

Comprehensive Resource Guide for
Managing Occupational Exposures
of Skin to Hazardous Chemicals

National Institute for Occupational Safety and Health 2007

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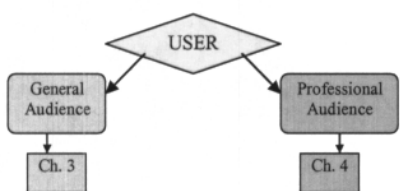
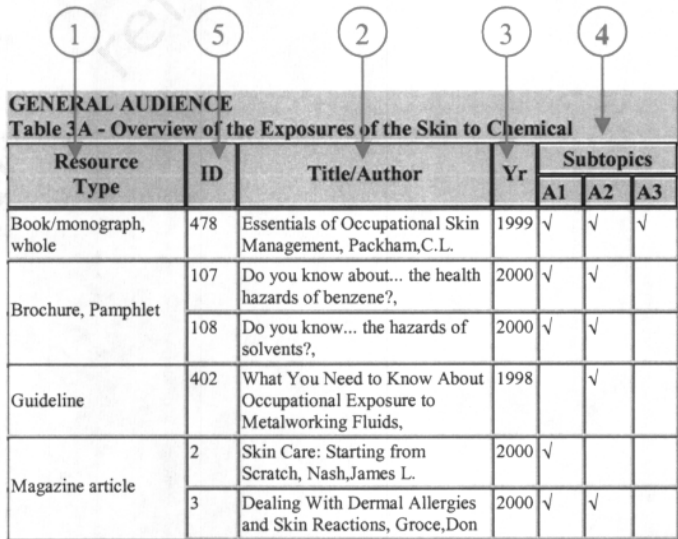
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<p>Step 4. Appendix B – Full Resource Citation and Summary</p> <p>In Appendix B, look up ID numbers for resource(s) of interest - IDs are listed in sequential order. Evaluate the resource(s) based on citation and summary information provided - Definitions for summary fields are found on Page B-2.</p> <p>See Section 2.4 for help on how to obtain selected resources.</p>																																																																	

CHAPTER 1. INTRODUCTION

This dermal resource guide is a tool that directs workers, employers, industrial hygienists, researchers, and policy makers to information resources on occupational skin exposures to chemicals, including health effects surveillance, exposure characterization, hazard identification, risk assessment, and risk control and management.

1.1 Background

More than 13 million workers in the United States are potentially exposed to chemicals at work via the skin. A worker's skin may be exposed to harmful chemicals through direct contact with contaminated surfaces, deposition of aerosols, and immersion in or splashes from liquids. Some chemicals cause contact dermatitis via direct skin contact. Contact dermatitis is one of the more frequently reported occupational illnesses, accounting for 10-15% of all occupational diseases, at an estimated annual cost in the US of at least \$1 billion.

Many chemicals readily pass through the skin (this is called dermal absorption). Dermal absorption can cause systemic health effects or can contribute to the effects of chemicals absorbed in the lung by inhalation. Chemicals are often absorbed through the skin without being noticed by the worker. In some cases, skin is a more significant route of exposure than the respiratory tract. This is particularly true for non-volatile chemicals which are relatively toxic and which remain on work surfaces for long periods of time.

1.2 Purpose of the Dermal Resource Guide

This dermal resource guide is designed to serve as a resource for information on dermal exposure for those who work in at-risk occupations, those who are in a position to investigate or control worker exposure of the skin to harmful chemicals, and those who research or set policy on dermal exposures. The guide provides lists and descriptions of resources by topic for people looking for specific information on dermal exposure anticipation, recognition, evaluation and control.

This dermal resource guide is not designed to be a comprehensive resource on dermal exposure literature, but rather a representative list of available dermal exposure resources. The guide contains for the most part review articles and overview or educational information. Individual research studies are not included here. In addition, the accuracy of information presented in the cited references has not been evaluated.

1.3 Intended Uses and Audiences

The dermal resource guide is designed to provide descriptions of resources available for two different audiences - General and Professional.

General audience resources are for those who have limited technical background or formal training in identifying and controlling harmful skin exposures. The general audience may include workers, small business employers, supervisors, and worksite owners, insurers, and manufacturers of industrial chemicals.

Professional audience resources are for those who typically use technical information for evaluating, recognizing, and controlling harmful skin exposures. The professional audience

may include industrial hygienists, occupational epidemiologists, dermatologists, occupational physicians and nurses, academic researchers, and policy makers.

In some cases resources for these two audiences are not mutually exclusive. General audience members are encouraged to look at the professional resources when they are interested in more detailed or technical information. Conversely, professionals looking for background information for training, educational or communication purposes may find relevant information in the resources for general audiences.

1.4 Topics

The dermal resource guide lists resources that address a number of broad topics. The topics differ somewhat between General and Professional audiences, but typically address the following:

- Overview of dermal exposure;
- Surveillance and clinical aspects of dermal exposures;
- Dermal exposure characterization;
- Dermal hazard identification;
- Dermal exposure risk assessment; and
- Dermal exposure risk management.

These topics were specified during a workshop held at the International Conference on Occupational and Environmental Exposure of Skin to Chemicals: Science and Policy, held September 11, 2002 in Crystal City, VA. The topics are defined and discussed in more detail in Chapters 3 and 4.

CHAPTER 2. DERMAL RESOURCE GUIDE DEVELOPMENT AND FORMAT

2.1 Criteria for Selection of Resources

Resources in the dermal resource guide were identified by first conducting an electronic search of review articles on dermal exposure topics published in English between 1995 and 2005. Key words were identified, grouped and used to search ten different bibliographic databases, including PubMed/Medline. Additional resources were identified from government guidelines, significant websites, and suggestions from dermal exposure experts. These efforts resulted in identification of over 600 resources potentially suitable for inclusion in the guide. Of these, 219 resources were retained in the final version of the guide.

Reviewers first screened abstracts and other available bibliographic information for each identified resource for relevance to the dermal resource guide. Based on the screening, each resource was recommended, not recommended, or potentially recommended for inclusion in the guide. Because of the large number of resources available, in order for a resource to be considered for inclusion, it needed to:

- Be published in English between 1995 and 2005 (In rare instances, review articles or resources published before 1995 were selected for review when they were considered key resources),
- Cover occupational exposures that are primarily via dermal pathways,
- Cover dermal exposures to chemical hazards, rather than physical or biological hazards,
- Deal primarily with human exposures, or animal studies directly related to human exposures,
- Be non-clinical and designed for the non-physician audience, and
- Be a review article or a meta-analysis of primary research studies.

2.2 Resource Review Process

Following screening, copies of recommended resources were obtained and reviewed for inclusion in the dermal resource guide. All resources that were included in the guide were reviewed more fully to summarize the content of the resource. Information was gathered on:

- Industry covered by the resources, including specific industries or occupations when they were discussed in depth;
- Chemical classes covered in the resource, including any specific chemicals that were covered in depth;
- Whether the resources discussed issues surrounding dermal exposure to chemical mixtures;
- Whether the resource was directed at a health and safety professional audience, or a general audience (see Section 1.3. above); and
- Major topics associated with dermal exposure covered in the resources.

In addition, a brief summary of each resource was written, or, in the case of websites and web pages, key information found within the resource was highlighted and as appropriate, summarized.

The draft dermal resource guide underwent an external process which included review by the general public. Minor edits and additions were made in response to reviewer comments. Several newer articles were also added during the review process. Of the original 600+ resources, 219 resources are included in the guide.

2.3 Dermal Resource Guide Contents

Resources included in this dermal resource guide are review articles published in peer reviewed journals, occasional primary journal articles, books, book chapters, brochures/pamphlets, databases, government policies and regulations, guidelines, magazine articles, technical reports, and websites and web pages. Individual research studies are not included here.

Websites and web pages were treated somewhat differently with respect to citations and summaries, given the unique nature of their content. First to clarify, websites contain a variety of different resources, including web pages and downloadable documents, data files, and databases. Websites are somewhat analogous to a book, with the website being the book and the web pages being chapters within the book. However websites are more complicated than books because web pages can be much more varied in content and format than chapters. In addition, website and web page content is not necessarily static content, as is the case with printed material. Information available on a website can change or be updated over time, can be removed, or can be moved to a different location within the website. It is not always clear on examination whether or not this has been done. Finally, the websites reviewed and included in this guide contained a variety of different, independent information that was located both throughout the websites as well as links to other websites. The advantage of resources available on websites is that they are instantaneously available and, for the most part, free, making websites an invaluable source of information for those addressing skin exposures in the field.

Website summaries include general descriptions of web pages, data files, and databases found within the website. The information cited in the guide is based on the version of the website reviewed for this guide.

2.4 Dermal Resource Guide Format

The dermal resource guide is divided into six chapters and two appendices. The content of each is described below:

- Chapter 1: Background, purpose, target audiences, and topic areas.
- Chapter 2: Dermal resource guide contents, format, and criteria for selection of resources.
- Chapter 3: General audience resources. The major topics covered are overview, exposure characterization, hazard identification, risk assessment, and risk management. Under each topic is a table listing those resources that include information on that topic, listed by resource type, ID number, author, date, and title.

- Chapter 4: Professional audience resources. The major topics covered are overview, surveillance and clinical aspects, exposure characterization, hazard identification, risk assessment, and risk management. Under each topic is a table listing those resources that include information on that topic, listed by resource type, ID number, author, date, and title.
- Chapter 5: Discussion of overall information availability.
- Appendix A: Acronyms
- Appendix B: Full Resource Citations and Summaries. Appendix B provides the citations and summaries of all resources in the guide, sorted by resource ID number. The website summaries list web pages, databases, and data files found at the site which contain useful information on dermal exposures.

2.5 Obtaining Resources

Resources may be obtained via a variety of means. Books, journals, and magazine articles may be obtained through subscribing libraries or through interlibrary loan. Books can also be purchased through a variety of suppliers.

More and more review articles are either available for purchase on line or are free. One convenient source for finding articles available online is PubMed/Medline (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>).

Some of the governmental and non-governmental agency publications can also be found either for purchase or download on line. Generally these can be located by typing in the report title using a search engine such as Google (www.google.com).

Websites and web pages can typically be accessed by the URL provided in the Dermal Resource Guide Appendix B. If the URL link is no longer in use, web pages or files may be searched by typing in key words on the website search engine. Alternatively, the table of contents links under the Home page can be used. For web resources described that do not have listed URLs, the resource might be found using the website search engine, typing in the name of the resource or keywords associated with the resource, and accessing the information they wish to see. If the resource is still not found on the website or web page, help can be solicited from the website web masters, usually through a “help” or “contact us” web page.

CHAPTER 3. RESOURCES FOR THE GENERAL AUDIENCE

3.1 Introduction

The resources identified below are appropriate for a general audience who wants background information on dermal exposures to chemicals. General audiences are those who desire to maintain a safe and healthful worksite, but have limited technical background or formal training in identifying and controlling hazardous skin exposures. The general audience may include workers, small business employers, supervisors, worksite owners, insurers, and manufacturers of industrial chemicals.

The resources presented in the tables are review articles published in peer reviewed journals, as well as books, magazines, websites, regulatory guidelines, databases, brochures and other types of resources. These are not meant to be a comprehensive list of information available for the general audience, but rather a representative list of what is available. In addition, the accuracy of the information contained in any resource has not been evaluated.

General audience members who would like more detailed information on some of the topic areas are encouraged to also look at the resources identified for professional audiences in Chapter 4. For example, if a user would like more information on factors that influence exposure conditions (Table 3B, Subtopic B2), they could look in Chapter 4 at Table 4C under Subtopic C2, Description of factors influencing exposure conditions.

3.2 Resources for the General Audience by Topic

The following five tables list resources covering each major topic related to occupational skin exposure to chemicals for a general audience. The major topics are further divided into varying numbers of subtopics, each of which is represented in the columns on the right-hand side of the tables.

Descriptions of each topic and subtopics are provided before each table to assist users in deciding what kind of information they are interested in learning more about.

