What do occupational hygienists really know about skin exposure?

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What do occupational hygienists really know about skin exposure?

Sharyn Gaskin[1], Naomi Currie[1], John W. Cherrie[2,3]

[1] Adelaide Exposure Science and Health, Public Health, University of Adelaide, Australia; [2] Institute of Biological Chemistry, Biophysics & Bioengineering, Heriot Watt University, Edinburgh, UK; [3]Institute of Occupational Medicine, Edinburgh, UK.

Abstract

This paper describes responses to a questionnaire on current work practices and understanding of the management of dermal exposure issues in the workplace from members of the British Occupational Hygiene Society (BOHS) and the Australian Institute of Occupational Hygienists (AIOH). The survey comprised questions in four key areas: employment demographics, experience managing dermal exposure, knowledge of dermal exposure management, and opinions on professional knowledge gaps and preferred training methods. The survey was disseminated in 2016 in the UK and 2018 in Australia, with 116 and 114 responses from each jurisdiction, respectively.

The majority of respondents had personally evaluated the risks of dermal exposure to chemicals (BOHS 92%; AIOH 86%), albeit infrequently (less than a few times per year). Occupational Hygienists reportedly adopted a range of strategies to control dermal exposure problems, including chemical elimination/substitution (BOHS 68%; AIOH 68%), changing work practices (BOHS 79%; AIOH 75%), and education (BOHS 77%; AIOH 83%). The use of gloves or other personal protective equipment remained the most commonly cited exposure control measure (BOHS 99%; AIOH 97%). While there appeared to be a good understanding of common dermal exposure workplace scenarios (e.g. isocyanate exposure in motor vehicle repair, solvent exposure during spray painting), the overwhelming majority of respondents wished to find out more about assessing the risks from dermal exposure to chemicals (BOHS 89%; AIOH 88%).

The outcomes suggest ways to increase the competence of professionals in dealing with dermal exposure matters in the workplace, through mechanisms such as web based guidance, interactive educational materials and webinars, as well as workshops and seminars.

Key words: Dermal; exposure controls; risk management; knowledge and practice

Introduction

Dermal exposure is the process of contact between a particular agent and the skin over a period of time. The level of exposure is influenced by preceding loading processes as well as subsequent absorption or desorption processes. Workers are exposed dermally from direct contact, splashes or other processes when handling chemicals or deposition onto the skin from the air and transfer from contaminated surface contact (Ness, 1994). Wet work (immersion of the hands and arms in aqueous liquids, frequent hand washing, and/or long duration glove use) is also identified as an important occupational hazard and risk factor (individually or together with skin contact) for the development of workplace skin disease such as occupational contact dermatitis (Cherrie et al., 2007; Thielitz and John, 2016).

While dermal exposure has received less attention than inhalation exposure, certain substances may be absorbed very efficiently through the skin (e.g. organic solvent *N*-methyl pyrrolidone (Akrill et al., 2002)) and have the potential to cause or contribute to systemic effects. In addition, local effects such as irritant contact dermatitis and non-melanoma skin cancer, are important occupational health concerns. Disruption of the skin barrier function as a consequence of physical damage, repeated occlusion from glove use (Graves et al., 1995), or dermatitis and other skin diseases can also enhance percutaneous absorption of chemicals.

Occupational skin disease (OSD) is the second most common work-related problem presenting to general practitioners in Australia (Hendrie and Driscoll 2003; SWA, 2012). Occupational contact dermatitis is the most common OSD in westernised industrial countries, reportedly about 86% of new OSDs reported under the EPIDERM scheme in Great Britain in 2019 (HSE, 2019) and as much as 90-95% in other jurisdictions (Lushniak 1995; Diepgen and Kanerva, 2006; Gupta et al., 2017).

The World Health Organisation (WHO, 2014) has highlighted the importance of dermal exposure and its potential impact on human health. Moreover, it specified that the current technical knowledge and standardisation related to assessment and management of skin exposure in the workplace have major gaps.

