

# **The new European information system (EIS-CHEMRISKS) for assessing exposures from consumer products in the indoor environment**

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## **ABSTRACT**

Information is needed about the overall nature of the reasonably foreseeable exposures from consumer products, including intended exposures of chemicals released into the air by design (e.g. fragrance materials), and other inhalation, dermal, and oral exposures arising from the use of consumer products (CPs) in the indoor environment. For example, important factors for assessing exposure to, and uptake from indoor emissions from CPs include the design, fabrication, and storage of CPs, the consumer's choice of and attitude towards a CP, physiological parameters, use and time-activity patterns, human contact rates, preventive measures associated with usage, and the use of aftercare solvents and other chemicals associated with the care and cleaning of a CP. The availability of relevant scenarios and human and residential exposure factors help to estimate exposures, as would access to direct monitoring and other CP testing and modelling methods. This paper discusses the above topics, their interfaces, and introduces a new European Union (EU)-wide effort from the European Commission's Institute for Health and Consumer Protection. This is the European Information System on Chemical Risks (EIS-CHEMRISKS), a multi-stakeholder effort to provide publicly available Web pages including scenarios, exposure factors, methods, and other information needed for the assessment of chemical emissions from products/articles.

## **INDEX TERMS**

European Information System on Chemical Risks; Consumer products

## **INTRODUCTION**

Many agencies, industry and academia have studied chemical emissions and exposures to pollutants from outdoor sources, and to some well-defined indoor sources of combustion and interior fixtures. Much less, however, is known about the quantitative and relative contributions of CPs to indoor air and other residential exposures. Some recent publications reviewing important aspects of the assessment of indoor exposures to CPs are available (e.g. Rogers *et al.*, 2001; Wallace *et al.*, 2001; Whitmyre *et al.*, 2001). However, developing additional data about the relative contributions of emissions from various types of CPs to the indoor environment remains an important area for research. This is especially true when considering the variations in CPs, consumer attitudes and product usage characteristics, appliances, and housing conditions encountered across the world. It is of primary importance to be able to estimate primary emissions of chemicals from CPs using reasonably foreseeable scenarios of product usage, exposure factors relevant to the scenario, e.g., consumer product usage and residential information specific to a defined consumer population or sub-population of interest in a country, region, age group, etc. Further, it is important to seek and use established and validated monitoring, testing, and/or modelling methods. In addition, further information is needed on the following issues:

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- consumer perceptions of risk and safety;
- optimization of risk and safety communication to consumers;
- quantification of some types of emissions;
- impact of the ageing and storage conditions of products on emissions;
- emissions and impact on indoor air quality of volatile chemical components from manmade polymers, fibre finishes and residues from dyeing processes, and from 'clothing treatments' such as chemical residues from dry cleaning.

### THE DIRECTIVE ON GENERAL PRODUCT SAFETY

In the EU, the General Product Safety Directive (GPSD), 2001/95/EC, represents a concerted effort by the European Commission to provide a 'broad-based, legislative framework of a horizontal nature' to ensure the sale of safe products. The key provisions of the GPSD require manufacturers and importers 'to place only safe products on the market.' According to the GPSD a 'safe product' shall mean any product which, under normal or reasonably foreseeable conditions of use including duration (and, where applicable, putting into service, installation and maintenance requirements) does not present any risk or only the minimum risks compatible with the product's use. Further, the product should be considered to be acceptable and consistent with a high level of protection for the safety and health of persons, taking into account in particular the:

1. characteristics of the product, including its composition, packaging, instructions for assembly and, where applicable, for installation and maintenance;
2. effect on other products, where it is reasonably foreseeable that it will be used with other products;
3. presentation of the product, the labelling, any warnings and instructions for its use and disposal and any other indication or information regarding the product;
4. categories of consumers at risk when using the product, in particular children and the elderly.

The scope of the GPSD is not limited to CPs and also includes 'products which are designed exclusively for professional use but have subsequently migrated to the consumer market.' The GPSD will replace Directive 92/59/EEC as of 15 January 2004.