For the general audience, the five major topics and associated subtopics are:

Topic 3A. Overview of Exposures of the Skin to Chemicals

- A.1. Occurrence of Skin Exposures in the Workplace
- A.2. Health Effects from Skin Exposure to Chemicals
- A.3. Dermal Regulations and Skin Notations

Topic 3B. Characterization of Exposure Condition (Exposure Characterization)

- B.1. Job/Tasks, Industries/Processes, or Chemicals with Skin Exposures
- B.2. Factors that Influence Exposure Conditions
- B.3. Protocols/Checklists to Characterize Exposure to Skin Hazards

Topic 3C. Hazard Identification

- C.1. Risk Phrases, Hazard Symbols, Skin Designations
- C.2. Tables/Charts/Lists of Hazards for Specific Chemicals
- C.3. Protocols/Checklists to Identify Skin Hazards in the Workplace

Topic 3D. Risk Assessment – Evaluating for the Presence of Harmful Chemicals

D.1. Protocols/Checklists to Identify Risk from Exposure

Topic 3E. Risk Management – Reduction of Skin Exposure Risk

E.1. Overview of Skin Exposure Control Options

E.2. Protocols/Checklists to Monitor Potential Exposures

E.3. “Best practices”/Guidelines/Recommendations

E.4. Guidelines/Recommendations for Post-Exposure Skin Decontamination

Each of the five tables presented below include the following columns:

- Resource Type - whether the resource is a book, brochure, journal article, website, and so forth;
- ID – unique ID number assigned to each resource, can be used to locate each resource in Appendix B;
- Title/Author - the resource title and author, if listed, for each resource;
- Yr - the publication year of the resource and, in the case of websites and web pages, the year the website or web page was reviewed for inclusion in the guide; and
- Subtopics - the definition of each subtopic is listed at the bottom of each table; each subtopic addressed by a resource is checked in the appropriate column.

A given resource may be repeated in multiple tables. This will happen when a resource provides information covering a variety of different topic areas.

Topic 3A. Overview of Exposures of the Skin to Chemicals

This table identifies resources that provide general background information on how exposure of the skin to chemicals in the workplace might cause health-related problems, as well as general information about health effects that can result from such exposures. Each resource is further described below based on the sub-topic of information included in the resource. Each checked box under sub-topics indicates that subject area is covered in the resource.

The following subtopics associated with exposure overview information are presented and defined below:

Subtopic A.1. Occurrence of Skin Exposures in the Workplace

These resources provide an overview of issues associated with the occurrence of skin exposures in the workplace.

Subtopic A.2. Health Effects from Skin Exposure to Chemicals

These resources contain general knowledge on the health hazards associated with skin exposure to chemicals. Health effects from skin exposure to chemicals can vary ranging from local effects such as irritation and burns or skin breakdown, to allergic reactions, including both localized responses, such as hives, as well as more remote location

responses, like respiratory or lung effects.

Subtopic A.3. Dermal Regulations and Skin Notations

These resources contain information about regulations covering occupational skin exposure to chemicals. Unlike chemical inhalation hazards, there currently are no occupational exposure limits for skin exposures to chemicals. Instead, regulatory agencies assign what is called a skin notation to a chemical to indicate that the chemical has the potential to contribute to the overall chemical exposure by absorption through the skin. Skin notations do not indicate whether or not a chemical can cause a localized response, only that skin exposure can contribute to overall exposure. The governmental web sites listed contain information on applicable standards. In addition to regulatory information, some of these resources also contain lists of chemicals that have skin notations.

GENERAL AUDIENCE						
Table 3A. Overview of Exposures of the Skin to Chemicals						
Resource Type	ID	Title/Author	Yr	Subtopics		
				A1	A2	A3
Book/monograph, whole	478	Essentials of Occupational Skin Management, Packham,C.L.	1999	√	√	√
Brochure, Pamphlet	107	Do you know about... the health hazards of benzene?	2000	√	√	
	108	Do you know... the hazards of solvents?	2000	√	√	
	147	Assessing and managing risks at work from skin exposure to chemical agents : guidance for employers and health and safety specialists	2001	√	√	√
	480	An Employer's Guide To Skin Protection, The Center to Protect Workers' Rights	2005	√	√	
	489	Choice of skin care products for the workplace, [No author]	2001		√	
	494	2005 Emergency Response Planning Guidelines (ERPG) and Workplace Environmental Exposure Level (WEEL) Handbook, American Industrial Hygiene Association (AIHA)	2005			√
	525	Quick selection guide to chemical protective clothing, Forsberg,K.	2002			√
	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√	√
Guideline	402	What You Need to Know About Occupational Exposure to Metalworking Fluids, [No author]	1998		√	
Journal article - review, meta-analysis	33	Federal government regulation of occupational skin exposure in the USA, Boeniger,M.F.	2003			√
	86	The value and limitations of protective gloves in medical health service: Part III, Mellstrom,G.A.	1996		√	
Magazine article	2	Skin Care: Starting from Scratch, Nash,J.L.	2000	√		
	3	Dealing With Dermal Allergies and Skin Reactions, Groce,D.	2000	√	√	
	58	Safe use of glutaraldehyde, Romano-Woodward,D.	2000		√	
	269	Protecting the hand-skin barrier in the workplace, Del,R.J.	2001		√	

A.1 = Occurrence of Skin Exposures in the Workplace
A.2 = Health Effects from Skin Exposure to Chemicals
A.3 = Dermal Regulations and Skin Notations

GENERAL AUDIENCE						
Table 3A. Overview of Exposures of the Skin to Chemicals (continued)						
Resource Type	ID	Title/Author	Yr	Subtopics		
				A1	A2	A3
Web Page	544	Toxicological Profile Information Sheet, Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√	√	√
	559	Skin Problems: How to Protect Yourself From Job-related Skin Problems, American Academy of Family Physicians	2004	√	√	
	562	Health and Safety Zone, Unison	2005	√	√	
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√	√	
Website	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005		√	√
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√	√
	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005	√	√	
	555	Ansell Chemsafe [Home page], Ansell Chemsafe	2005	√		
	557	Electronic Library of Construction Occupational Safety and Health, Centers for Disease Control	2005	√	√	
	558	Canadian Centre for Occupational Health and Safety [Home page], Canadian Centre for Occupational Health and Safety	2005	√	√	
	564	European Agency for Safety and Health and Work [Home page], European Agency for Safety and Health and Work	2005	√	√	√
	567	Montana Department. of Labor and Industries - Employment Relations [Home page], [No author]	2005	√	√	
	568	The American Skin Association [Home page], [No author]	2005	√	√	
	573	International Brotherhood of Teamsters [Home page], International Brotherhood of Teamsters	2006	√	√	
	575	Alliance for the Polyurethanes industry, [No author]	2006	√	√	

A.1 = Occurrence of Skin Exposures in the Workplace
A.2 = Health Effects from Skin Exposure to Chemicals
A.3 = Dermal Regulations and Skin Notations

GENERAL AUDIENCE						
Table 3A. Overview of Exposures of the Skin to Chemicals (continued)						
Resource Type	ID	Title/Author	Yr	Subtopics		
				A1	A2	A3
Website (continued)	582	The Center for the Protection of Worker's Rights [Home page], The Center for the Protection of Worker's Rights	2006	√		
	589	Oregon OSHA [Home page], Oregon OSHA	2006		√	√
	590	United States Army Center for Health Promotion & Preventive Medicine [Home page], U.S. Army Center for Health Promotion and Preventive Medicine	2006	√		
	591	Occupational Health and Safety [Magazine On-line version][Home page]	2006	√		√
	593	Portland Cement Association [Home page], Portland Cement Association	2006	√	√	
	594	National Ready Mixed Concrete Association [Home page], National Ready Mixed Concrete Association	2006	√		

A.1 = Occurrence of Skin Exposures in the Workplace
A.2 = Health Effects from Skin Exposure to Chemicals
A.3 = Dermal Regulations and Skin Notations

Topic 3B. Characterization of Exposure Condition (Exposure Characterization)

Exposure characterization is a part of an exposure assessment. Exposure characterization is the process of describing the conditions in a given occupational environment that may influence exposure. These conditions may include:

- the source of the chemical;
- the amount of chemical you are exposed to, the amount of time you are exposed in a work day and how often you are exposed in a given week;
- the routes of the exposure to the chemical, meaning whether you are exposed through your skin, your lungs as you breathe, or through your mouth if you eat contaminated food or drink from a contaminated cup;
- the chemical and physical properties of the chemical; and
- work practices, or how work using the chemical is performed.

Subtopic B.1. Job/Tasks, Industries/Processes, or Chemicals with Skin Exposures

These resources may contain information on industries, processes, or jobs that are prone to harmful skin chemical exposures. If available, the specific chemicals or classes of chemicals involved in the skin exposures are listed in the resource summary in Appendix B.

Subtopic B.2. Factors that Influence Exposure Conditions

These resources contain descriptions of factors that influence the exposure conditions. Exposure conditions are not only the working conditions in which a job is being performed, but also the specific factors that influence exposure. Factors that can influence exposure conditions include the intensity or amount of the exposure, how long the exposure lasts and how frequently the exposure occurs in a given day, week month or year. Other factors that influence exposure conditions include what sort of control measures are in place to help reduce exposure, including engineering controls, work practices that either increase or decrease exposures, and the use of personal protective equipment (PPE) such as gloves. So, two different workplaces with workers performing the same task can have different exposure conditions based on what kind of control measures are in use at each workplace.

Subtopic B.3. Protocols/Checklists to Characterize Exposure to Skin Hazards

The resources in this subtopic provide protocols and checklists that can be followed to characterize exposures to skin hazards. Only those resources with protocols or checklists specific to dermal exposure characterization are checked here.

GENERAL AUDIENCE						
Table 3B. Characterization of Exposure Condition (Exposure Characterization)						
Resource Type	ID	Title/Author	Yr	Subtopics		
				B1	B2	B3
Book/monograph, whole	478	Essentials of Occupational Skin Management, Packham,C.L.	1999	√	√	
Brochure, Pamphlet	147	Assessing and managing risks at work from skin exposure to chemical agents : guidance for employers and health and safety specialists, [No Author]	2001	√		
	480	An Employer's Guide To Skin Protection, The Center to Protect Workers' Rights	2005	√	√	
	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√	
Guideline	402	What You Need to Know About Occupational Exposure to Metalworking Fluids	1998		√	
Web Page	562	Health and Safety Zone, Unison	2005	√		
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√	√	
Website	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	√	√
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√		
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√	
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√	√
	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005	√		
	557	Electronic Library of Construction Occupational Safety and Health, Centers for Disease Control	2005	√	√	√
	558	Canadian Centre for Occupational Health and Safety [Home page], Canadian Centre for Occupational Health and Safety	2005	√	√	

B.1 = Job/Tasks, Industries/Processes, or Chemicals with Skin Exposures

B.2 = Factors that Influence Exposure Conditions

B.3 = Protocols/Checklists to Characterize Exposure to Skin Hazards

GENERAL AUDIENCE**Table 3B. Characterization of Exposure Condition (Exposure Characterization) (continued)**

Resource Type	ID	Title/Author	Yr	Subtopics		
				B1	B2	B3
Website (continued)	564	European Agency for Safety and Health and Work [Home page], European Agency for Safety and Health and Work	2005	√		
	567	Montana Department. of Labor and Industries - Employment Relations [Home page], [No author]	2005	√		
	573	International Brotherhood of Teamsters [Home page], International Brotherhood of Teamsters	2006	√		
	575	Alliance for the Polyurethanes industry, [No author]	2006	√	√	
	589	Oregon OSHA [Home page], Oregon OSHA	2006	√	√	
	590	United States Army Center for Health Promotion & Preventive Medicine [Home page], U.S. Army Center for Health Promotion and Preventive Medicine	2006	√		√
	591	Occupational Health and Safety [Magazine On-line version][Home page], [No author]	2006	√		√
	593	Portland Cement Association [Home page] , Portland Cement Association	2006		√	

B.1 = Job/Tasks, Industries/Processes, or Chemicals with Skin Exposures

B.2 = Factors that Influence Exposure Conditions

B.3 = Protocols/Checklists to Characterize Exposure to Skin Hazards

Topic 3C. Hazard Identification

Hazard Identification is the process of the identifying chemical substances that are harmful to the skin or harmful to the body if absorbed through the skin. As part of this process, the nature of the hazard is determined, such as whether the chemical causes skin irritation, skin corrosion, skin sensitization or some type of effect elsewhere in the body from absorption through the skin. The resources listed in this table will help in the determining the kind of skin hazards from different chemicals.