Intervention studies involving worker education have demonstrated positive outcomes including changes in behaviour and disease outcomes (Agner and Held 2002; Dulon et al., 2009). Therefore, understanding and awareness of the importance of dermal exposure and its management should be an important competency among the professionals engaged in workplace health and safety and risk assessment. Although researchers have suggested the idea of "dermal occupational exposure limits" for more than 20 years (Bos et al., 1998), the development of surface limits has been limited and mostly only guidance (e.g. OSHA, 2014). In 2019, the American Conference of Governmental Industrial Hygienists (ACGIH, 2019) introduced the TLV-SL (Threshold Limit Value – Surface Limit) with a notice of intent to change to introduce a TLV-SL for o-phthalaldehyde of 25 µg/100 cm^2.

The aim of this survey was to gather information on current professional work practices and understanding of the management of dermal exposure issues in the workplace amongst occupational hygienists. The objective of the research was to identify ways to increase the competence of occupational hygienists and allied professionals in dealing with dermal exposure matters.

Methods

This research involved an online survey of professional members of kindred societies with an interest and experience in the field of occupational hygiene. The survey was initially conducted in the UK, disseminated to members of the British Occupational Hygiene Society (BOHS) in 2016 (with 116 respondents), and then subsequently targeting members of the Australian Institute of Occupational Hygienists (AIOH) in 2018 (with 114 respondents).

The survey, hosted on the web data collection tool Survey Monkey, was developed by experienced practicing occupational hygienists, with a specialisation in dermal exposure. The survey received relevant ethics approval (approval No. H-2018-221).

The survey comprised of 20 questions, divided into four key areas:

- Employment demographics;
- Experience managing dermal exposure;
- Knowledge of dermal exposure management and resources; and
- Opinions about knowledge gaps and preferred training methods.

Survey results from quantitative questions were analysed using descriptive statistics. Survey comments were examined for common themes, with key comments identified and basic frequency response rates distinguished.

Results

Participant characteristics

The professional experience of both survey populations was similar, with many members of both organisations having over 20 years of experience in occupational hygiene practice (BOHS 39%, n=45; AIOH 31%, n=35). There were more Australian respondents who were early in their career in occupational hygiene (1-5 years' experience) compared with UK colleagues (BOHS 10%, n=12; AIOH 17%, n=19).

Employment demographics of respondents were similar in both the UK and Australia, with the majority employed directly in industry (BOHS 41%, n=46; AIOH 37%, n=41), followed by those working as a consultant (BOHS 29%, n=32; AIOH 36%, n=40), and then regulatory or academic roles (BOHS 16%, n=18; AIOH 10%, n=12 and BOHS 14%, n=16; AIOH 10%, n=12, respectively).

Participant experience in managing dermal exposure

The majority of occupational hygienists surveyed had experience evaluating the risks of dermal exposure to chemicals (BOHS 92%, n=107; AIOH 86%, n=76). While a quarter of all respondents did so on several occasions each year, the majority did so infrequently.

Respondents typically relied upon Safety Data Sheets to help assess dermal exposure risk in the workplace (BOHS 92%, n=100; AIOH 90%, n=79), with professional judgement also playing a significant role in identifying skin exposure hazards present in a task (BOHS 71%, n=77; AIOH 61%, n=54). A variety of other resources, such as scientific literature and toxicology reference texts, were also used.

The sources of scientific resources recommended by respondents to others in the field of occupational hygiene varied depending on geographic region (Figure 1). The Australian respondents mostly cited USA (68%) and local (Aus) (18%) resources such as Threshold Limit Values (TLV) and Biological Exposure Indices (BEI) documentation published by the American Conference of Governmental Industrial Hygienists (ACGIH) and SafeWork Australia Workplace Exposure Standards. Other government regulatory bodies and scientific organisations were also recommended, such as the National Institute for Occupational Safety and Health (NIOSH, USA) and the Health and Safety

Executive (HSE, UK). In contrast, the UK respondents preferred a variety of local (UK) and European resources (42% and 33%, respectively).

