</td>
<td>Propiconazole</td>
<td>CAS-No. 60207-90-1</td>
<td>2.7 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Solvent-based impregnation ready for use</td>
<td>IPBC</td>
<td>3-Iodopropargyl-N-butylcarbamate CAS-No. 55406-53-6</td>
<td>0.20 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Solvent-based impregnation ready for use</td>
<td>Propiconazole</td>
<td>CAS-No. 60207-90-1</td>
<td>0.37 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Solvent-based impregnation ready for use</td>
<td>Tebuconazole</td>
<td>CAS-No.107.534-96-3</td>
<td>0.37 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Solvent-based impregnation ready for use</td>
<td>IPBC</td>
<td>3-Iodopropargyl-N-butylcarbamate CAS-No. 55406-53-6</td>
<td>0.15 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Solvent-based impregnation ready for use</td>
<td>Propiconazole</td>
<td>CAS-No. 60207-90-1</td>
<td>0.27 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Solvent-based impregnation ready for use</td>
<td>Tebuconazole</td>
<td>CAS-No.107.534-96-3</td>
<td>0.27 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>IPBC</td>
<td>3-Iodopropargyl-N-butylcarbamate CAS-No. 55406-53-6</td>
<td>0.30 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>Dithio-2,2-bis(benzmethylamide) CAS No. 2527-58-4</td>
<td>0.004 % by weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>IPBC</td>
<td>3-Iodopropargyl-N-butylcarbamate CAS-No. 55406-53-6</td>
<td>0.30 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>Propiconazole</td>
<td>CAS-No. 60207-90-1</td>
<td>0.90 % by weight</td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Water-based exterior paint</td>
<td>Dithio-2,2-bis(benzmethylamide) CAS No. 2527-58-4</td>
<td>0.004 % by weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Exterior wood coating</td>
<td>Tolyfluoranid (731-27-1)</td>
<td>0,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Exterior wood coating</td>
<td>3-Iodo-2-propynyl-butylcarbamat (55406-53-6)</td>
<td>0,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>Exterior wood coating</td>
<td>Dichlormfluoranid (1085-98-9)</td>
<td>0,6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based exterior</td>
<td>TROYSAN POLYPHASE AF3</td>
<td>55406-53-6</td>
<td>1-2.5</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Solvent-based exterior wood coating</td>
<td>FUNGIPOL AX-45</td>
<td>26530-20-1</td>
<td>0.3%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior &amp; exterior paint</td>
<td>BIOPOL TL-3</td>
<td>55965-84-9</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Type of paint</td>
<td>Biocidal Product</td>
<td>Active Substance(s)</td>
<td>Concentration (% unless otherwise noted)</td>
<td>Notified</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior paint</td>
<td>FUNGIPOL PTI-15</td>
<td>13463-41-7 &amp; 26530-20-1 &amp; 886-50-1</td>
<td>0.6%</td>
<td>CAS 886-50-1: no</td>
</tr>
<tr>
<td>ES</td>
<td>Water-based exterior</td>
<td>FUNGIPOL PTI-15</td>
<td>13463-41-7 &amp; 26530-20-1 &amp; 886-50-1</td>
<td>1.8%</td>
<td>CAS 886-50-1: no</td>
</tr>
<tr>
<td>ES</td>
<td>Water-based based paint</td>
<td>Mirecide TF/100.M</td>
<td>10605-21-7 &amp; 330-54-1 &amp; 26530-20-1</td>
<td>0.25%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior/ exterior paint</td>
<td>ACTICIDE MKB</td>
<td>886-50-0; 13463-41-7; 26530-20-1</td>
<td>0.3-1%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Water-based interior/ exterior paint</td>
<td>ECOCIDE PF</td>
<td>2-metilisotiazolona 2882-20-4; 5-chloro-2-metilisotiazolona 26172-55-4</td>
<td>0.15%</td>
<td>Not found</td>
</tr>
<tr>
<td>ES</td>
<td>Wood coating</td>
<td>PREVENTOL A-4-S</td>
<td>1085-48-9</td>
<td>0.55-1.5%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Powder coating</td>
<td>Ionpure WPA 10</td>
<td>65997-17-3</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>Anti fungi paint</td>
<td>Preventol A-14 D</td>
<td>Diuron 330-54-1 Carbendazina 10605-21-7 2-octil-2H-isotianzol-3-ona 26530-20-1</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Waterbased exterior masonry paint &amp; water-based exterior wood coating</td>
<td>ROCIMA 371</td>
<td>3-Iodo-2-propynyl butylcarbamate 55406-53-6 Diuron 330-54-1</td>
<td>0.7%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Solventbased exterior paint &amp; solvent-based woodstain</td>
<td>Polyphase 728S</td>
<td>Terbutryn 886-50-0 IPBC 55406-53-6</td>
<td>ca 0.6% max</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Fungicidal wash</td>
<td>Polybor</td>
<td>Disodium octoborate 12008-41-2 Benzalkonium chloride 68391-01-5</td>
<td>ca 3%</td>
<td>CAS 12008-41-2: no</td>
</tr>
<tr>
<td>EU</td>
<td>Water-based wood coating</td>
<td>Caflon BQC-50</td>
<td>Tetrahydro-1,3,4,6-tetraakis(hydroxymethyl)imidazo[4,5-d]imidazole-2,5(1H,3H)-dione 5395-50-6 Formaldehyde 50-00-0</td>
<td>ca 3%</td>
<td>CAS 5395-50-6: PT6</td>
</tr>
<tr>
<td>EU</td>
<td>Water-based exterior wood coating</td>
<td>Acticide F(N)</td>
<td></td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Water-based exterior wood coating</td>
<td>Acticide MKC</td>
<td>Irgarol 28159-98-0 Octylisothiazolone 26530-20-1 Pyrithione zinc 13463-41-7</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>Water-based exterior wood coating</td>
<td>Polyphase AF-3</td>
<td>IPBC 55406-53-6</td>
<td>ca 0.5%</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>in can as above</td>
<td>Acticide MKB</td>
<td>triazine derivative 886-50-0 zinc pyrithione 13463-41-7 zinc oxide 1314-13-2 octyl-isothiazol-3-one 26530-20-1</td>
<td>0.4 - 1.0 % wt</td>
<td>CAS 1314-13-2: no</td>
</tr>
</tbody>
</table>
**Annex III**