Subtopic C.1. Risk Phrases, Hazard Symbols, Skin Designations

These resources contain information on skin hazard classifications associated with specific chemicals. Phrases, symbols, or other designations are used to describe the potential skin hazards. Skin hazards from chemicals can include skin irritation and corrosion; irritant contact dermatitis; sensitization of skin and respiratory tract as a result of skin exposure to specific chemicals; allergic contact dermatitis; and contribution to the overall body exposure to specific chemicals.

Subtopic C.2. Tables/Charts/Lists of Hazards for Specific Chemicals

These resources include tables, charts or lists of chemicals with the potential for significant skin exposures. These may include fact sheets that describe exposure conditions that may lead to harmful effects.

Subtopic C.3. Protocols/Checklists to Identify Skin Hazards in the Workplace

These resources provide protocols and/or checklists that can be used in the workplace to aid in the identification of skin hazards.

GENERAL AUDIENCE						
Table 3C. Hazard Identification						
Resource Type	ID	Title/Author	Yr	Subtopics		
				C1	C2	C3
Book/monograph, whole	478	Essentials of Occupational Skin Management, Packham,C.L.	1999			√
Brochure, Pamphlet	107	Do you know about... the health hazards of benzene?	2000	√		
	147	Assessing and managing risks at work from skin exposure to chemical agents : guidance for employers and health and safety specialists, [No author]	2001			√
	525	Quick selection guide to chemical protective clothing, Forsberg,K.	2002	√	√	
Technical publication/report	527	NIOSH Pocket Guide to Chemical Hazards (NPG) February 2004, National Institute for Occupational Safety and Health (NIOSH)	2004		√	
Web Page	533	International Chemical Safety Cards (ICSCs): US National Version, National Institute for Occupational Safety and Health	2005	√	√	
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005		√	
Website	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	√	√
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√	√	
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√	√
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005			√
	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005		√	
	557	Electronic Library of Construction Occupational Safety and Health, Centers for Disease Control	2005			√

C.1 = Risk Phrases, Hazard Symbols, Skin Designations

C.2 = Tables/Charts/Lists of Hazards for Specific Chemicals

C.3 = Protocols/Checklists to Identify Skin Hazards in the Workplace

GENERAL AUDIENCE**Table 3C. Hazard Identification (continued)**

Resource Type	ID	Title/Author	Yr	Subtopics		
				C1	C2	C3
Website (continued)	558	Canadian Centre for Occupational Health and Safety [Home page], Canadian Centre for Occupational Health and Safety	2005			√
	564	European Agency for Safety and Health and Work [Home page], European Agency for Safety and Health and Work	2005		√	
	582	The Center for the Protection of Worker's Rights [Home page], The Center for the Protection of Worker's Rights	2006		√	
	591	Occupational Health and Safety [Magazine On-line version][Home page], [No author]	2006	√		√

C.1 = Risk Phrases, Hazard Symbols, Skin Designations

C.2 = Tables/Charts/Lists of Hazards for Specific Chemicals

C.3 = Protocols/Checklists to Identify Skin Hazards in the Workplace

Topic 3D. Risk Assessment - Evaluating for the Presence of Harmful Chemicals

Risk Assessment is a measurement or an estimate of the chances of a given exposure to cause harm. With respect to skin exposures, risk assessments are performed by workplace health and safety representatives to provide the employer with some kind of estimate of the likelihood of an illness or injury to result from exposure of the skin to a particular chemical hazard. These resources provide guidance on how to identify whether or not a chemical skin exposure hazard is present in the workplace.

Subtopic D.1. Protocols/Checklists to Identify Risk from Exposure

These resources provide protocols and checklists to be used in guiding individuals in determining if an identified skin exposure hazard may be harmful.

GENERAL AUDIENCE				
Table 3D. Risk Assessment – Evaluating for the Presence of Harmful Chemicals				
Resource Type	ID	Title/Author	Yr	Subtopics
				D1
Book/monograph, whole	478	Essentials of Occupational Skin Management, Packham,C.L.	1999	√
Brochure, Pamphlet	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√
Website	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√
	557	Electronic Library of Construction Occupational Safety and Health, Centers for Disease Control	2005	√

D.1 = Protocols/Checklists to Identify Risk from Exposure

Topic 3E. Risk Management - Reduction of Skin Exposure Risk

Risk Management is the process of controlling risks to workplace hazards. The resources provide basic information on how to monitor for potential exposures; what control options are available; and how to decontaminate skin once exposure has occurred.

Subtopic E.1. Overview of Skin Exposure Control Options

These resources provide an overview on how to control skin exposures to chemicals. Controls are used to minimize the exposure to harmful chemicals. There are a number of different kinds of controls available, however some controls are better than others.

- The most effective control approach is to eliminate the use of the harmful chemical or substitute a less harmful chemical in its place. An example would be replacing a solvent-based cleaner that causes skin drying and irritation with a water-based cleaner.
- If elimination or substitution is not possible, the next favored method of control is an engineering control. An example of an engineering control is enclosing a process that releases vapors or dusts that are irritating to the skin. The enclosure would remove the potential for contact with the skin. Another common engineering control is the use of ventilation, where an exhaust fan draws the chemical vapor or dusts from the work area.
- If engineering controls cannot be put in place, then work practices should be changed. This means changing the way a worker performs a job or task in order to lower exposures. For example, if skin contact is occurring through contaminated work surfaces, then work surfaces could be cleaned regularly or covered with a disposable material that can be replaced regularly.
- Administrative controls can also be used. These include training programs (e.g., programs that show workers how to avoid skin contact) and hazard monitoring and medical surveillance programs to determine if workers are being exposed to harmful chemicals.
- When all else fails, the use of personal protective equipment (PPE), such as gloves and coveralls, can be used to lower exposures to workers. It is important to remember, though, that PPE only works if it is properly selected, put on, worn and taken off. This means that workers must be trained regularly, have an adequate size selection and supply of PPE, and be monitored regularly to ensure proper fit and use.
- Finally, employers can also implement skin management programs that promote good skin care. This can include creams that provide a protective barrier between the skin and the chemicals, as well as creams and lotions that remove chemicals from the skin and help maintain healthy skin.

Subtopic E.2. Protocols/Checklists to Monitor Potential Exposures

These resources contain protocols and/or checklists to use in routine qualitative monitoring of potential exposures to skin hazards. These will help identify whether or not chemical skin hazards are present in the workplace.

Subtopic E.3. "Best practices"/Guidelines/Recommendations

These resources include information on best practices, guidelines, or recommendations for chemical substitution, engineering controls, work practices, administrative controls, use of personal protective equipment, and implementation of a skin management program.

Subtopic E.4. Guidelines/Recommendations for Post-Exposure Skin Decontamination

These resources contain information on how to decontaminate skin once skin exposures have occurred.

DRAFT-Do not cite, reference or distribute

GENERAL AUDIENCE

Table 3E. Risk Management – Reduction of Skin Exposure Risk

Resource Type	ID	Title/Author	Yr	Subtopics			
				E1	E2	E3	E4
Book/monograph, whole	478	Essentials of Occupational Skin Management, Packham,C.L.	1999	√	√	√	√
Brochure, Pamphlet	107	Do you know about... the health hazards of benzene?	2000			√	
	108	Do you know... the hazards of solvents?	2000			√	
	147	Assessing and managing risks at work from skin exposure to chemical agents : guidance for employers and health and safety specialists, [No author]	2001			√	
	480	An Employer's Guide To Skin Protection, The Center to Protect Workers' Rights	2005	√		√	√
	488	Cost and effectiveness of chemical protective gloves for the workplace, [No author]	2001			√	
	489	Choice of skin care products for the workplace, [No author]	2001			√	
	490	Selecting protective gloves for work with chemicals, [No author]	2000			√	
	525	Quick selection guide to chemical protective clothing, Forsberg,K.	2002			√	
	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√	√	√
Guideline	402	What You Need to Know About Occupational Exposure to Metalworking Fluids, [No author]	1998			√	
Journal article - review, meta-analysis	86	The value and limitations of protective gloves in medical health service: Part III, Mellstrom,G.A.	1996			√	
Magazine article	2	Skin Care: Starting from Scratch, Nash,J.L.	2000	√		√	
	5	Hand Protection: Preventing Chemical Exposures, Minter,S.G.	1999			√	
	58	Safe use of glutaraldehyde, Romano-Woodward,D.	2000		√	√	√
	124	Helping hands. skin care for the hands, Crassweller,I.	1999			√	√
	134	Protecting hands against chemical exposures, Sarkis,K.	2000			√	

E.1 = Overview of Skin Exposure Control Options

E.2 = Protocols/Checklists to Monitor Potential Exposures

E.3 = "Best Practices"/Guidelines/Recommendations

E.4 = Guidelines/Recommendations for Post-Exposure Skin Decontamination

GENERAL AUDIENCE							
Table 3E. Risk Management – Reduction of Skin Exposure Risk (continued)							
Resource Type	ID	Title/Author	Yr	Subtopics			
				E1	E2	E3	E4
Magazine article (continued)	251	Chemical hand protection, Brown,J.W.,III	2002			√	
	269	Protecting the hand-skin barrier in the workplace, Del,R.J.	2001			√	
Other - Guideline from private lab	491	A Guide to Dermal Exposure Reduction, Colormetric Laboratories Inc.	1999	√			
Technical publication/report	527	NIOSH Pocket Guide to Chemical Hazards (NPG) February 2004, National Institute for Occupational Safety and Health (NIOSH)	2004			√	√
Web Page	533	International Chemical Safety Cards (ICSCs): US National Version, National Institute for Occupational Safety and Health	2005	√		√	√
	534	Recommendations for Chemical Protective Clothing, National Institute for Occupational Safety and Health	2005			√	
	559	Skin Problems: How to Protect Yourself From Job-related Skin Problems, American Academy of Family Physicians	2004	√			
	562	Health and Safety Zone, Unison	2005	√			
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√		√	
	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	√	√	√
Website	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√			√
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√		√	√

E.1 = Overview of Skin Exposure Control Options

E.2 = Protocols/Checklists to Monitor Potential Exposures

E.3 = “Best Practices”/Guidelines/Recommendations

E.4 = Guidelines/Recommendations for Post-Exposure Skin Decontamination

GENERAL AUDIENCE

Table 3E. Risk Management – Reduction of Skin Exposure Risk (continued)

Resource Type	ID	Title/Author	Yr	Subtopics			
				E1	E2	E3	E4
Website (continued)	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√	√	
	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005	√		√	
	555	Ansell Chemsafe [Home page], Ansell Chemsafe	2005	√		√	
	557	Electronic Library of Construction Occupational Safety and Health, Centers for Disease Control	2005			√	√
	558	Canadian Centre for Occupational Health and Safety [Home page], Canadian Centre for Occupational Health and Safety	2005			√	
	560	International Programme on Chemical Safety [Home page], World Health Organization	2005				√
	564	European Agency for Safety and Health and Work [Home page], European Agency for Safety and Health and Work	2005			√	
	567	Montana Department. of Labor and Industries - Employment Relations [Home page], No author	2005	√		√	√
	572	NASD: National Ag Safety Database, Centers for Disease Control and Prevention	2006	√		√	√
	573	International Brotherhood of Teamsters [Home page], International Brotherhood of Teamsters	2006	√			
	575	Alliance for the Polyurethanes industry, [No author]	2006	√		√	√
	582	The Center for the Protection of Worker's Rights [Home page], The Center for the Protection of Worker's Rights	2006	√		√	√
589	Oregon OSHA [Home page], Oregon OSHA	2006	√		√		

E.1 = Overview of Skin Exposure Control Options

E.2 = Protocols/Checklists to Monitor Potential Exposures

E.3 = "Best Practices"/Guidelines/Recommendations

E.4 = Guidelines/Recommendations for Post-Exposure Skin Decontamination

GENERAL AUDIENCE

Table 3E. Risk Management – Reduction of Skin Exposure Risk (continued)

Resource Type	ID	Title/Author	Yr	Subtopics			
				E1	E2	E3	E4
Website (continued)	590	United States Army Center for Health Promotion & Preventive Medicine [Home page], U.S. Army Center for Health Promotion and Preventive Medicine	2006			√	√
	591	Occupational Health and Safety [Magazine On-line version][Home page], [No author]	2006		√	√	
	593	Portland Cement Association [Home page] , Portland Cement Association	2006	√		√	
	594	National Ready Mixed Concrete Association [Home page], National Ready Mixed Concrete Association	2006	√		√	

E.1 = Overview of Skin Exposure Control Options

E.2 = Protocols/Checklists to Monitor Potential Exposures

E.3 = “Best Practices”/Guidelines/Recommendations

E.4 = Guidelines/Recommendations for Post-Exposure Skin Decontamination

CHAPTER 4. RESOURCES FOR THE PROFESSIONAL AUDIENCE

4.1 Introduction

The resources identified below are appropriate for a professional audience to use in investigating and controlling harmful skin exposures in the workplace. Included in the professional audience are those who may be involved in conducting scientific risk assessments and preparing technical recommendations. In general, they have adequate knowledge to use technical information for evaluating, recognizing, and controlling harmful skin exposures. The professional audience may include industrial hygienists, occupational epidemiologists, dermatologists, occupational physicians and nurses, academic researchers and policy makers.