A relatively small proportion of respondents had used dermal exposure models to assess the risk of chemical uptake through the skin (BOHS 22%, n=25; AIOH 17%, n=15), and these included RISKOFDERM (Risk Assessment of Occupational Dermal Exposure to Chemicals), IH SkinPerm (Tibaldi et al., 2014), ECETOC TRA (Targeted Risk Assessment), DREAM (Dermal Exposure Assessment Method) (van wendel de joode et al., 2003), National Institute for Occupational Safety and Health Skin Permeation calculator, BEAT (Bayesian Exposure Assessment Toolkit) and MEASE (Estimation and assessment of substance exposure for metals). A brief summary of the most commonly cited models is provided in an appendix to this paper. Considerably more respondents had used biological monitoring methods to assess skin exposure to chemicals (BOHS 44%, n=50; AIOH 45%, n=39). The most commonly tested-for substances in the UK were isocyanates (21%) followed by aromatic substances such as benzene (11%), toluene (10%) and styrene (8%), whereas lead (11%) was the most common substance involved in biological monitoring reported by Australian respondents, followed by aromatic compounds such as polycyclic aromatic hydrocarbons (PAHs) (9%) and organophosphorus pesticides (9%).

The vast majority of respondents had encountered workers with irritant contact dermatitis (BOHS 94%, n=101; AIOH 93%, n=80). When asked if/how they distinguish between irritant contact dermatitis, allergic contact dermatitis, and allergic contact urticaria the majority correctly depended on a referral to an occupational physician or dermatologist (BOHS 56%; AIOH 62%), with 27% (n=23) of AIOH respondents relying on a GP diagnosis. Almost one third of participants (BOHS 24%; AIOH 30%) did not make a distinction between the three skin conditions. We did not ask whether hygienists actually recommended referral to an occupational health professional when observing skin disease but it is positive that they are not undertaking diagnosis themselves, given that this is a specialist area of medicine.

Occupational hygienists reportedly adopted a range of strategies to control dermal exposure problems. These included chemical elimination/substitution (BOHS 68%, n=75; AIOH 68%, n=59), changing work practices (BOHS 79%, n=87; AIOH 75%, n=65), and education (BOHS 77%, n=85; AIOH 83%, n=72). The use of gloves or other PPE remained the most commonly cited exposure control measure (BOHS 99%, n=109; AIOH 97%, n=84).

The survey included four multiple choice questions designed to test respondents' knowledge of common workplace dermal exposure scenarios (Table 1). Occupational hygienists' correctly identified "a combination of exposure routes, but predominantly inhalation" as the most likely cause of sensitisation to isocyanates while working with hexamethylene diisocyanate (HDI) (BOHS 71%, n=80; AIOH 74%, n=60). They were largely aware that the main risk from hands contaminated with inorganic lead dust is through inadvertent ingestion (BOHS 67%, n=74; AIOH 82%, n=67), but were less sure about whether occasional small splashes of toluene would be the main cause of elevated blood toluene levels (BOHS 67%, n=73; AIOH 60%, n=48). The majority of respondents correctly identified hand-washing with soap and water as a main contributor to occupational contact dermatitis (BOHS 83%, n=90; AIOH 74%, n=60).

In terms of professional development, respondents overwhelmingly reported interest in knowing more about assessing the risks from dermal exposure in the workplace (BOHS 90%, n=103; AIOH 89%, n=72). Desirable formats for skills development included web based guidance, interactive educational materials and webinars, as well as workshops and seminars (Figure 2).

Discussion

This work represents the first survey of occupational hygienists on their knowledge and practice in managing dermal exposure issues in the workplace. Results show the experience of UK and Australian professional groups is remarkably similar. The results show a good level of awareness and knowledge of common occupational dermal exposure issues. It would be interesting to see if similar outcomes would be found for industrial/occupational hygienists in other jurisdictions from developed and developing nations. Furthermore, allied health and safety professionals such as occupational health nurses or safety professionals may engage in dermal exposure risk assessment and management in the workplace, but little is known about the knowledge and practice in these professional groups and may warrant further investigation. Whilst there have been reviews of worker training programs in preventing occupational dermal exposure and skin disease (Saary et al., 2005; Zack et al., 2017), there appears to be limited attention given to evaluation of competency in professional bodies engaging in this discipline of workplace health and safety.