**Questionnaire results: Biocides Reported by the Adhesives Industry**

**Respondent 1**  
France

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water based adhesives</td>
<td>Bronopol</td>
<td>&lt; 500 ppm</td>
</tr>
<tr>
<td>Starch adhesives</td>
<td>OIT</td>
<td>&lt; 300 ppm</td>
</tr>
<tr>
<td></td>
<td>BIT</td>
<td>&lt; 500 ppm</td>
</tr>
<tr>
<td></td>
<td>CIT/MIT</td>
<td>&lt; 15 ppm</td>
</tr>
<tr>
<td></td>
<td>MIT</td>
<td>&lt; 300 ppm</td>
</tr>
<tr>
<td></td>
<td>Tetramethylol acetylene diurea</td>
<td>0.2%</td>
</tr>
<tr>
<td></td>
<td>S triazine Derivated</td>
<td>&lt; 500 ppm</td>
</tr>
<tr>
<td></td>
<td>Zinc Oxyde</td>
<td>&lt; 500 ppm</td>
</tr>
<tr>
<td></td>
<td>Zinc Pyrithione</td>
<td>&lt; 500 ppm</td>
</tr>
<tr>
<td></td>
<td>Dazomet</td>
<td>&lt; 0.3%</td>
</tr>
<tr>
<td></td>
<td>Sodium Pyridine thione</td>
<td>&lt; 0.1%</td>
</tr>
<tr>
<td></td>
<td>Methyl-chlorophénol</td>
<td>&lt; 0.2%</td>
</tr>
<tr>
<td></td>
<td>Orthophényl phenol</td>
<td>&lt; 0.1%</td>
</tr>
<tr>
<td></td>
<td>Méthylchloro acetamid</td>
<td>&lt; 500 ppm</td>
</tr>
<tr>
<td></td>
<td>Sodium Fluoride</td>
<td>&lt; 0.5%</td>
</tr>
<tr>
<td></td>
<td>Carbendazime</td>
<td>&lt; 0.2%</td>
</tr>
<tr>
<td></td>
<td>4-Propoxycarbonylphénolate de sodium</td>
<td>&lt; 0.3%</td>
</tr>
<tr>
<td></td>
<td>4-Ethoxycarbonylphénolate de sodium</td>
<td>&lt; 0.3%</td>
</tr>
<tr>
<td></td>
<td>Tributyltin Benzoate</td>
<td>&lt; 0.5%</td>
</tr>
<tr>
<td></td>
<td>Folpet</td>
<td>&lt; 0.5%</td>
</tr>
<tr>
<td></td>
<td>Oxybisphénoxarsine</td>
<td>&lt; 0.05%</td>
</tr>
</tbody>
</table>