Professional audience members who are looking for more general treatments of some of the topics provided below, including material appropriate for worker training activities, are encouraged to also look at the resources identified for the general audience in Chapter 3.

As a reminder, the resources are review articles published in peer reviewed journals, as well as books, magazines, websites, regulatory guidelines, databases, brochures and a number of other types of resources. They also are not meant to be a comprehensive list of review information available for the professional audience, but rather a representative list of what is available. In addition, the accuracy of the information contained in any resource has not been evaluated.

4.2 Resources for the Professional Audience by Topic

The following tables provide a review of resources covering each of six major topics, as listed below, related to occupational skin exposure to chemicals for a professional audience. The major topics are further divided into subtopics, each of which is represented in the columns on the right-hand side of the tables. Descriptions of each topic and its related subtopics are given before each table to assist users in deciding what kind of information they are interested in obtaining.

For the professional audience, the six major topics and related subtopics are:

Topic 4A. Overview of the Investigation and Control of Occupational Skin Exposures

- A.1. Occurrence of Skin Exposures in Workplace
- A.2. Health Hazards Resulting from Skin Exposure to Chemicals
- A.3. Investigation, Intervention, and Control of Occupational Skin Exposures
- A.4. Skin Physiology and Functions as a Barrier to Chemical Insults
- A.5. Dermal Regulations and Skin Notations

Topic 4B. Surveillance and Clinical Aspects

- B.1. Surveillance Studies Reporting Incidences of Occupational Skin Exposures
- B.2. Loss of Workdays and Impact on Productivity
- B.3. Surveillance Study Protocols/Procedures for Gathering Data
- B.4. Clinical Protocols for Recognition of Skin Exposure Health Effects

Topic 4C. Exposure Characterization

- C.1. Workplace Factors Associated with Harmful Skin Exposures
- C.2. Description of Factors Influencing Exposure Conditions
- C.3. Checklists/Questionnaires to Quantify Skin Exposure Incidences
- C.4. Methods to Measure Exposures
- C.5. Exposure Modeling

Topic 4D. Hazard Identification from Toxicological Studies or Modeling

- D.1. Potential Health Effects Resulting from Specific Chemicals
- D.2. Summaries of Health Effects, Dose-Response Relationships
- D.3. Characterization Protocols

Topic 4E. Risk Assessment

- E.1. Guidelines for Risk Assessment or Analysis
- E.2. Example Risk Assessments

Topic 4F. Risk Management

- F. 1. Strategies for Exposure Control
- F.2. Protocols for Risk Assessment

As in Chapter 3, each of the tables presented below include the following columns:

- Resource Type - whether the resource is a book, brochure, journal article, website, and so forth;
- ID – unique ID number assigned to each resource, can be used to locate each resource in Appendix B;
- Title/Author - the resource title and author, if listed, for each resource;
- Yr - the publication year of the resource and, in the case of the website and web pages, the year the website or web page was reviewed for inclusion in the guide; and
- Subtopics - Subtopics addressed under the given table topic. The definition of each subtopic is listed at the bottom of each table. Each subtopic addressed by a resource is checked.

A given resource may be repeated in multiple tables. This will happen when a resource provides information covering a variety of different topic areas.

Topic 4A. Overview of the Investigation and Control of Occupational Skin Exposures

These resources provide an overview of the occurrence of skin exposures to chemicals in the workplace; health hazards that can result from skin exposure to chemicals; the process of investigating, intervening and controlling occupational skin exposures; and background information on basic skin physiology and how it functions as a barrier to chemical absorption into the body.

Subtopic A.1. Occurrence of Skin Exposures in the Workplace

These resources provide a general overview of the occurrence of skin exposures to harmful chemicals in the workplace. This overview may not be the primary focus of the resource, but rather introductory material that leads into the main focus of the resource.

Subtopic A.2. Health Hazards Resulting from Skin Exposure to Chemicals

These resources provide an overview description of the different kinds of adverse health effects that can result from skin exposure to chemicals.

Subtopic A.3. Investigation, Intervention, and Control of Occupational Skin Exposures

These resources provide an introduction to the recognition, evaluation and control of skin hazards in the workplace. Background information can be found on skin hazards, including an overview of occupational skin exposure investigations, intervention approaches that can be adopted and controls strategies that can be put into place.

Subtopic A.4. Skin Physiology and Functions as a Barrier to Chemical Insults

These resources provide an introduction to skin physiology, including the function of the different layers of skin, how they act as barriers to chemical absorption, and how when compromised or damaged, they can alter the skin's natural barrier properties.

Subtopic A.5. Dermal Regulations and Skin Notations

These resources either contain information about regulations covering occupational skin exposure to chemicals or information about the designation of chemicals based on their skin hazards or their potential to be absorbed by the skin. The governmental web sites listed contain information on applicable standards. In addition to regulatory information, some of these resources also contain information on chemicals with skin notations.

PROFESSIONAL AUDIENCE

Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures

Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Book/monograph, chapter	423	Chemical Protective Clothing and the Skin: Practical Considerations, Boeniger,M.	2002				√	
	501	Development of Occupational Skin Disease, Weber,L.W ; Pierce,J.T.	2003				√	
	517	Systemic toxicity from percutaneous absorption, Andersen,K.E.	1999				√	
	578	Occupational Skin Exposure-Absorption of Chemical Agents and Assessment of Exposures, Harris,R.	2000				√	
	142	Protective gloves for occupational use, Boman,A.	2005					√
	506	Surface and dermal monitoring for toxic exposures, Ness,S.A.	1994		√	√		
	526	Dermatotoxicology, Zhai,H.	2004				√	
	579	Health Risk Assessment: Dermal and Inhalation Exposure and Absorption of Toxicants (Dermatology), Wang,R.G.M., Knaak,J.B., Maibach,H.I.	1993				√	
Brochure, Pamphlet	520	Physician's Alert for Occupational Contact Dermatitis Among Construction Workers., Center to Protect Workers' Rights	2001	√	√			
	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√		√	
Guideline	474	Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America, Boyce,J.M.	2002				√	

A.1 = Occurrence of Skin Exposures in Workplace

A.2 = Health Hazards Resulting from Skin Exposure to Chemicals

A.3 = Investigation, Intervention, and Control of Occupational Skin Exposures

A.4 = Skin Physiology and Functions as a Barrier to Chemical Insults

A.5 = Dermal Regulations and Skin Notations

PROFESSIONAL AUDIENCE

Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Guideline (continued)	493	SAMPLING FOR SURFACE CONTAMINATION, Occupational Safety and Health Administration (OSHA)	2005					√
Journal article – primary	224	Surveillance of occupational skin disease: EPIDERM and OPRA, Cherry,N.	2000	√				
	256	Skin cleansers for occupational use: testing the skin compatibility of different formulations, Klotz,A.	2003				√	
Journal article - review, meta-analysis	23	Dermal exposure to chemicals in the workplace: just how important is skin absorption?, Semple,S.	2004	√	√		√	
	25	Dermal exposure assessment in occupational medicine, Sartorelli,P.	2002	√				
	27	Methods for assessing risks of dermal exposures in the workplace, McDougal,J.N.	2002			√	√	
	30	Developing COSHH Essentials: dermal exposure, personal protective equipment and first aid, Garrod,A.N.	2003					√
	34	The importance of occupational skin diseases in the United States, Lushniak,B.D.	2003	√				
	37	Dermal toxicity due to industrial chemicals, Mathur,A.K.	2002				√	
	43	Proposal for the assessment of quantitative dermal exposure limits in occupational environments: Part 1. Development of a concept to derive a quantitative dermal occupational exposure limit, Bos,P.M.	1998					√
	44	Skin lesions and environmental exposures. An overview for the occupational health nurse. Agency for Toxic Substances and Disease Registry, [No author]	1996		√		√	

A.1 = Occurrence of Skin Exposures in Workplace

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A.5 = Dermal Regulations and Skin Notations

PROFESSIONAL AUDIENCE

Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Journal article - review, meta-analysis (continued)	45	Occupation-related allergies in dentistry, Hamann,C.P.	2005	√	√			
	46	Solvents and the skin, Rowse,D.H.	2004		√		√	√
	48	Occupational contact dermatitis, Lushniak,B.D.	2004	√	√	√		
	68	Carbonless copy paper and workplace safety: a review, Graves,C.G.	2000	√	√			
	71	Dermal absorption of benzene: implications for work practices and regulations, Kalnas,J.	2000	√				√
	103	Pesticide-related illness among migrant farm workers in the United States, Das,R.	2001		√			
	185	Understanding percutaneous absorption for occupational health and safety. Wester,R.C, MaibachH.I.	2000				√	
	234	Percutaneous penetration studies for risk assessment, Sartorelli,P.	2000			√		
	243	Criteria for skin notation in different countries, Nielsen,J.B.	2004					√
	244	Occupational contact dermatitis II: risk assessment and prognosis, Emmett,E.A.	2003			√	√	
	255	Skin-conditioning products in occupational dermatology, Elsner,P.	2003				√	
	267	A critique of assumptions about selecting chemical-resistant gloves: a case for workplace evaluation of glove efficacy, Klingner,T.D.	2002					√
	282	Occupational issues of irritant contact dermatitis, Chew,A.L.	2003		√			
	283	Occupational contact dermatitis, Antezana,M.	2003		√			
297	Occupational contact dermatitis. Recognition and management, Koch,P.	2001		√				

A.1 = Occurrence of Skin Exposures in Workplace

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A.4 = Skin Physiology and Functions as a Barrier to Chemical Insults

A.5 = Dermal Regulations and Skin Notations

PROFESSIONAL AUDIENCE

Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Journal article - review, meta-analysis (continued)	299	The epidemiology of occupational contact dermatitis, Diepgen, T.L.	1999		√			
	315	Prediction of irritancy in the human skin irritancy model and occupational setting, Tupker, R.A.	2003				√	
	331	Factors affecting thresholds in allergic contact dermatitis: safety and regulatory considerations, Basketter, D.A.	2002				√	
	340	Classification criteria for skin-sensitizing chemicals: a commentary, Basketter, D.A.	1999			√		√
	348	From xenobiotic chemistry and metabolism to better prediction and risk assessment of skin allergy, Smith Pease, C.K.	2003				√	
	367	Misinterpretation and misuse of exposure limits, Hewett, P.	2001					√
	368	Harmonization of future needs for dermal exposure assessment and modeling: a workshop report, Marquart, H.	2001					√
	468	Concepts of skin protection: considerations for the evaluation and terminology of the performance of skin protective equipment, Brouwer, D.H.	2005			√	√	
	471	When should a substance be designated as sensitizing for the skin ('Sh') or for the airways ('Sa')?, Schnuch, A.	2002					√
	475	Management of dermatitis in the rubber manufacturing industry, Toeppen-Sprigg, B.	1999	√	√	√		