Resources referred to for professional development by occupational hygienists in this area were diverse in this study, and this implies a need for local (national) initiatives and resources for information and training. In this context, it would be most efficient if national groups and authorities could share resources. An excellent example of this in relation to respiratory health is the Breathe Freely initiative (www.breathefreely.org.uk ; accessed 24/01/2020), which was originally developed by the BOHS to help reduce occupational lung disease in industry in the UK. Through generous contribution and sharing from BOHS this is now also an initiative of the AIOH in Australia (www.breathefreelyaustralia.org.au).

This study clearly highlights a desire by professionals working in occupational hygiene to have further awareness and training in dermal exposure assessment and management. Importantly, the format of delivery is an important consideration, as the majority of respondents preferred either web-based options such as webinars and online materials (including case studies), or attendance to brief (one day) workshops/training sessions or conference seminars. These could also ideally be available to allied professionals and others with an interest in the topic.

It is recommended that the professional societies call for and host case studies on their websites and perhaps look to revitalising their role in guidance in this important area of occupational hygiene. This could include highlighting valuable reference documents aimed at practical guidance for the occupational hygienist such as “Controlling skin exposure to chemicals and wet work: a practical book” (Sithamparanadaraj and Evans, 2008), “A practical guide to occupational skin management” (Packham, 2018) and chemical resistance glove selection guides e.g. Ansell (2008) as well as other useful websites and resources (see appendix 1 for exposure models).

Furthermore, this work demonstrates the need to encourage occupational hygienists to think more holistically about inhalation, skin and other routes of exposure when planning exposure control measures, as too often PPE is relied upon as the only solution. It is also recommended that engineering and technology disciplines improve control measures, with an emphasis on designing out skin exposures in the workplace. Biological monitoring may have been an under-utilised method for evaluating total exposure to chemicals in the workplace in this study, and may be an area for further guidance (e.g. HSE, 1997). Similarly, more information on the use of predictive dermal exposure models such as those briefly summarised in this paper (appendix) may assist occupational hygienists in undertaking risk assessments in the workplace. Although it is acknowledged that many of these models were developed for regulatory risk assessment and thus of varying practical use to occupational hygienists.

In fact, there is a principal need for more precise and harmonised methodology for the determination of occupational dermal exposure. In this regard, Kasiotis et al. (2019) recently updated progress of the SysDEA Project or Systematic analysis of Dermal Exposure to hazardous chemical Agents at the workplace. This research aimed to improve standardisation in measurement methods for dermal exposure to chemicals in the workplace and could be useful in informing best practice.

In conclusion, the present study shows occupational hygienists encounter dermal exposure issues in the workplace as part of their professional practice. Occupational hygienists currently use various strategies to solve these problems, but overwhelmingly want to find out more and improve their competency in this area of practice. Thus it is recommended that dermal exposure curriculum and training opportunities should have a higher profile in the professional societies and include web-based options for professional development.

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Conflicts of interst

The authors have no conflict of interest to declare.

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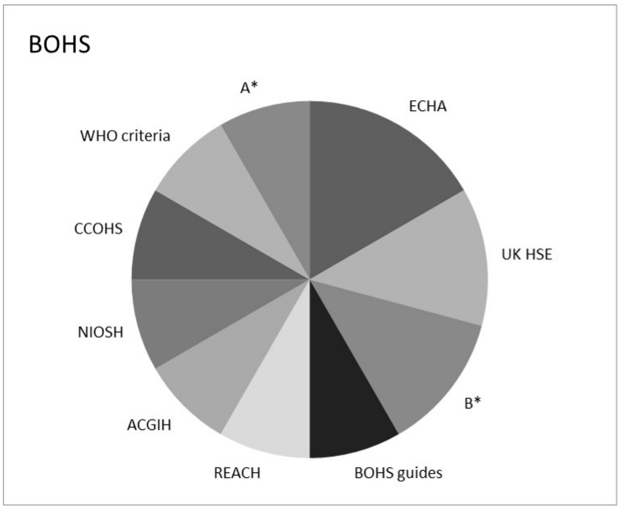
Table 1: Multiple-choice questions to test occupational hygienists' knowledge of common dermal exposure scenarios. Asterisk (*) denotes the most appropriate answer.