**Respondent 2a**  
Italy

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilient Floor covering adhesives</td>
<td>CIT/ BIT/ MIT</td>
<td>10-14 ppm CIT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50-70 ppm BIT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50-80 ppm MIT</td>
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</tbody>
</table>
Respondent 2b
Italy

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER BASED ADHESIVE</td>
<td>BIT, CIT-MIT, TRIAZINE</td>
<td>100 ppm, 14ppm, 900 ppm</td>
</tr>
<tr>
<td>EMULSION POLYMERS</td>
<td>BIT, CIT-MIT, CH2O DONORS</td>
<td>100 ppm, 14ppm, 200 ppm</td>
</tr>
<tr>
<td>WATER BASED SOLUTION POLYMERS</td>
<td>CIT, CH2O DONORS, BRONOPOL</td>
<td>75 ppm, 200 ppm, 200 ppm</td>
</tr>
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</table>

Respondent 3
Denmark

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterbased polyvinyl adhesive</td>
<td>CIT/MIT</td>
<td>&lt;15 ppm</td>
</tr>
<tr>
<td></td>
<td>Bronopol</td>
<td>&lt;0,05</td>
</tr>
<tr>
<td>Waterbased polyvinyl adhesive</td>
<td>BIT</td>
<td>&lt;0,02</td>
</tr>
<tr>
<td>Waterbased polyvinyl adhesive</td>
<td>Chloroacetamid</td>
<td>&lt;0,1%</td>
</tr>
<tr>
<td>Waterbased putties and fillers</td>
<td>CIT/MIT</td>
<td>&lt;15 ppm</td>
</tr>
<tr>
<td></td>
<td>Magnesium chloride/nitrate</td>
<td>&lt;0,0002%</td>
</tr>
<tr>
<td></td>
<td>Coppernitrat dihydrate</td>
<td>&lt;0,0001%</td>
</tr>
<tr>
<td>Acrylic sealant</td>
<td>CIT/MIT</td>
<td>&lt;15 ppm</td>
</tr>
<tr>
<td></td>
<td>Magnesium chloride/nitrate</td>
<td>&lt;0,0002%</td>
</tr>
<tr>
<td></td>
<td>Coppernitrat dihydrate</td>
<td>&lt;0,0001%</td>
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Respondent 4
Italy

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinylesters based dispersions</td>
<td>CIT + MIT, bronopol</td>
<td>12 mg, 90 mg</td>
</tr>
<tr>
<td>Vinylesters based dispersions</td>
<td>CIT + MIT, bronopol, BIT + MIT</td>
<td>12 mg, 90 mg, 50 mg</td>
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Respondent 5
Sweden

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<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood adhesives</td>
<td>1,2-Benzisothiazol-3(2H)-one (%)/Cas-no: 2834-33-5</td>
<td>&lt; 0,02 %</td>
</tr>
<tr>
<td></td>
<td>bronopol (%)</td>
<td>&lt; 0,02 %</td>
</tr>
<tr>
<td></td>
<td>Cas-no: 52-51-7</td>
<td>&lt; 0,02 %</td>
</tr>
<tr>
<td></td>
<td>A mixture of 5-chloro-2-</td>
<td>&lt; 15 ppm</td>
</tr>
<tr>
<td></td>
<td>methyl-2H-isothiazol-3-one</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and 2-methyl-2H-isothiazol-3-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>one (3:1) (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cas-no: 55965-84-9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-methyl-3(2H)-isothiazolone</td>
<td>&lt; 0,01 %</td>
</tr>
<tr>
<td></td>
<td>(%) Cas-no: 2682-20-4</td>
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</tbody>
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Respondent 6
UK