A.1 = Occurrence of Skin Exposures in Workplace

A.2 = Health Hazards Resulting from Skin Exposure to Chemicals

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A.5 = Dermal Regulations and Skin Notations

PROFESSIONAL AUDIENCE

Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Journal article - review, meta-analysis (continued)	495	Detailed Review Document on Classification Systems for Skin Irritation/Corrosion in OECD Member Countries, Environment Directorate Joint Meeting of the Chemicals Committee and the Working Party on Chemicals	1999					√
	602	The role of the skin in the development of chemical respiratory hypersensitivity, Kimber,I.	1996		√			
Other - Commentary	456	Exposure and absorption of hazardous materials through the skin, Boeniger,M.F.	2000					√
Other - Editorial	353	Dermal exposure: a decade of real progress, Fenske,R.A.	2000			√		
Technical publication/report	102	Epidemiology of skin and respiratory diseases among hairdressers, Leino,T.	2001	√	√			
	486	CEFIC Workshop on methods to determine dermal permeation for human risk assessment, Jones,AD,et al	2004				√	
	527	NIOSH Pocket Guide to Chemical Hazards (NPG) February 2004, National Institute for Occupational Safety and Health (NIOSH)	2004					√
	561	Environmental Health Criteria Document on Dermal Absorption [Draft], World Health Organization International Programme on Chemical Safety	2005				√	
Web Page	542	HSDB - Hazardous Substances Data Bank, National Library of Medicine	2005					√
	544	Toxicological Profile Information Sheet, Agency for Toxic Substances and Disease Registry (ATSDR)	2005		√	√		

A.1 = Occurrence of Skin Exposures in Workplace

A.2 = Health Hazards Resulting from Skin Exposure to Chemicals

A.3 = Investigation, Intervention, and Control of Occupational Skin Exposures

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A.5 = Dermal Regulations and Skin Notations

PROFESSIONAL AUDIENCE								
Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures (continued)								
Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Web Page (continued)	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√		√	√	
Website	24	National Institute for Occupational Safety and Health (NIOSH) [Home page], National Institute for Occupational Safety and Health (NIOSH)	2005	√	√	√		√
	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	√			√
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√	√	√		√
	543	Agency for Toxic Substances and Disease Registry (ATSDR) [Home page], Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√				
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√	√	√	√
	546	Dermatological Engineering, Enviroderm Services	2005	√	√		√	
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√	√	√	
	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005	√	√			
	575	Alliance for the Polyurethanes industry, [No author]	2006		√			

A.1 = Occurrence of Skin Exposures in Workplace

A.2 = Health Hazards Resulting from Skin Exposure to Chemicals

A.3 = Investigation, Intervention, and Control of Occupational Skin Exposures

A.4 = Skin Physiology and Functions as a Barrier to Chemical Insults

A.5 = Dermal Regulations and Skin Notations

PROFESSIONAL AUDIENCE**Table 4A. Overview of the Investigation and Control of Occupational Skin Exposures (continued)**

Resource Type	ID	Title/Author	Yr	Subtopics				
				A1	A2	A3	A4	A5
Website (continued)	581	American Industrial Hygiene Association [Home page], American Industrial Hygiene Association	2006					√
	586	EXTOXNET - The EXTension TOXicology NETwork, University of California-Davis; Oregon State University; Michigan State University; Cornell University; University of Idaho.	2006		√			√

A.1 = Occurrence of Skin Exposures in Workplace

A.2 = Health Hazards Resulting from Skin Exposure to Chemicals

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A.5 = Dermal Regulations and Skin Notations

Topic 4B. Surveillance and Clinical Aspects

Public health surveillance is the ongoing systematic collection, analysis, and interpretation of health data for purposes of improving health and safety. *Occupational surveillance* studies involve the tracking of illnesses, injuries, exposures and hazards in the workplace. The resources provided in the table below review information on dermal exposure surveillance work as well as clinical guidance on collecting data for surveillance studies, including information on assessing health effects from skin exposure to chemicals in the workplace.

Subtopic B.1. Surveillance Studies Reporting Incidences of Occupational Skin Exposures

These resources summarize or refer to surveillance studies that report the incidence or prevalence of occupational skin exposures to chemicals. These may be studies where skin exposure to chemicals was a major focus of the study, or a minor focus of the surveillance study.

Subtopic B.2. Loss of Workdays and Impact on Productivity

These resources review information on lost workdays due to skin exposure health effects and/or review information on the impact of skin exposure health effects on worker productivity. This may include information on workers' compensation claims associated with skin exposure health effects.

Subtopic B.3. Surveillance Study Protocols/Procedures for Gathering Data

These resources contain guidance for collecting representative data for surveillance studies, including standard protocols or prevailing procedures used in surveillance studies.

Subtopic B.4. Clinical Protocols for Recognition of Skin Exposure Health Effects

These resources contain guidance for standard protocols or prevailing procedures used in clinical examinations that facilitate in the recognition and identification of harmful health effects that result from skin exposures to chemicals.

PROFESSIONAL AUDIENCE							
Table 4B. Surveillance and Clinical Aspects							
Resource Type	ID	Title/Author	Yr	Subtopics			
				B1	B2	B3	B4
Book/monograph, chapter	423	Chemical Protective Clothing and the Skin: Practical Considerations, Boeniger,M.	2002	√			
	501	Development of Occupational Skin Disease, Weber,Lutz W ; Pierce,J.T.	2003				√
	517	Systemic toxicity from percutaneous absorption, Andersen,K.E.	1999	√			
Brochure, Pamphlet	520	Physician's Alert for Occupational Contact Dermatitis Among Construction Workers., Center to Protect Workers' Rights	2001				√
	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√	√	√
Journal article - primary	199	Occupational contact dermatitis to nickel: experience of the British dermatologists (EPIDERM) and occupational physicians (OPRA) surveillance schemes, Shum,K.W.	2003	√			
	224	Surveillance of occupational skin disease: EPIDERM and OPRA, Cherry,N.	2000	√			
	458	Occupational dermatitis causing days away from work in U.S. private industry, 1993, Burnett-CA; Lushniak-BD; McCarthy-	1998	√	√	√	
Journal article - review, meta-analysis	34	The importance of occupational skin diseases in the United States, Lushniak,B.D.	2003	√	√		
	44	Skin lesions and environmental exposures. An overview for the occupational health nurse. Agency for Toxic Substances and Disease Registry, [No author]	1996				√
	45	Occupation-related allergies in dentistry, Hamann,C.P.	2005	√			
	48	Occupational contact dermatitis, Lushniak,B.D.	2004	√	√		
	50	The dermal toxicity of cement, Winder,C.	2002	√	√		

B.1 = Surveillance Studies Reporting Incidences of Occupational Skin Exposures

B.2 = Loss of Workdays and Impact on Productivity

B.3 = Surveillance Study Protocols/Procedures for Gathering Data

B.4 = Clinical Protocols for Recognition of Skin Exposure Health Effects

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Table 4B. Surveillance and Clinical Aspects (continued)

Resource Type	ID	Title/Author	Yr	Subtopics			
				B1	B2	B3	B4
Journal article - review, meta-analysis (continued)	52	Toxicity of methyl methacrylate in dentistry, Leggat,P.A.	2003	√			
	68	Carbonless copy paper and workplace safety: a review, Graves,C.G.	2000	√			
	70	Differences between the sexes with regard to work-related skin disease, Meding,B.	2000	√			
	74	Textile dye allergic contact dermatitis prevalence, Hatch,K.L.	2000	√			
	94	What can we learn from epidemiological studies on irritant contact dermatitis?, Diepgen,T.L.	1995	√		√	
	103	Pesticide-related illness among migrant farm workers in the United States, Das,R.	2001	√			
	244	Occupational contact dermatitis II: risk assessment and prognosis, Emmett,E.A.	2003	√			√
	267	A critique of assumptions about selecting chemical-resistant gloves: a case for workplace evaluation of glove efficacy, Klingner,T.D.	2002	√			
	270	Occupational contact dermatitis in the textile industry, Wigger-Alberti,W.	2003	√			
	278	Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure, Susitaival,P.	2003			√	
	282	Occupational issues of irritant contact dermatitis, Chew,A.L.	2003	√	√		√
	283	Occupational contact dermatitis, Antezana,M.	2003				√
	286	Strategies for prevention: occupational contact dermatitis, Brown,T.	2004	√	√	√	
	290	Occupational issues of allergic contact dermatitis, Andersen,K.E.	2003	√			√
	299	The epidemiology of occupational contact dermatitis, Diepgen,T.L.	1999	√			
306	Epidemiological studies on the prevention of occupational contact dermatitis, Diepgen,T.L.	1996	√				

B.1 = Surveillance Studies Reporting Incidences of Occupational Skin Exposures

B.2 = Loss of Workdays and Impact on Productivity

B.3 = Surveillance Study Protocols/Procedures for Gathering Data

B.4 = Clinical Protocols for Recognition of Skin Exposure Health Effects

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Table 4B. Surveillance and Clinical Aspects (continued)

Resource Type	ID	Title/Author	Yr	Subtopics			
				B1	B2	B3	B4
Journal article - review, meta-analysis (continued)	307	The epidemiology of occupational contact dermatitis, Lushniak,B.D.	1995	√	√	√	
	311	Occupational contact dermatitis I: incidence and return to work pressures, Emmett,E.A.	2002	√	√		
	314	Clues to an accurate diagnosis of contact dermatitis, Rietschel,R.L.	2004	√			
	327	In-use testing and interpretation of chemical-resistant glove performance, Boeniger,M.F.	2002		√		
	475	Management of dermatitis in the rubber manufacturing industry, Toeppen-Sprigg,B.	1999	√			
	604	Beryllium exposure: dermal and immunological considerations, Day,G.A.	2006	√			
Technical publication/report	102	Epidemiology of skin and respiratory diseases among hairdressers, Leino,T.	2001	√		√	
Web Page	542	HSDB - Hazardous Substances Data Bank, National Library of Medicine	2005	√			
	556	Bureau of Labor Statistics ; Industry Illness and Injury Data, Bureau of Labor Statistics	2005	√	√	√	
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√	√	√	
Website	24	National Institute for Occupational Safety and Health (NIOSH) [Home page], National Institute for Occupational Safety and Health (NIOSH)	2005	√	√		
	539	Environmental Protection Agency (EPA) [Home page], Environmental Protection Agency	2005	√	√	√	
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005				√

B.1 = Surveillance Studies Reporting Incidences of Occupational Skin Exposures

B.2 = Loss of Workdays and Impact on Productivity

B.3 = Surveillance Study Protocols/Procedures for Gathering Data

B.4 = Clinical Protocols for Recognition of Skin Exposure Health Effects

PROFESSIONAL AUDIENCE							
Table 4B. Surveillance and Clinical Aspects (continued)							
Resource Type	ID	Title/Author	Yr	Subtopics			
				B1	B2	B3	B4
Website (continued)	543	Agency for Toxic Substances and Disease Registry (ATSDR) [Home page], Agency for Toxic Substances and Disease Registry (ATSDR)	2005				√
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√		
	546	Dermatological Engineering, Enviroderm Services	2005			√	√
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√		√
	560	International Programme on Chemical Safety [Home page], World Health Organization	2005				√
	566	Oregon Worker Illness and Injury Prevention Program (OWIIPP), Oregon Department of Human Services	2005	√	√	√	
	574	California Division of Labor Statistics and Research [Home page], California Division of Labor Statistics and Research	2003	√	√		
	576	DermNet, New Zealand Dermatological Society Incorporated	2006				√
	582	The Center for the Protection of Worker's Rights [Home page], The Center for the Protection of Worker's Rights	2006	√	√		
	589	Oregon OSHA [Home page], Oregon OSHA	2006	√			

B.1 = Surveillance Studies Reporting Incidences of Occupational Skin Exposures

B.2 = Loss of Workdays and Impact on Productivity

B.3 = Surveillance Study Protocols/Procedures for Gathering Data

B.4 = Clinical Protocols for Recognition of Skin Exposure Health Effects

Topic 4C. Exposure Characterization

Exposure Characterization, a component of exposure assessment, is the process of describing the conditions of a given occupational environment that may influence exposure. These conditions may include the source of the chemical, the magnitude, frequency, duration, and routes of the exposure to the chemical; the chemical and physical properties of the chemical; and work practices, or how work using the chemical is performed in a given working environment. The resources found in this table review information associated with dermal exposure characterization to chemicals.