Test questions/scenarios	**Multiple-choice answers**	**% response (n)**	
		BOHS	**AIOH**
Someone is working with hexamethylene diisocyanate (HDI) in a motor vehicle repair body shop. They are sensitised to isocyanates. Is the cause likely to be due to…?	1. Dermal exposure 2. Inhalation exposure 3. Ingestion *4. A combination of exposure routes, but predominantly inhalation	19 (21) 22 (25) 1 (1) 71 (80)	11 (9) 15 (12) 0 (0) 74 (60)
The main risk from hands contaminated with inorganic lead dust is uptake…	1. Through the skin 2. By inhalation *3. By ingestion	25 (28) 8 (9) 67 (74)	10 (8) 9 (7) 82 (67)
Dermal exposure of a spray painter to toluene from occasional small splashes onto the unprotected hands is likely to be the main cause of elevated blood toluene levels?	1. True *2. False	33 (36) 67 (73)	41 (33) 60 (48)
In a food processing plant, regular hand washing using soap and water is likely to have made an important contribution to three cases of occupational contact dermatitis amongst the workforce?	*1. True 2. False	83 (90) 18 (20)	74 (60) 26 (21)



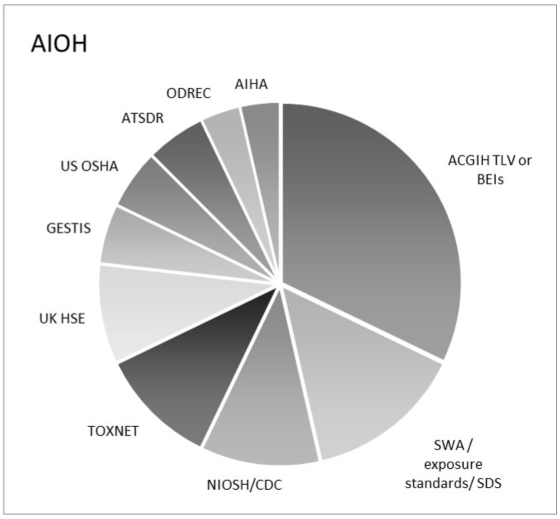


Figure 1: Top ten scientific resources recommended by occupational hygienists for dermal exposure assessment and management (BOHS, left; AIOH, right). *Note: (A) refers to Sithamparanadaraj and Evans (2008), and (B) Packham (2018).