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesives</td>
<td>CIT/MIT )</td>
<td>0.0004%</td>
</tr>
<tr>
<td></td>
<td>Formaldehyde ) blend</td>
<td>0.0004% Typical</td>
</tr>
<tr>
<td></td>
<td>Bronopol )</td>
<td>0.0001%</td>
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</tbody>
</table>

Respondent 7
Denmark

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polychloroprene and polyisoprene dispersions</td>
<td>Metilenbis(metillossazolidine) and Ottil-isotiazolone</td>
<td>1g/kg</td>
</tr>
<tr>
<td>Acticide MBS</td>
<td>MIT and BIT</td>
<td>MIT: &lt;0.053 g/l BIT: &lt;0.053 g/l</td>
</tr>
<tr>
<td>Rocima 520 S</td>
<td>CIT and MIT</td>
<td>CIT:&lt;0.015 g/l</td>
</tr>
</tbody>
</table>

Respondent 8
Netherlands

<table>
<thead>
<tr>
<th>Type of treated article/material</th>
<th>Active biocidal substance(s)</th>
<th>Quantities per unit**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterbased adhesives</td>
<td>Acticide MBF50 (MIT, BIT and formaldehydedonor)</td>
<td>0.1-0.15 wt%</td>
</tr>
<tr>
<td>Waterbased adhesives</td>
<td>Kathon</td>
<td>14 ppm</td>
</tr>
<tr>
<td>Silane terminated polymers adhesives</td>
<td>Acticide PLP5 (OIT)</td>
<td>0.4 wt%</td>
</tr>
</tbody>
</table>
Annex IV

Summary of VROM studies into treatment of articles in shipping containers

A 2002 study tested a random sample of over 300 containers for traces of four chemicals: methyl bromide, formaldehyde, sulfuryl fluoride and phosphine. Traces of methyl bromide, formaldehyde and phosphine were found in 21% of the containers; in 5% of the containers, the traces were above the maximum allowable concentrations. Sulfuryl fluoride was not found in any containers. Chemicals were found in about 16% of the containers holding textiles or plastics, compared to 38% of the containers holding foodstuffs. Moreover, only three of the 303 containers tested had any form of warning label.

In a second study, published in 2005, examined articles in 11 containers that arrived by sea for the presence of chloropicrin, 1,2-dichloroethane, methyl bromide, phosphine, and sulfuryl fluoride. These containers held 21 different types of goods, including textile products, leather goods (the shoes and bags appear to have been made of leather), and plastic goods, as well as medicines. The list of goods and the results of detection are found in the table below, which has been reproduced from the study.

<table>
<thead>
<tr>
<th>Seq.no.</th>
<th>Container Object</th>
<th>MeBr</th>
<th>CP</th>
<th>DCE</th>
<th>SO₂F₂</th>
<th>PH₂</th>
<th>Main ingestion route</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slippers</td>
<td>18</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>2</td>
<td>Marbles</td>
<td>18</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>3</td>
<td>Footstool</td>
<td>174</td>
<td>3</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>4</td>
<td>Medicines</td>
<td>7</td>
<td>0.3</td>
<td>0.9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Mouth (digestive)</td>
</tr>
<tr>
<td>5</td>
<td>Bamboo wind chime</td>
<td>9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>6</td>
<td>Shoes</td>
<td>15</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>7</td>
<td>Tablecloths</td>
<td>7</td>
<td>0.3</td>
<td>0.9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>8</td>
<td>Mattress</td>
<td>15</td>
<td>0.3</td>
<td>0.9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>9</td>
<td>Cushions</td>
<td>7</td>
<td>0.3</td>
<td>0.9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>10</td>
<td>Dried flowers</td>
<td>9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>11</td>
<td>Plastic icons</td>
<td>0.1</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>12</td>
<td>Polyvinyl figures</td>
<td>n.d.</td>
<td>n.d.</td>
<td>36</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>13</td>
<td>Bags</td>
<td>2</td>
<td>1.7</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>14</td>
<td>Photo albums</td>
<td>2</td>
<td>1.7</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>15</td>
<td>Decoration material</td>
<td>2</td>
<td>1.7</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
<tr>
<td>16</td>
<td>Jewellery box</td>
<td>2</td>
<td>1.7</td>
<td>n.d.</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Inhalation</td>
</tr>
</tbody>
</table>