Subtopic C.1. Workplace Factors Associated with Harmful Skin Exposures

These resources review information on workplace factors that influence the potential for skin exposure to chemicals in the workplace, including the tasks performed, industrial processes in which workers are engaged, chemicals used or produced, and occupations or job titles of individuals involved in that work.

Subtopic C.2. Description of Factors Influencing Exposure Conditions

These resources provide quantitative descriptions of environmental factors that influence the potential for skin exposure, including exposure duration and frequency; concomitant exposure to chemical mixtures; the concentration of the chemical(s) to which the worker is exposed; the affected skin surface area that is exposed; and factors associated with chemical uptake through the skin.

Subtopic C.3. Checklists/Questionnaires to Quantify Skin Exposure Incidences

These resources contain either questionnaires, checklists or other tools or descriptions of tools that can be used to aid in the collection of quantitative exposure data by professionals, as well as in the reporting and characterization of skin exposures using quantitative data.

Subtopic C.4. Direct Methods to Measure Exposures

These resources review methods that can be used to measure exposure. Exposure can be evaluated by: measuring chemical contamination of the workplace environment surfaces on which skin contact occurs; measuring exposure to the skin by sampling the skin or skin surrogates, such as body suits, patches, tapes strips or visualization techniques and performing biomonitoring.

Subtopic C.5. Exposure Modeling

These resources review exposure characterization methods using modeling based on predictive algorithms developed experimentally or using exposure estimates developed from exposure modeling.

PROFESSIONAL AUDIENCE

Table 4C. Exposure Characterization

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Book/monograph, chapter	485	Surface and dermal monitoring, Ness,S.A.	2000		√	√	√	√
	500	Approaches for Occupational Dermal Exposure Assessment and Management, Fehrenbacher,M.C.; Arnold,Fred ; Marquardt,H.; Evans,P.G.	2003		√		√	√
	501	Development of Occupational Skin Disease, Weber,L.W. ; Pierce,J.T.	2003		√			
	517	Systemic toxicity from percutaneous absorption, Andersen,K.E.	1999	√	√			
	518	Health risk assessment, Paustenbach,D.	1999		√		√	√
	578	Occupational Skin Exposure-Absorption of Chemical Agents and Assessment of Exposures, Harris,R.	2000		√			
	595	Dermal Exposure Modeling, Keil,Charles B.	2000		√			√
Book/monograph, whole	140	Occupational skin disease, Adams,R.M.	1999		√		√	√
	506	Surface and dermal monitoring for toxic exposures, Ness,SA	1994		√	√	√	
	526	Dermatotoxicology, Zhai,H.	2004		√			√
	579	Health Risk Assessment: Dermal and Inhalation Exposure and Absorption of Toxicants (Dermatology), Wang,Rhoda G.M.,Knaak,James B.; Maibach,Howard I.	1993		√			√
	580	Contact & Occupational Dermatology, Marks,James G.; Elsner,P.; Deleo,Vincent A.	2002				√	
Brochure, Pamphlet	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√	√	√	
Data file	605	Syracuse Research Corporation - Business Areas : Environmental Science [Home page], Syracuse Research Corporation	2006		√		√	

- C.1 = Workplace Factors Associated with Harmful Skin Exposures
- C.2 = Description of Factors Influencing Exposure Conditions
- C.3 = Checklists/Questionnaires to Quantify Skin Exposure Incidences
- C.4 = Methods to Measure Exposures
- C.5 = Exposure Modeling

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Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Guideline	474	Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America, Boyce,J.M.	2002					√
	493	SAMPLING FOR SURFACE CONTAMINATION, Occupational Safety and Health Administration (OSHA)	2005				√	
	496	GUIDANCE DOCUMENT FOR THE CONDUCT OF SKIN ABSORPTION STUDIES, Environment Directorate Joint Meeting of the Chemicals Committee and the Working Party on Chemicals	2004		√			
Journal article - primary	72	A real-time in-vivo method for studying the percutaneous absorption of volatile chemicals, Thrall,K.D.	2000		√		√	√
	100	DREAM: A method for semi-quantitative dermal exposure assessment, Van-Wendel-de-Joode,B.	2003					√
	121	Effect of personal hygiene on blood lead levels of workers at a lead processing facility, Askin,D.P.	1997	√			√	
	179	Total body burden arising from a week's repeated dermal exposure to N,N-dimethylformamide., Chang H.; Tsai C.; Lin Y.; Shih T.; Lin W.	2005		√		√	

C.1 = Workplace Factors Associated with Harmful Skin Exposures

C.2 = Description of Factors Influencing Exposure Conditions

C.3 = Checklists/Questionnaires to Quantify Skin Exposure Incidences

C.4 = Methods to Measure Exposures

C.5 = Exposure Modeling

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Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Journal article – primary (continued)	180	Dimethyl sulphate; a hidden problem in occupational medicine., Schettgen T.; Broding HC.; Angerer J.Drexler H.	2004		√		√	
	321	A dermal model for spray painters. Part II: estimating the deposition and uptake of solvents, Semple,S.	2001	√	√			
	322	A dermal model for spray painters. Part I: subjective exposure modeling of spray paint deposition, Brouwer,D.H.	2001	√	√			√
	373	An overview of human exposure modeling activities at the US EPA's National Exposure Research Laboratory, Furtaw,E.J.,Jr.	2001					√
	601	Reliability of a semi-quantitative method for dermal exposure assessment (DREAM), van Wendel de,Joode B.	2005				√	√
Journal article - review, meta-analysis	23	Dermal exposure to chemicals in the workplace: just how important is skin absorption?, Semple,S	2004		√		√	√
	25	Dermal exposure assessment in occupational medicine, Sartorelli,P.	2002		√			
	27	Methods for assessing risks of dermal exposures in the workplace, McDougal,J.N.	2002		√			√
	30	Developing COSHH Essentials: dermal exposure, personal protective equipment and first aid, Garrod,A.N.	2003		√			√
	35	Understanding percutaneous absorption for occupational health and safety, Wester,R.C.	2000		√			√
	36	Dermal exposure assessment in occupational epidemiologic research, Vermeulen,R.	2002		√			√
	39	A toolkit for dermal risk assessment and management: an overview, Oppl,R.	2003					√

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PROFESSIONAL AUDIENCE

Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Journal article - review, meta-analysis (continued)	41	Use of qualitative and quantitative fluorescence techniques to assess dermal exposure, Cherrie,J.W.	2000				√	
	42	Dermal exposure assessment, Schneider,T.	2000				√	√
	43	Proposal for the assessment of quantitative dermal exposure limits in occupational environments: Part 1. Development of a concept to derive a quantitative dermal occupational exposure limit, Bos,P.M.	1998		√			
	44	Skin lesions and environmental exposures. An overview for the occupational health nurse. Agency for Toxic Substances and Disease Registry,	1996				√	
	46	Solvents and the skin, Rowse,D.H.	2004		√			
	48	Occupational contact dermatitis, Lushniak,B.D.	2004	√				
	67	Hand wash and manual skin wipes, Brouwer,D.H.	2000				√	
	71	Dermal absorption of benzene: implications for work practices and regulations, Kalnas,J.	2000		√			√
	73	Percutaneous absorption of organic solvents, Boman,A.	2000		√			√
	74	Textile dye allergic contact dermatitis prevalence, Hatch,K.L.	2000				√	
	94	What can we learn from epidemiological studies on irritant contact dermatitis?, Diepgen,T.L.	1995	√				
	109	Use of patches and whole body sampling for the assessment of dermal exposure, Soutar,A.	2000				√	√
	185	Understanding percutaneous absorption for occupational health and safety. Wester RC.; Maibach HI.	2000		√			√

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Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Journal article - review, meta-analysis (continued)	202	Determinants of dermal exposure relevant for exposure modeling in regulatory risk assessment, Marquart,J.	2003	√	√			√
	218	Temporal, personal and spatial variability in dermal exposure, Kromhout,H.	2001	√	√			√
	220	Assessment of dermal exposure--empirical models and indicative distributions, Phillips,A.M.	2001					√
	227	To what extent are biomonitoring data available in chemical risk assessment?, Brondeau,M.T.	1999		√		√	
	234	Percutaneous penetration studies for risk assessment, Sartorelli,P.	2000		√			
	244	Occupational contact dermatitis II: risk assessment and prognosis, Emmett,E.A.	2003		√		√	
	248	Deriving default dermal exposure values for use in a risk assessment toolkit for small and medium-sized enterprises, Warren,N.	2003					√
	257	Toxic effects of chemical mixtures, Zeliger,H.I.	2003		√			
	282	Occupational issues of irritant contact dermatitis, Chew,A.L.	2003				√	
	283	Occupational contact dermatitis, Antezana,M.	2003				√	
	290	Occupational issues of allergic contact dermatitis, Andersen,K.E.	2003				√	
	297	Occupational contact dermatitis. Recognition and management, Koch,P.	2001		√			
	314	Clues to an accurate diagnosis of contact dermatitis, Rietschel,R.L.	2004				√	
	315	Prediction of irritancy in the human skin irritancy model and occupational setting, Tupker,R.A.	2003		√		√	

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Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Journal article - review, meta-analysis (continued)	320	Suction methods for assessing contamination on surfaces, Byrne,M.A.	2000				√	√
	323	Conceptual model for assessment of dermal exposure, Schneider,T.	1999		√		√	√
	327	In-use testing and interpretation of chemical-resistant glove performance, Boeniger,M.F.	2002				√	√
	347	Modelling skin permeability in risk assessment--the future, Fitzpatrick,D.	2004		√			√
	348	From xenobiotic chemistry and metabolism to better prediction and risk assessment of skin allergy, Smith Pease,C.K.	2003		√			
	349	Factors determining percutaneous metal absorption, Hostynek,J.J.	2003		√			
	350	Quantitative structure-permeability relationships (QSPRs) for percutaneous absorption, Moss,G.P.	2002		√			
	351	Assessing dermal absorption, Poet,T.S.	2000		√			
	354	Improved estimation of dermal pesticide dose to agricultural workers upon reentry, Kissel,J.	2000		√			√
	356	Dermal exposure assessment techniques, Fenske,R.A.	1993		√		√	√
	359	Dermal route in systemic exposure, Benford,D.J.	1999		√		√	√
	362	New approaches for assessment of occupational exposure to metals using on-site measurements, Nygren,O.	2002				√	
	368	Harmonization of future needs for dermal exposure assessment and modeling: a workshop report, Marquart,H.	2001		√		√	√
	376	Conservatism in pesticide exposure assessment, Ross,J.H.	2000		√			

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Table 4C. Exposure Characterization (continued)								
Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Journal article - review, meta-analysis (continued)	400	Quantitating Absorption of Complex Chemical Mixtures, Riviere,J.E.	2004		√			
	468	Concepts of skin protection: considerations for the evaluation and terminology of the performance of skin protective equipment, Brouwer,D.H.	2005		√			√
	469	Dermal Measurement and Wipe Sampling Methods: A Review, McArthur,B	1992				√	
	470	Assessment of dermal absorption and penetration of components of a fuel mixture (JP-8), McDougal,J.N.	2002		√			
	508	Techniques for Estimating the Percutaneous Absorption of Chemicals due to Occupational and Environmental Exposure, Leung H-W ; Paustenbach DJ	1994		√		√	√
	596	A distributed parameter physiologically-based pharmacokinetic model for dermal and inhalation exposure to volatile organic compounds, Roy,A.	1996		√			√
	597	Assessment of dermal exposure to chemicals, van Hemmen,J.J.	1995		√		√	
	598	Factors affecting soil adherence to skin in hand-press trials, Kissel,J.C.	1996		√			
	603	Percutaneous absorption of arsenic from environmental media, Lowney,Y.W.	2005		√			
Other - Commentary	456	Exposure and absorption of hazardous materials through the skin, Boeniger,M.F.	2000		√			
Technical publication/report	98	Dermal absorption of cutting fluid mixtures, Baynes,R.E.	2003		√			
	102	Epidemiology of skin and respiratory diseases among hairdressers, Leino,T.	2001	√			√	

