EPHECT I: European household survey on domestic use of consumer products and development of worst-case scenarios for daily use

C. Dimitroulopoulou [a,e,*], E. Lucica [b], A. Johnson [b], M.R. Ashmore [c], I. Sakellaris [a], M. Stranger [d], E. Goelen [d]

[a] Mechanical Engineering Dept., University of West Macedonia, 50100 Kozani, Greece
[b] IPSOS, 1410 Waterloo, Belgium
[c] Stockholm Environment Institute, University of York, York YO10 5DD, UK
[d] Environmental Risk and Health Unit, VITO, 2400 Mol, Belgium
[e] Centre for Radiation, Chemical and Environmental Hazards, Public Health England, Harwell Science and Innovation Campus, OX11 0RQ, UK

HIGHLIGHTS

- Results of a European household survey on the use of 15 domestic consumer products.
- Development of *worst-case scenarios* for domestic consumer products use in Europe.
- Our worst-case scenarios for amount used in cosmetics, agree with US studies.
- Our worst-case scenarios for amount used in cosmetics are higher than EU studies.

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ABSTRACT

Consumer products are frequently and regularly used in the domestic environment. Realistic estimates for product use are required for exposure modelling and health risk assessment. This paper provides significant data that can be used as input for such modelling studies. A European survey was conducted, within the framework of the DG Sanco-funded EPHECT project, on the household use of 15 consumer products. These products are all-purpose cleaners, kitchen cleaners, floor cleaners, glass and window cleaners, bathroom cleaners, furniture and floor polish products, combustible air fresheners, spray air fresheners, electric air fresheners, passive air fresheners, coating products for leather and textiles, hair styling products, spray deodorants and perfumes. The analysis of the results from the household survey (1st phase) focused on identifying consumer behaviour patterns (selection criteria, frequency of use, quantities, period of use and ventilation conditions during product use). This can provide valuable input to modelling studies, as this information is not reported in the open literature. The above results were further analysed (2nd phase), to provide the basis for the development of '*most representative worst-case scenarios*' regarding the use of the 15 products by home-based population groups (housekeepers and retired people), in four geographical regions in Europe. These scenarios will be used for the exposure and health risk assessment within the EPHECT project. To the best of our knowledge, it is the first time that daily worst-case scenarios are presented in the scientific published literature concerning the use of a wide range of 15 consumer products across Europe.

1. Introduction

In everyday life, several consumer products are used frequently and on a regular basis in the domestic environment. According to the definition used within the DG-Sanco funded EPHECT (Emissions, exposure Patterns and Health Effects of Consumer producTs in the EU) Project, "*Consumer products are any article chemically formulated, used in a non-permanent way in indoor environments, and intended for housekeeping or personal care activities or enjoyment.*" (Missia et al., 2012).

To assess population exposure to consumer products, information is required not only about the chemical emissions from this product, the duration and frequency of product use, but also about the indoor location where the product is used and the ventilation conditions during its use. Therefore, one of the key steps in assessing exposure is to identify consumer behaviour patterns (i.e. how and when the products are used, how often, for how long and in which quantities). In Europe, under the REACH legislation (Regulation, Evaluation and Authorisation of CHemicals), there is an on-going effort to collect information on the

* Corresponding author at: Mechanical Engineering Dept, University of West Macedonia, 50100 Kozani, Greece.
E-mail address: Sani.Dimitroulopoulou@phe.gov.uk (C. Dimitroulopoulou).

use of consumer products, in order to define exposure scenarios that describe safe conditions for the use of consumer products (Van Engelen et al., 2007).

A limited number of studies have been carried out to collect the above information on the individual exposure factors. These studies present variability on the methods they used as well as on the products they investigated. In the USA, some early studies were focused on cleaning products. One of the first studies was by Weegels and van Veen (2001), who investigated the frequency of use of cleaning products. The USEPA-funded study (SUPERB — Study of Use of Products and Exposure-Related Behaviour) was focused on the use of cleaning products and air fresheners in California (Hertz-Picciotto et al., 2010). Within this study, frequency of use for eight products and their performance during the cleaning tasks was collected in three annual telephone and six quarterly web-based surveys (Moran et al., 2012). More studies were focused on personal care products. These include a series of studies by Loretz et al. (2005, 2006, 2008) on the frequency and the amount used by a female population in the USA for various cosmetics. In these studies, the participants kept a diary where information on the daily use was recorded, whereas they were supplied with product, whose weight was measured at the beginning and at the end of the project.