The study found that methyl bromide was the most commonly found active substance, followed by chloropicrin. VROM then tested the goods in an emissions chamber and found that 16 of the 21 emitted one or more of the chemical substances (these results are reproduced on the following page). The study concludes that consumers can be exposed to substances used to treat goods during shipment.

None of the containers were labelled to indicate treatment.

In addition to the substances analysed in these two studies, formaldehyde is also known to be used to treat containers (for example for shipments of rattan wood), as well as ammonia is also used.\(^{94}\)

<table>
<thead>
<tr>
<th>Object and container gas</th>
<th>MeBr</th>
<th>CP</th>
<th>DCE</th>
<th>SO(_2)F(_2)</th>
<th>PH(_3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Slippers</td>
<td>MeBr</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2 Mattresses</td>
<td>MeBr</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3 Footstool</td>
<td>MeBr en CP</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4 Medicines</td>
<td>MeBr en CP</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5 Bamboo wind chime</td>
<td>MeBr</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6 Shoes</td>
<td>MeBr</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 Mattresses</td>
<td>MeBr en CP en DCE</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8 Tablecloths</td>
<td>MeBr en CP</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9 Mattresses</td>
<td>MeBr en CP en DCE</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10 Mattresses</td>
<td>MeBr</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11 Cushions</td>
<td>MeBr</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12 Cushions</td>
<td>CP</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13 Dried flowers</td>
<td>MeBr en CP</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14 Perfume blocks</td>
<td>MeBr en CP</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15 Polyvinyl figures</td>
<td>MeBr en CP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16 Bag</td>
<td>MeBr en CP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>17 Photo album</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18 Ornamental material</td>
<td>MeBr en CP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19 Jewellery box</td>
<td>DCE en PH(_3)</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20 Pinchot urn</td>
<td>MeBr</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>21 Candle holder</td>
<td>MeBr</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

| Total                         | 13   | 5  | 2   | 0   | 0     |

+ = emission determined  
- = no emission determined  
MeBr = methyl bromide  
CP = chloroplatin  
DCE = 1,2-dichlorethan  
SO\(_2\)F\(_2\) = sulfurylfluoride  
PH\(_3\) = phosphin
Annex V

List of Contacts

This list does not include the companies who responded to the written questionnaire for the project and provided information in follow-up telephone interviews: the questionnaire specified that responses would be confidential.

Across articles and materials
Dr. Baumann
University of Dortmund

Detergents
Laura Tuccimei
Technical and Scientific Affairs Manager
AISE, International Association Soaps, Detergents and Maintenance Products
Brussels
Information provided on PT6 biocides in detergents

Paints (water-based and anti-fungi)
Jacques Warnon
Technical Director
CEPE, Brussels
Information provided

Plastics
Dr Wolfgang Siebourg
PlasticsEurope
Brussels
Information and referral to Bayer

Mr Paolo Bochicchio
EU Regulatory Affairs Manager
EUPC
Brussels
Meeting to request EuPC cooperation

Mr Walter Claes
HSE Director, EuPC
Managing Director, European Single ply Waterproof Association (ESWA)
Brussels
Information provided on biocides in soft PVC waterproofing, geomembranes and other materials

Mr Roel van't Veer
General Manager
The European Plastic Pipes and Fittings Association (TEPPFA)
Brussels
Information provided on use of biocides in plastic pipes (confirmation that they are not used)
Mr Ton Pluijmet
ERFMI – European Resilient Flooring Manufacturers Institute
Brussels
*Information provided on biocides used in vinyl flooring*

Mr Arjen Sevenster
Manager Technical and Environmental Affairs
European Council of Vinyl Manufacturers (ECVM)
PlasticsEurope
*Referral to Dr Claes and other representatives and experts*