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Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Technical publication/report (continued)	136	Occupational dermal exposure assessment : a review of methodologies and field data : final report, Chen,C.K.	1996				√	√
	149	Skin and respiratory sensitizers: reference chemicals data bank, European Centre for Ecotoxicology and Toxicology of Chemicals.	1999					√
	154	Summary report for the workshop on issues associated with dermal exposure and uptake U.S. Environmental Protection Agency, Bethesda, MD, December 10-11, 1998, United States.	2000		√		√	√
	156	Dermal and non-dietary ingestion exposure workshop : NERL Human Exposure Research Program, Hubal,E.C.	1998		√		√	√
	158	Prediction & Assessment of Dermal Exposure, Guy,R.	1998		√			√
	384	Percutaneous Absorption of Chemical Mixtures Relevant to the Gulf War Final rept. 1 Feb 1999-31 Jan 2002, Riviere,J.E.	2002		√			
	386	Quantitating the Percutaneous Absorption of Mechanistically Defined Chemical Mixtures Final rept. 15 Nov 1997-14 Nov 2000, Riviere,J.E.; Baynes,R.E.;Smith,C.	2001		√			
	398	Quantitating the Percutaneous Absorption of Mechanistically-Defined Chemical Mixtures Final rept. 15 Dec 2000-14 Dec 2003, Riviere,J.E.; Monteiro-Riviere,N.A.; Baynes,R.E.; Xia,X.; Smith,C.	2004	√	√			
	486	CEFIC Workshop on methods to determine dermal permeation for human risk assessment, Jones,AD,et al	2004		√			√

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Table 4C. Exposure Characterization (continued)								
Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Technical publication/report (continued)	511	Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment),	2001		√			√
	561	Environmental Health Criteria Document on Dermal Absorption [Draft], World Health Organization International Programme on Chemical Safety	2005		√			
Web Page	542	HSDB - Hazardous Substances Data Bank, National Library of Medicine	2005	√				
	544	Toxicological Profile Information Sheet, Agency for Toxic Substances and Disease Registry (ATSDR)	2005				√	
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√				
	569	US Environmental Protection Agency - Office of Pollution Prevention and Toxics (OPPT) : Exposure Assessment Tools and Models, US Environmental Protection Agency - Office of Pollution Prevention and Toxics (OPPT)	2005					√
	584	Harmonized Test Guidelines [OPPTS], U.S. Environmental Protection Agency (EPA)	1998				√	
	592	OECD's Database on Chemical Risk Assessment Models, Organization for Economic Co-operation and Development (OECD)	2006					√

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Table 4C. Exposure Characterization (continued)

Resource Type	ID	Title/Author	Yr	Subtopics				
				C1	C2	C3	C4	C5
Website	24	National Institute for Occupational Safety and Health (NIOSH) [Home page], National Institute for Occupational Safety and Health (NIOSH)	2005	√	√		√	
	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	√		√	
	539	Environmental Protection Agency (EPA) [Home page], Environmental Protection Agency	2005		√		√	√
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√				
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√			
	546	Dermatological Engineering, Enviroderm Services	2005	√	√		√	
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√		√	
	575	Alliance for the Polyurethanes industry,	2006	√				
	588	ASTM International [Home page], ASTM International	2006	√			√	
	606	Home page of Wil ten Berge [Wil ten Berge model for dermal absorption], ten Berge, W.	2004					√
	607	The pioneer in the reduction of dermal exposure [Colormetric Laboratories, Inc. Home page], Colormetric Laboratories, Inc.	2005				√	

C.1 = Workplace Factors Associated with Harmful Skin Exposures

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Topic 4D. Hazard Identification from Toxicological Studies or Modeling

Hazard identification, another component of exposure risk assessment, is the process of determining or establishing the existence of a hazard through field observations and/or laboratory analysis of the exposures and/or adverse health effects. As part of this process, the nature of the hazard is determined, such as whether the chemicals causes skin irritation, skin corrosion, sensitization or some systemic toxic effect, and the dose-response relationship under the conditions of exposure is determined. Resources found in the following two tables review information associated with hazard identification based on toxicological studies or modeling efforts.

Subtopic D.1. Potential Health Effects Resulting from Specific Chemicals

These resources review or summarize information on potential health effects resulting from skin exposure to chemicals. Health effects can include localized skin irritation and corrosion, including irritant contact dermatitis; sensitization of the skin, including allergic contact dermatitis/sensitization, and/or the respiratory tract as a result of skin exposure; the potential contribution of skin exposure and resulting dermal absorption to systemic toxicity; or the contribution of skin exposure to overall or total exposure to a chemical(s).

Subtopic D.1.a. Irritant Contact Dermatitis

These resources address chemically induced irritant contact dermatitis. This form of dermatitis is caused by direct exposure of the skin to a chemical or other irritating substance. Irritation in the form of inflammation usually occurs either immediately or within a short period of time.

Subtopic D.1.b. Allergic Contact Dermatitis/Sensitization

Resources found here include information on allergic contact dermatitis, which is an immunologically mediated reaction of the skin caused by direct contact of the skin of a sensitized individual to a chemical that is an allergen. Inflammation also occurs, but only in sensitized individuals.

Subtopic D.1.c. Systemic Toxicity

Resources listed under this subtopic include information on dermal exposures that can cause systemic toxicity. Unlike irritant and allergic contact dermatitis, which cause localized toxic effects, systemic toxicity refers to chemicals that when absorbed through the skin are transported to other sites in the body where their toxic effects occur. It is possible for a chemical to produce both a local and systemic adverse health effect.

Subtopic D.1.d. Other Health Effects

These resources contain information on other health effects that can be caused by dermal exposure and include conditions such as: urticaria, which is immediate hypersensitivity, foreign body dermatitis, caused by foreign compounds such as fiber glass, silica, and asbestos penetrating the skin; pigmentation changes of the skin; cancer, and other health effects.

Subtopic D.2. Summaries of Health Effects, Dose-Response Relationships

These resources contain sources of data or actual databases that provide summaries for the health effects and the significance of those health effects that result from skin exposures to chemicals in the workplace.

Subtopic D.3. Characterization Protocols

These resources contain protocols or guidelines for use in chemical hazard

characterizations. Protocols and guidelines cited include those for various kinds of toxicological studies. The responses being characterized in these protocols and guidelines include corrosivity, irritation potential, sensitization potential, and potential to cause systemic effects. Also included below are resources that provide protocols and guidelines for measuring skin permeation rates and reservoir effects, as well as protocols for developing and validating qualitative and quantitative structure activity relationships ([Q]SARs), for application in hazard identification and for use in validating [Q]SARs as a screening tool to identify skin hazards in high priority chemicals.

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Table 4D(I). Hazard Identification from Toxicological Studies or Modeling

Resource Type	ID	Title/Author	Yr	D1 Subtopics			
				D1a	D1b	D1c	D1d
Book/monograph, chapter	423	Chemical Protective Clothing and the Skin: Practical Considerations, Boeniger,M.	2002	√			
	501	Development of Occupational Skin Disease, Weber,L.W ; Pierce,J.T.	2003	√	√		
	517	Systemic toxicity from percutaneous absorption, Andersen,K.E.	1999		√	√	
	578	Occupational Skin Exposure-Absorption of Chemical Agents and Assessment of Exposures, Harris,R.	2000	√	√		
Book/monograph, whole	140	Occupational skin disease, Adams,R.M.	1999	√	√	√	√
	141	Handbook of occupational dermatology, Kanerva,L.	2000	√	√	√	
	526	Dermatotoxicology, Zhai,H.	2004	√	√	√	√
	579	Health Risk Assessment: Dermal and Inhalation Exposure and Absorption of Toxicants (Dermatology), Wang,R.G.M.,Knaak,J.B.; Maibach,H.I.	1993				√
	580	Contact & Occupational Dermatology, Marks,J.G.; Elsner,P.; Deleo,V.A.	2002	√	√		
Brochure, Pamphlet	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√		√
Data file	605	Syracuse Research Corporation - Business Areas : Environmental Science [home page], Syracuse Research Corporation	2006	√	√		
Guideline	583	Documentation of the Threshold Limit Values for Chemical Substances, American Conference of Governmental Industrial Hygienists (ACGIH)	2001	√	√	√	√

D1 = Potential Health Effects Resulting from Specific Chemicals

D1a = Irritant Contact Dermatitis

D1b = Allergic Contact Dermatitis/Sensitization

D1c = Systemic Toxicity

D1d = Other Health Effects

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Table 4D(I). Hazard Identification from Toxicological Studies or Modeling (continued)

Resource Type	ID	Title/Author	Yr	D1 Subtopics			
				D1a	D1b	D1c	D1d
Journal article - review, meta-analysis	37	Dermal toxicity due to industrial chemicals, Mathur,A.K.	2002	√	√	√	√
	43	Proposal for the assessment of quantitative dermal exposure limits in occupational environments: Part 1. Development of a concept to derive a quantitative dermal occupational exposure limit, Bos,P.M.	1998	√	√		
	44	Skin lesions and environmental exposures. An overview for the occupational health nurse. Agency for Toxic Substances and Disease Registry, [No author]	1996	√	√	√	√
	45	Occupation-related allergies in dentistry, Hamann,C.P.	2005	√	√		
	46	Solvents and the skin, Rowse,D.H.	2004	√	√	√	√
	48	Occupational contact dermatitis, Lushniak,B.D.	2004	√	√		√
	50	The dermal toxicity of cement, Winder,C.	2002	√	√		√
	52	Toxicity of methyl methacrylate in dentistry, Leggat,P.A.	2003			√	
	53	Occupational skin-protection products--a review, Kresken,J.	2003	√	√		
	61	Alternative approaches to the identification and characterization of chemical allergens, Kimber,I.	2001		√		
	68	Carbonless copy paper and workplace safety: a review, Graves,C.G.	2000	√			
	70	Differences between the sexes with regard to work-related skin disease, Meding,B.	2000	√	√		
	244	Occupational contact dermatitis II: risk assessment and prognosis, Emmett,E.A.	2003	√	√		

D1 = Potential Health Effects Resulting from Specific Chemicals

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Table 4D(I). Hazard Identification from Toxicological Studies or Modeling (continued)

Resource Type	ID	Title/Author	Yr	D1 Subtopics			
				D1a	D1b	D1c	D1d
Journal article - review, meta-analysis (continued)	245	Cleansing without compromise: the impact of cleansers on the skin barrier and the technology of mild cleansing, Ananthapadmanabhan,K.P.	2004	√			
	250	Dermatological aspects of a successful introduction and continuation of alcohol-based hand rubs for hygienic hand disinfection, Kampf,G.	2003	√			
	255	Skin-conditioning products in occupational dermatology, Elsner,P.	2003	√			
	258	Effectiveness of skin protection creams as a preventive measure in occupational dermatitis: a critical update according to criteria of evidence-based medicine, Kutting,B.	2003	√			
	267	A critique of assumptions about selecting chemical-resistant gloves: a case for workplace evaluation of glove efficacy, Klingner,T.D.	2002	√	√	√	
	270	Occupational contact dermatitis in the textile industry, Wigger-Alberti,W.	2003	√	√		
	282	Occupational issues of irritant contact dermatitis, Chew,A.L.	2003	√			
	283	Occupational contact dermatitis, Antezana,M.	2003	√	√		
	297	Occupational contact dermatitis. Recognition and management, Koch,P.	2001	√			
	299	The epidemiology of occupational contact dermatitis, Diepgen,T.L.	1999	√	√		
	306	Epidemiological studies on the prevention of occupational contact dermatitis, Diepgen,T.L.	1996		√		
	307	The epidemiology of occupational contact dermatitis, Lushniak,B.D.	1995	√			
	314	Clues to an accurate diagnosis of contact dermatitis, Rietschel,R.L.	2004	√	√		