### CONSUMER ATTITUDES, RESPONSES TO PRODUCT INFORMATION AND RISK PERCEPTION

Consumers are often more concerned about issues such as trust, credibility, control, competence, voluntariness, fairness, caring, and compassion than about details of quantitative risk assessment (Covello and Sandman, 2001). Consumer attitudes towards products, including awareness and perception of possible health and environmental risks, can play a role in purchase decisions and during actual use of a product (Weegels and Kanis, 2000). Research has been conducted on how labelling and other factors such as product odour might affect consumer beliefs, behaviour, and exposures (e.g. Kovacs *et al.*, 1997; Riley *et al.*, 2000, 2001).

### EMISSIONS FROM CONSUMER PRODUCTS

It is important to characterize the primary emissions from CPs through on-site testing, application of test methods, and/or modelling. Recent publications reviewing important aspects of the assessment of indoor exposures to CPs are available (e.g. Wallace *et al.*, 2001; Whitmyre *et al.*, 2001). Developing additional data about the relative indoor emissions from various types of CPs remains an important area for research, especially when considering the

variations in CPs, consumer attitudes and product usage characteristics, appliances, and housing conditions encountered across the world. Emission rates of most chemicals in products are greatest when products are new; however, emissions are likely to continue for longer periods at low levels for products such as carpets and pressed-wood products.

### SCENARIOS AND EXPOSURE FACTORS FOR ASSESSING HUMAN EXPOSURES

An important aspect of consumer protection is to prevent or reduce exposures to environmental agents. For example, high enough levels of exposure to some VOCs, alone or in combination, can lead to short-term or long-term health impacts. It is usually not possible, however, to measure the necessity or effectiveness of mitigation strategies directly in terms of prevented disease, reduced premature death, or avoided dysfunction. One method of choice used for consumer protection, often conducted initially during the early phases of the research and development of a product, instead, is to measure or estimate the actual or expected human exposure. The exposures are used, along with the product's toxicology profile, to assess whether a product is expected to be safe, i.e., not to cause adverse health effects during its expected use.

Estimating the exposures to a chemical in the residential environment requires an understanding of the known or reasonably expected sources of the exposures. This understanding can help to delineate in a stepwise approach progressing from less refined, more conservative assessments, to more refined, data-rich assessments, as judged to be needed for risk assessments. An advantage of using the scenario(s) approach is that initial estimates of exposure can be developed with very little data; going along with the possible disadvantage of having a high level of uncertainty associated with the need to include assumptions and inferences in the face of limited data.

Exposure factors are the values associated with the many key variables used to estimate the human exposures to the product. Exposure factors include physiological parameters (e.g. body weight, inhalation rates) and variables related to human activities (e.g. time indoors vs. outdoors, and time spent performing various tasks). Several compilations of exposure factors have been published (e.g. US EPA, 1997; ECETOC, 2001); the US exposure factors have thus far been the most extensive collection. Expert judgment and review of the original data could be needed when deciding whether to use an exposure factor value for a specific assessment, e.g. use of US EPA-published exposure factors outside the US.

A key need is to define likely scenarios associated with use of the CPs. Important information includes the frequencies, durations, and amounts used in a likely scenario, the location in the residence, and whether exhaust fans might be used or windows opened by the consumer. Scenarios can also include data or assumptions about physical/chemical properties of the CP of interest, and housing factors that could impact the exposure assessment. It is also necessary to consider the potential for, and to identify and characterize secondary source/sink emission properties of CPs such as upholstered furniture, which could absorb and reemit chemicals emitted from other sources, thus increasing cumulative exposure (Smith and Bristow, 1994). While gathering analysing, and utilizing this information, it is important to recognize:

- the potential for meaningful intra- and inter-individual variations in the usage of CPs (Weegels and van Veen, 2001);
- the potential contribution of non-CP sources (e.g. outdoor; smoking) to the exposures to a chemical in the residential environment;
- that an unexpected exposure factor, e.g. poor eyesight, in a scenario could have a key impact on the exposure from a CP (e.g. Curry *et al.*, 1994).