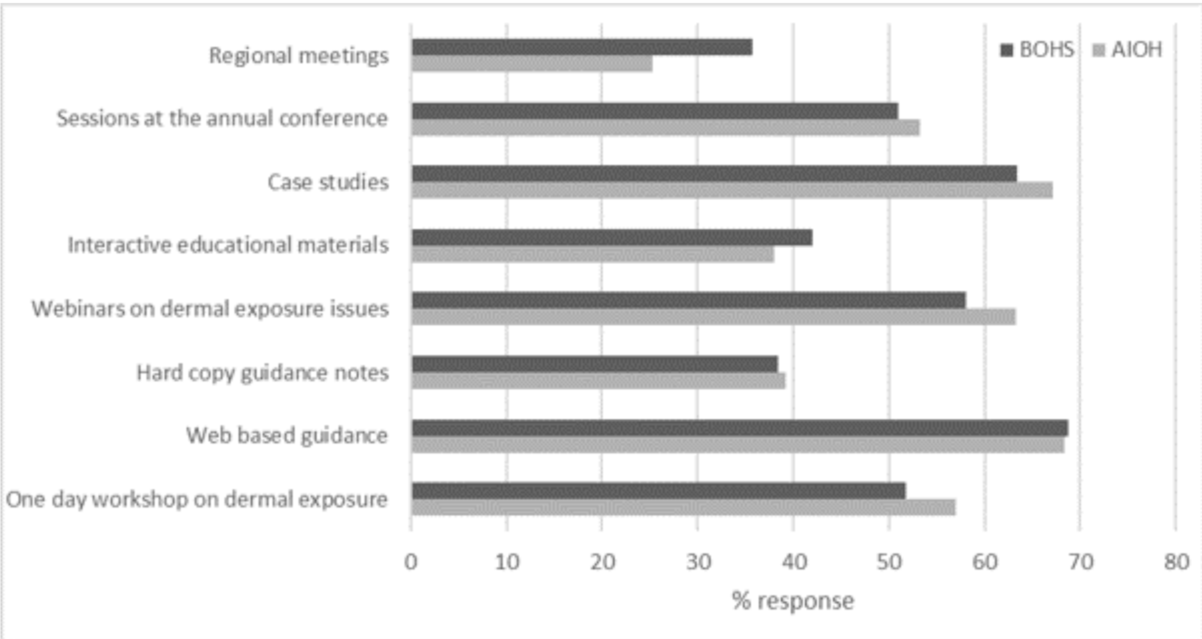


Figure 2: Interest in various formats of professional development relating to assessing and managing the risks from dermal exposure in the workplace.

Appendix – Summary of Common Dermal Exposure Models

BEAT

The Bayesian Exposure Assessment Toolkit (BEAT) assists with assessing dermal and inhalation exposure to biocides in occupational settings. It compares input from the operator with a database of collated exposure data to determine the probable risk posed by the task under investigation. BEAT includes worked examples for 23 biocide product types, in solid and liquid forms, and the large number of inbuilt defaults make it particularly useful when there is limited task-specific exposure data available. However, understanding which values to use from the dataset may require professional expertise and the wrong selection of situation could result in either under or overestimation of risk probability. BEAT was created by the European Chemicals Agency (ECHA) and works as a Microsoft Excel download. For more information contact the Health and Safety Executive (beat@hsl.gsi.gov.uk).

BEAT
Exposure Workers
Routes inhalation, dermal,
Substances Biocides
Situations Solids, liquids
Software Microsoft Excel
Region of origin Europe

ChemSTEER

The Chemical Screening Tool for Exposures & Environmental Releases (ChemSTEER) can help users estimate dermal and inhalation exposure to chemicals in an occupational setting. Tool users can choose from a variety of industry-specific functions involving processing, manufacturing and use of a specific chemical to calculate both human exposure and the potential amount of chemical released to the environment. An extensive set of inbuilt data and models means the tool can be used with limited exposure data, provided basic inputs such as substance volume, worker activities and ventilation rates are available. A Quickstart guide is available to accompany the tool and includes screenshots and examples of different situations in use. ChemSTEER is a free Windows application and available to download from the United States Environmental Protection Agency website https://www.epa.gov

ChemSTEER
Exposure Workers
Routes Inhalation, dermal, environmental releases
Substances Industrial chemicals
Situations Solids, liquids, gases. Limited data
Software Microsoft Excel
Region of origin Europe

ConsExpo

ConsExpo is a consumer exposure model designed for assessing inhalation, oral and dermal exposure from commercial, non-food, products. It is an online model containing built-in data and product application choices, especially useful when there is limited exposure data available. ConsExpo provides a basic over-estimate of human exposure in a residential or business environment to products such as paint or household deodorisers, based on default values and inputs such as body weight, inhalation rate and exposure time. The January 2018 version,

ConsExpo
Exposure Consumers
Routes Dermal, inhalation, oral
Substances consumer / products (non-food)
Situations Solids, vapours. Limited data
Software online
Region of origin Europe

ConsExpo Web 1.0.2, includes peak exposure time in the output and is linked to the European Chemicals Agency (ECHA) reporting tool requirements. ConsExpo Web is a free online tool from the National Institute for Public Health and the Environment website http://www.consexpoweb.nl/ ; https://www.rivm.nl/en/consexpo