In Europe, Hall and co-workers (Hall et al., 2007, 2011) developed distributions for the frequency of use and the amount of personal care products, based on data from the European Toiletries and Cosmetics Database (ETCD) developed by TNS (Taylor Nelson Sofres). This is the largest European database, which provides data on the use of all major toiletries and cosmetics in France, Germany, UK, Spain and Italy. In total, 44,100 households and 18,057 individual consumers in five European countries provided data using their own products. ETCD recorded data on the daily frequency of use of cosmetic products and brands through a postal survey, based on the completion of a paper diary and questionnaire. Questions such as how often the participants use the cosmetics, where they apply them (parts of the body and location when used) and the reasons for use, were included. The diary and questionnaires were sent out to the same participants once every six months and the diaries were completed over a period of one week.

More recently, in the Netherlands, Biesterbos et al. (2013) developed a database on the use of personal care products, based on the replies of 516 men and women who filled in a digital questionnaire. This questionnaire was person-oriented and included information on the patterns and circumstances of use for 32 personal care products.

Apart from the above studies, significant survey work has been carried out by IPSOS (market research company in Belgium). Wanquet (2006) conducted a survey for the Belgian Federal Public Service on the "*Purchase behavior and use patterns of air fresheners*". A total of 646 respondents living in Belgium, aged 18 and older, and in charge of household purchases were interviewed, through face-to-face methodology. The survey aimed at identifying the most popular distribution channels for air fresheners, the most frequently used type of air fresheners, as well as use patterns of air fresheners (e.g. how the different types of air fresheners are used, for how long, how often).

Furthermore, IPSOS conducted a survey in collaboration with VITO (Flemish Institute for Technological Research), for BIM (The Brussels Institute for Management of the Environment) on "*The impact of using household cleaning products on indoor pollution*" (Stranger et al., 2009; Vandenbroucke;, 2010). A total of 500 individuals aged 18 and older, living in Brussels and who are in charge of household chores were interviewed through online methodology. The main objectives of the study were to identify consumer behaviour with regards to ten different types of cleaning products. The study focused on collecting information on consumer behaviour patterns (i.e. how consumers select these products, how they use them, how often they use them, how much product they use each time, what the most popular brands are).

The above two studies provided findings on consumer behaviour patterns, as well as information on methodology and questionnaire design, which served as input for carrying out the present survey research. Within the framework of the EPHECT project, the focus was on consumer products, as defined within the project. Although the above US and European studies provide useful data about the frequency and quantities of product use, not all of them provide data on the location where these products are used and especially on the ventilation conditions during the product use. Therefore, as part of the EPHECT project, a multi-country survey was carried out, taking into account the above parameters, in order to produce data on consumer behaviour, regarding 15 selected household consumer products. The results served as basis for the development of scenarios for the use of consumer products, in the frame of exposure and health risk assessment, as well as for the design of representative consumer product emission tests.

This paper is the first of a series of three interrelated papers to health risk assessment from exposure to air pollutants emitted from consumer products, as estimated within the DG Sanco-funded EPHECT project (Dimitroulopoulou et al., 2015; Trantallidi et al., 2015). The aim of this paper is two-fold; first, to provide important data from the results of the household survey on the use of domestic products, which will supply new information to what is currently reported in other studies, regarding the location and ventilation conditions during the use of 15 consumer products that were examined within EPHECT. This information will be useful to modellers working on the development of exposure scenarios. Secondly, to develop worst-case scenarios for the daily use of the above consumer products by home-based population groups (housekeepers and retired people), across four EU geographical regions (North, East, South, West). To the best of our knowledge, this is the first time that such worst-case daily exposure scenarios are presented in the scientific literature. These daily scenarios will be used as input for exposure and health risk assessment within the EPHECT project.

2. Methodology

2.1. Description of IPSOS survey

The IPSOS survey was focused on creating an inventory on consumption and use habits for 15 consumer product classes selected in EPHECT. These are all-purpose cleaners, kitchen cleaners, floor cleaners, glass and window cleaners, bathroom cleaners, furniture polish products, floor polish products, combustible air fresheners, spray air fresheners, electric air fresheners, passive air fresheners, coating products for waterproof of leather and textiles, hair styling products, spray deodorants and perfumes.

The aim of the survey was to collect data on consumer behaviour patterns, by identifying the most frequently used products, as well as by collecting detailed information on product use (e.g. how and when people use the product, in which rooms of the house, how often, how much product is used, whether or not the product is diluted into water or mixed with other products before use, whether or not people ventilate the room while using the products).

2.1.1. Study population

The survey was conducted in 2011, in ten countries across Western, Southern, Eastern and Northern Europe (Czech Republic, Germany, Denmark, Spain, France, Hungary, Italy, Poland, the UK and Sweden), through an online survey methodology. A total of 4335 people were interviewed across the ten countries (between 350 and 500 in each country) (Fig. 1). The target population in each country consisted of people aged 18 and older, who take part in household cleaning tasks and who used at least one of the 15 domestic product classes in the last 6 months prior to the survey. The demographic characteristics are presented in Table 1.