Theo Speeleveld
Secretary General, EUROPUR
*Information provided on use of biocides in polyurethane foam (generally not used)*

**Treated Wood**

Mr John C Bate
Managing Director
Rowlinson Timber Ltd (importers)
*Email to request a telephone interview*

Mr Mike Connell
Arch Timber Protection, UK
*Meeting at WEI-IEO; Questionnaire Response; Follow-up telephone conversation*

Mr Magnus Estberg
Nordic Wood Preservation Council
*Information provided on use of wood preservatives in Nordic countries*

Mr Kees Boon
VHN – [NL Wood Treatment Association]
*Meeting at WEI-IEO; Telephone interview to follow-up his questionnaire response, including statistics on wood treatment in the Netherlands as well as information on issues related to the disposal of treated wood*

Gunilla Beyer
Nordic Timber Council, Swedish Timber Council
*Provided data on treated wood in Sweden*

European Timber Trade Association
Brussels
*Email to request data on imports of treated wood*

Mr Gerfried Jungmeier
Joanneum Research Forschungsgesellschaft m.b.H (Graz)
Chairman, COST Actions E31: Management of Recovered Wood
*Email to request data on treated wood waste*

Mikko Viljakainen
Wood Focus Finland
*Provided information on treated wood in Finland*

Aasmund Bunkholt (Wood Focus, Norway)
Wood Focus Norway
*Email to request data on treated wood*

Mr Joran Jermer
International Research Group for Wood Preservation
*Provided information on wood preservatives*
Dr Chris Coggins
European Wood Preservative Manufacturers Group
British Wood Preserving and Damp-proofing Association
Telephone interview; provided production data and other information on treated wood in the UK and the EU.

Richard Plowman
LOFA
Email to request info on treated wood for garden furniture.

European Furniture Manufacturers Association
Email to request data on garden furniture mfg in the EU

Mr Fons J.M. Ceelaert
Secretary General
FEFPEB – Fédération Européenne des Fabricants de Palettes et Emballages en Bois
Tilburg, Netherlands
Email to request data on treated wood used in pallets and packaging

**Second-hand wood**

Dr Peek
University of Hamburg
Email to request data in addition to his 2004 paper

Wood Recyclers’ Association
United Kingdom
Email to request data on wood reuse and recycling in the UK

Helen Irons, Kristina Flynn
UK WRAP (Waste and Resources Action Programme)
Email exchange on reuse and recycling of treated wood in UK

**Containers**

Ms T. Knol, VROM Inspectorate (author of studies on containers)
Email exchange on use of biocides in shipments; research papers also provided

**Imports**

Dr Bie Tao
State Environmental Protection Administration
China
Email to ask which administration is responsible for biocides

Ms Gwenn Sonck
Secretary General
Euro - China Business Association
Email to ask for contacts regarding export of treated articles

Dr Sunil Prasad
Europe-India Chamber of Commerce
Brussels
Email to request information for the study

**Textiles**

Chinese Chamber of Commerce for Textiles
Email to request information on treated textile exports

**Carpets**

Dr. Bahadır Kaleağası
Turkish Industrialists' and Businessmen's Association
TÜSİAD Representation to the EU and UNICE in Brussels
http://www.tusiad.org/english.nsf
Facilitated information on biocides in woold carpets produced in Turkey (generally not treated)

Leather
Dr T Ramasami, Director
Dr R Rajaram, Biochemistry Department
Central Leather Research Institute
Chennai, India
www.clri.org
Emails to request info on use of biocides in India tanning industry

Mr Lakhara
Managing Director
Footwear Design and Development Institute
Chennai, India
www.fddiindia.com
Email to request information on use of biocides in Indian tanning industry, including follow-up to statement on PCP on the Institute’s web site

Dr Elangovan
Council for Leather Exports
Chennai and other locations, India
India
www.leatherindia.org
Email to request information on the use of biocides in the Indian tanning industry

Neohim (Producer of wood preservatives and other biocides)
St. Petersburg, Russia
Request for information on biocides markets, in particular wood preservatives and leather

China Chamber of International Commerce
Belgium & Italy offices
Email to request information on leather exports