DREAM

The DeRmal Exposure Assessment Method (DREAM) is an European observational strategy that can be used to estimate chemical or biological exposure through an observational questionnaire and accompanying calculations. Tool users can determine potential dermal exposure from three main routes of chemical-skin contact; immersion, surface transfer and deposition. The protective factors of PPE, as given by the manufacturer and equation set estimates, is then subtracted from the initial estimate to predict relative dermal exposure in DREAM units for nine body parts, including the hands and face. DREAM has been criticised as outdated and not keeping track with changes in PPE protection factors, due to a lack of formal revisions since its inception by in 2003. The original research paper accompanying the model can be found at http://doi.org/10.1093/annhyg/meg012

DREAM
Exposure Workers
Routes Dermal
Substances Industrial chemicals, biological agents
Situations Aerosols, splashes, contact
Software Questionnaire, equations
Region of origin Europe

EASE

The Estimation and Assessment of Substance Exposure (EASE) tool is designed to estimate dermal and inhalation exposure in occupational settings for a range of chemical and biological substances. EASE was created by the United Kingdom Health and Safety Executive in 1992, with the last published revision occurring in 2002. A major rewrite of the free tool, which was to have produced version 3.0 was abandoned due to the existence of equivalent models and software problems. Further information can be found in the articles by Tickner et al. (2004) and Creely et al. (2005), and the Belgian Society for Occupational Hygiene website has links available to download the tool http://www.industox.nl/ease-new-disk1.zip and http://www.industox.nl/ease-new-disk2.zip (requires Windows XP).

EASE
Exposure Workers
Routes Dermal, inhalation
Substances Generic, chemicals, biological agents
Situations Health hazards
Region of origin UK

ECETOC TRA

The ECTOC Targeted Risk Assessment Tool (TRA) helps the user determine the generic risk of worker, consumer and environmental exposure to industrial chemicals. It brings together and builds upon the tools EASE and ConsExpo, comparing the substance's physical properties, pattern of use and the pattern of control with inbuilt reference data to produce an easy-to-interpret risk ratio in accordance with European chemical hazard guidelines. The tool guides the user through three tiers of exposure assessment. Tier 0 enables low risk chemicals to be screened out, Tier 1 seeks to identify potential risks and Tier 2, where suitable, further refines the potential risk for chemicals identified in the Tier 1 output. ECTOC TRA is a free Microsoft Excel spreadsheet, with the updated July 2018 version available to download from the European Centre for Ecotoxicology and Toxicology of Chemicals website at http://www.ecetoc.org/. A major revision of the tool is planned for 2019-2020.

ECETOC TRA
Exposure Workers, consumers, environment
Routes Inhalation, dermal, oral (systemic)
Substances Generic, chemicals, biological agents
Situations Solids, liquids
Software Microsoft Excel
Region of origin Europe

EMKG-Expo-Tool

The EMKG Exposure Tool can be used to assess inhalation exposure from different chemical and biological substances in small-medium sized occupational settings. The EMKG-Expo-Tool compares inbuilt reference limits for the substance, based on European standards, with the data added by the tool user to produce an estimate of relative risk. Required inputs include the type of substance, its volatility and any control strategies used. It is most suited to solid and liquid agents and designed to be easy to interpret by those who are not necessarily experts in occupational hygiene. Values over the reference level are highlighted as 'risk not adequately controlled' and the user given the option of further refining the input or prompted to use a more precise tool for second-tier assessment. The EMKG-Expo-Tool is a JAVA application that can be downloaded free, along with its user guide, from the German Federal Institute for Occupational Safety and Health (BAuA) website https://www.baua.de.

EMKG-Expo-Tool
Exposure Workers
Routes Inhalation
Substances Generic, chemicals, biological agents
Situations Solids, liquids
Software JAVA
Region of origin Europe

IH SkinPerm

The Industrial Hygiene Skin Permeation tool (IH SkinPerm) can be used to determine more accurate estimates of dermal exposure in occupational settings. The model can be used to assess dermal uptake from pure liquid short-term exposure in three scenarios, splashes, deposition over time, and airborne vapour concentration. Required input includes the mass of the substance, the area of skin exposed and the substance's chemical properties. The tool focuses on real-world scenarios, taking into account evaporation and skin factors to distinguish between hazard and risk, and graph potential exposure over time. Although still considered a Tier-1 tool, IH SkinPerm enables more precise estimates of dermal exposure than other generic models. The tool is able to be downloaded as a free Microsoft

IH SkinPerm
Exposure Workers
Routes Dermal
Substances Chemicals
Situations Pure liquids
Software Microsoft Excel
Region of origin United States of America

Excel application from the American Industrial Hygiene Association website https://www.aiha.org. See also Tibaldi et al., 2014.