## TESTING AND MODELLING METHODS

Testing methods for CPs can transcend estimates or measurements of exposure by identifying and assessing adverse effects that the product can cause. When appropriate, they can provide an estimation of the relationship between dose and level of exposure to a substance emitted by the CP, and the incidence and severity of an effect. From this, a risk assessment of the CP can be performed. For textile-containing CPs a well-known testing method is that for formaldehyde emissions standardized by the American Association of Textile Chemists and Colorists (AATCC, 1998), which together with known exposure-response relationships for formaldehyde, can define a safe CP. Working groups of the European Committee for Standardization (CEN) are developing testing methods to help ensure the safety of CPs (CEN, 2002).

Various models are available for use in estimating exposures to chemicals in CPs (e.g. Whitmyre *et al.*, 2001). The data used in these models might include time-varying emission data and the associated residential air levels of the chemical from use of a CP in a defined exposure scenario. The emissions and air levels might be available from monitoring studies of the product, chemical, and scenario of interest, or from a surrogate product or chemical. Other key information needed for the modelling and assessment include selected physical/chemical properties of the chemical of interest, exposure factors for the user of the product and perhaps other occupants of the residence, along with product usage information and residential factors associated with the scenario of interest.

## EUROPEAN INFORMATION SYSTEM ON CHEMICAL RISKS

A consequence of the GPSD is the development of the EIS-CHEMRISKS, which is being designed as a European-wide expert network to systematically exchange and assess information on risks from chemicals released from consumer products and articles. The JRC efforts will focus on filling the exposure data gaps in a systematic and coherent manner. This work will support the rapid exchange (RAPEX) notifications system of the General Product Safety Directive (2001/95/EC) and may provide technical support to the relevant aspects of REACH (Registration, Evaluation and Authorization of CHemicals), i.e., regarding downstream users.

The task of developing and operating EIS -CHEMRISKS is a very complex and demanding one, as heterogeneous users, and a multitude of sources are being targeted. The JRC will establish a single web-based gateway to all major European initiatives in the field of Human Exposure to Chemicals contained and released from products/articles. EIS-CHEMRISKS will act as an interactive EU wide information source and a common communication tool for the user society to develop and continuously update the themes mentioned below.

The thematic Structure of EIS-CHEMRISKS includes the following items:

- European inventory and harmonization of exposure data sources and data sets;
- European Exposure Factors Database;
- standards for the determination of chemicals emissions from products/articles;
- harmonization of modelling approaches of exposure to chemicals released from products/articles;
- sectoral product/article state-of-the-art reports (textiles, toys, cleaning products, etc.);
- state-of-the-art reviews on promising emerging approaches for improving the exposure assessment such as toxicogenomics and low-dose/concentration biomarkers;
- European Annual Status Report 'Risks from Human Exposure to Chemicals released from Consumer Products/Articles'.

## CONCLUSION AND IMPLICATIONS

With respect to the contribution of CPs to indoor air pollution, more information is needed about

- scenarios and exposure factors for types of CPs, consumers, and residences building inhabitants needed for the assessments of interest, e.g. within the EU's member states;
- quantifying some types of CP emissions;
- the impact of the storage and ageing of products on emissions;
- the availability and applicability of testing and modelling methods; and
- consumer attitudes and the responses to product information.

Given the ongoing development of new data, methods, and models, and the evaluation, refinement, and validation of existing data, methods, and models, it is very useful to monitor journals, newsletters, and meetings published or sponsored by human exposure-related professional societies such as the International Society of Exposure Analysis (ISEA, 2003), and Web sites such as the Exposure Assessment Tools and Models one from US EPA (US EPA, 2003) for new information about exposure factors, methods, models, and validation and case studies. Finally, the European Commission's EIS-CHEMRISKS is being designed as a European-wide expert network to systematically exchange and assess information on risks from chemicals released from consumer products/articles.

## ACKNOWLEDGEMENT

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