MEASE/ MEASE 2

MEASE is a dermal and inhalation exposure tool adapted from the EASE and ECETOC models. It provides a risk estimate of exposure from metals, inorganic naturally occurring substances and their compounds and alloys, and is designed for heavy-metal industry such as mining, smelting and metal recycling. The model includes situations such as the transfer and production of metal products, with specific options for solids, liquids and gaseous product situations. MEASE was created as a free Microsoft Excel tool by EBRC Consulting in accordance with the Health Risk Assessment Guidance for Metals (HERAG). MEASE 2, updated February 2018, and an accompanying guide book are available to download from the EBRC website at https://www.ebrc.de/

MEASE 2
Exposure Workers,
Routes inhalation, dermal
Substances industrial metals
Situations Tasks, solids, liquids, gaseous
Software Microsoft Excel
Region of origin Europe

NIOSH Finite Dose Skin Permeation Calculator

The tool allows more precise estimates of chemicals that have permeated the skin, including estimates for fluxes, skin concentrations, and amounts absorbed from any size dose applied to partially or fully hydrated skin. Unlike other models which have been developed to calculate the steady-state permeability from an aqueous solution of infinite volume, this tool corresponds to a typical occupational exposure scenario of infinite dose. It may allow more in-depth risk assessment to be undertaken. The tool is available free from the CDC National Institute for Occupational Safety and Health website https://www.cdc.gov/niosh/topics/skin/finiteskinpermcalc.html

NIOSH SKIN CALCULATOR
Exposure Workers
Routes Dermal
Substances Chemicals
Situations Pure liquids
Software JAVA
Region of origin United States of America

RISKOFDERM

The tool allows for estimating the potential dermal exposure rate belonging to a specific scenario or task of hands and the rest of the body. A dermal exposure rate distribution is estimated from the given input values. The use must choose the most appropriate process from a list of scenarios, and provide input on potential dermal exposure loading. The tool is freely available through ECHA www.echa.europa.eu or as a paper version of the toolkit (pdf). See also Van Hemmen et al., 2003.

RISKOFDERM
Exposure Workers
Routes Dermal
Substances Chemicals
Situations Liquids
Region of origin Europe

SprayExpo

SprayExpo is a mechanical model designed to predict inhalation and dermal exposure amongst workers during spraying of biocidal products such as pesticides or antifungal coating. It comes in the form of a Microsoft Excel application and can help determine short-term exposure from indoor airborne concentration of different sized aerosol droplets. Required input includes room dimensions and the spraying technique, which are combined with pre-filled data to produce a numerical and graphical estimate of potential exposure levels over time. The model does not take into account splashes of liquid biocides and consequently is only recommended for use in spray-application situations. Version 2.3 of SprayExpo, compatible with EU standards, can be downloaded free from the German Federal Institute for Occupational safety and Health (BAuA) website at https://www.baua.de.

SprayExpo
Exposure Workers
Routes dermal, inhalation
Substances Biocides
Situation Aerosols, spray application, indoor
Software Microsoft Excel
Region of origin Europe

STOFFENMANAGER®

STOFFENMANAGER® is a web-based dermal and inhalation exposure model, initially developed to facilitate risk assessment of chemicals in small-to-medium enterprises. It aims to assist workplaces to prioritise and control risks of handing chemical products in their workplaces. The tool contains a risk banding model for dermal exposure. The core of the model is the RISKOFDERM toolkit. More information can be found at https://www.stoffenmanager.com or Tielemans et al., 2008.

STOFFENMANAGER®
Exposure Workers
Routes dermal, inhalation
Substances Chemicals
Situation Chemicals
Region of origin Europe