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Table 4D(I). Hazard Identification from Toxicological Studies or Modeling (continued)

Resource Type	ID	Title/Author	Yr	D1 Subtopics			
				D1a	D1b	D1c	D1d
Journal article - review, meta-analysis (continued)	335	Chemical substances and contact allergy--244 substances ranked according to allergenic potency, Schlede,E.	2003		√		
	338	A chemical dataset for evaluation of alternative approaches to skin-sensitization testing, Gerberick,G.F.	2004		√		
	340	Classification criteria for skin-sensitizing chemicals: a commentary, Basketter,D.A.	1999	√	√	√	
	348	From xenobiotic chemistry and metabolism to better prediction and risk assessment of skin allergy, Smith Pease,C.K.	2003		√		
	471	When should a substance be designated as sensitizing for the skin ('Sh') or for the airways ('Sa')?, Schnuch,A.	2002		√		
	523	Quantitative structure-activity relationships for predicting skin and respiratory sensitization, Rodford,R.	2003		√		
	602	The role of the skin in the development of chemical respiratory hypersensitivity, Kimber,I.	1996		√	√	√
	604	Beryllium exposure: dermal and immunological considerations, Day,G.A.	2006		√	√	
Technical publication/report	98	Dermal absorption of cutting fluid mixtures, Baynes,R.E.	2003	√			
	102	Epidemiology of skin and respiratory diseases among hairdressers, Leino,T.	2001	√	√		√
	149	Skin and respiratory sensitizers : reference chemicals data bank, European Centre for Ecotoxicology and Toxicology of Chemicals.	1999	√	√		

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PROFESSIONAL AUDIENCE							
Table 4D(I). Hazard Identification from Toxicological Studies or Modeling (continued)							
Resource Type	ID	Title/Author	Yr	D1 Subtopics			
				D1a	D1b	D1c	D1d
Technical publication/report (continued)	398	Quantitating the Percutaneous Absorption of Mechanistically-Defined Chemical Mixtures Final rept. 15 Dec 2000-14 Dec 2003, Riviere,J.E.; Monteiro-Riviere,N.A.; Baynes,R.E.; Xia,X.; Smith,C.	2004			√	
Web Page	542	HSDB - Hazardous Substances Data Bank, National Library of Medicine	2005	√	√	√	√
	544	Toxicological Profile Information Sheet, Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√	√	√	√
Website	24	National Institute for Occupational Safety and Health (NIOSH) [Home page], National Institute for Occupational Safety and Health (NIOSH)	2005	√	√	√	
	535	Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM) [Home page], The Interagency Coordinating Committee on the Validation of Alternative Methods	2005		√		
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√	√	√	√
	543	Agency for Toxic Substances and Disease Registry (ATSDR) [Home page], Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√	√	√	√
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	√	√	
	546	Dermatological Engineering, Enviroderm Services	2005	√	√	√	

D1 = Potential Health Effects Resulting from Specific Chemicals
D1a = Irritant Contact Dermatitis
D1b = Allergic Contact Dermatitis/Sensitization
D1c = Systemic Toxicity
D1d = Other Health Effects

PROFESSIONAL AUDIENCE**Table 4D(I). Hazard Identification from Toxicological Studies or Modeling (continued)**

Resource Type	ID	Title/Author	Yr	D1 Subtopics			
				D1a	D1b	D1c	D1d
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√		
	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005	√	√		
	560	International Programme on Chemical Safety [Home page], World Health Organization	2005	√	√	√	√
	575	Alliance for the Polyurethanes industry, [No author]	2006		√		
	586	EXTOXNET - The EXTension TOXicology NETwork, University of California-Davis; Oregon State University; Michigan State University; Cornell University; University of Idaho.	2006	√	√	√	
	588	ASTM International [Home page], ASTM International	2006		√		

D1 = Potential Health Effects Resulting from Specific Chemicals

D1a = Irritant Contact Dermatitis

D1b = Allergic Contact Dermatitis/Sensitization

D1c = Systemic Toxicity

D1d = Other Health Effects

PROFESSIONAL AUDIENCE					
Table 4D(II). Hazard Identification from Toxicological Studies or Modeling					
Resource Type	ID	Title/Author	Yr	Subtopics	
				D2	D3
Book/monograph, chapter	518	Health risk assessment, Paustenbach,D.	1999	√	√
Book/monograph, whole	140	Occupational skin disease, Adams,R.M.	1999		√
	579	Health Risk Assessment: Dermal and Inhalation Exposure and Absorption of Toxicants (Dermatology), Wang,R.G.M.,Knaak,J.B.; Maibach,H.I.	1993	√	
	580	Contact & Occupational Dermatology, Marks,J.G.; Elsner,P. ; Deleo,V.A.	2002		√
Data file	605	Syracuse Research Corporation - Business Areas : Environmental Science [Home page], Syracuse Research Corporation	2006		√
Guideline	379	Health Effects Test Guidelines: OPPTS 870.2500, Acute Dermal Irritation, [No author]	1998		√
	496	GUIDANCE DOCUMENT FOR THE CONDUCT OF SKIN ABSORPTION STUDIES, Environment Directorate Joint Meeting of the Chemicals Committee and the Working Party on Chemicals	2004		√
	583	Documentation of the Threshold Limit Values for Chemical Substances, American Conference of Governmental Industrial Hygienists (ACGIH)	2001	√	
Journal article - primary	72	A real-time in-vivo method for studying the percutaneous absorption of volatile chemicals, Thrall,K.D.	2000	√	√
	179	Total body burden arising from a week's repeated dermal exposure to N,N-dimethylformamide., Chang H.; Tsai C.; Lin Y.; Shih T.; Lin W.	2005	√	
Journal article - review, meta-analysis	43	Proposal for the assessment of quantitative dermal exposure limits in occupational environments: Part 1. Development of a concept to derive a quantitative dermal occupational exposure limit, Bos,P.M.	1998		√
	46	Solvents and the skin, Rowse,D.H.	2004	√	√
	61	Alternative approaches to the identification and characterization of chemical allergens, Kimber,I.	2001		√

D2 = Summaries of Health Effects, Dose-Response Relationships

D3 = Characterization Protocols

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Table 4D(II). Hazard Identification from Toxicological Studies or Modeling (continued)

Resource Type	ID	Title/Author	Yr	Subtopics	
				D2	D3
Journal article - review, meta-analysis (continued)	68	Carbonless copy paper and workplace safety: a review, Graves,C.G.	2000		√
	73	Percutaneous absorption of organic solvents, Boman,A.	2000	√	
	234	Percutaneous penetration studies for risk assessment, Sartorelli,P.	2000		√
	244	Occupational contact dermatitis II: risk assessment and prognosis, Emmett,E.A.	2003	√	
	257	Toxic effects of chemical mixtures, Zeliger,H.I.	2003		√
	290	Occupational issues of allergic contact dermatitis, Andersen,K.E.	2003	√	
	299	The epidemiology of occupational contact dermatitis, Diepgen,T.L.	1999		√
	306	Epidemiological studies on the prevention of occupational contact dermatitis, Diepgen,T.L.	1996	√	
	314	Clues to an accurate diagnosis of contact dermatitis, Rietschel,R.L.	2004	√	
	331	Factors affecting thresholds in allergic contact dermatitis: safety and regulatory considerations, Basketter,D.A.	2002	√	
	335	Chemical substances and contact allergy--244 substances ranked according to allergenic potency, Schlede,E.	2003		√
	338	A chemical dataset for evaluation of alternative approaches to skin-sensitization testing, Gerberick,G.F.	2004		√
	347	Modeling skin permeability in risk assessment--the future, Fitzpatrick,D.	2004		√
	348	From xenobiotic chemistry and metabolism to better prediction and risk assessment of skin allergy, Smith Pease,C.K.	2003	√	√
	350	Quantitative structure-permeability relationships (QSPRs) for percutaneous absorption, Moss,G.P.	2002		√
	359	Dermal route in systemic exposure, Benford,D.J.	1999		√
400	Quantitating Absorption of Complex Chemical Mixtures, Riviere,J.E.	2004		√	

D2 = Summaries of Health Effects, Dose-Response Relationships

D3 = Characterization Protocols

PROFESSIONAL AUDIENCE

Table 4D(II). Hazard Identification from Toxicological Studies or Modeling (continued)

Resource Type	ID	Title/Author	Yr	Subtopics	
				D2	D3
Journal article - review, meta-analysis (continued)	508	Techniques for Estimating the Percutaneous Absorption of Chemicals due to Occupational and Environmental Exposure, Leung H-W ; Paustenbach DJ	1994		√
	521	Quantitative structure-activity relationships for predicting percutaneous absorption rates, Walker,J.D.	2003		√
	522	Quantitative structure-activity relationships for predicting skin and eye irritation, Patlewicz,G.	2003		√
	523	Quantitative structure-activity relationships for predicting skin and respiratory sensitization, Rodford,R.	2003		√
Technical publication/report	98	Dermal absorption of cutting fluid mixtures, Baynes,R.E.	2003		√
	136	Occupational dermal exposure assessment : a review of methodologies and field data : final report, Chen,Ching K.	1996	√	
	384	Percutaneous Absorption of Chemical Mixtures Relevant to the Gulf War Final rept. 1 Feb 1999-31 Jan 2002, Riviere,J.E.	2002		√
	386	Quantitating the Percutaneous Absorption of Mechanistically Defined Chemical Mixtures Final rept. 15 Nov 1997-14 Nov 2000, Riviere,J.E.; Baynes,R.E.;Smith,C.	2001		√
	398	Quantitating the Percutaneous Absorption of Mechanistically-Defined Chemical Mixtures Final rept. 15 Dec 2000-14 Dec 2003, Riviere,J.E.; Monteiro-Riviere,N.A.; Baynes,R.E.; Xia,X.; Smith,C.	2004	√	
	486	CEFIC Workshop on methods to determine dermal permeation for human risk assessment, Jones,AD,et al	2004		√
	561	Environmental Health Criteria Document on Dermal Absorption [Draft], World Health Organization International Programme on Chemical Safety	2005		√

D2 = Summaries of Health Effects, Dose-Response Relationships

D3 = Characterization Protocols

PROFESSIONAL AUDIENCE					
Table 4D(II). Hazard Identification from Toxicological Studies or Modeling (continued)					
Resource Type	ID	Title/Author	Yr	Subtopics	
				D2	D3
Web Page	544	Toxicological Profile Information Sheet, Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√	
	571	Chemicals Testing - Guidelines, Organization for Economic Co-operation and Development (OECD)	2005		√
	584	Harmonized Test Guidelines [OPPTS], U.S. Environmental Protection Agency (EPA)	1998		√
	592	OECD's Database on Chemical Risk Assessment Models, Organization for Economic Co-operation and Development (OECD)	2006		√
Website	535	Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM) [Home page], The Interagency Coordinating Committee on the Validation of Alternative Methods	2005		√
	539	Environmental Protection Agency (EPA) [Home page], Environmental Protection Agency	2005		√
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√	
	543	Agency for Toxic Substances and Disease Registry (ATSDR) [Home page], Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√	
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√
	560	International Programme on Chemical Safety [Home page], World Health Organization	2005	√	√
	586	EXTOXNET - The EXTension TOXicology NETwork, University of California-Davis; Oregon State University; Michigan State University; Cornell University; University of Idaho.	2006	√	
	606	Home page of Wil ten Berge [Wil ten Berge model for dermal absorption], ten Berge, W.	2004		√

D2 = Summaries of Health Effects, Dose-Response Relationships

D3 = Characterization Protocols

Topic 4E. Risk Assessment

Risk assessment is the measurement or estimate of the chances of a given level of exposure to a chemical to cause harm. With respect to skin exposures, risk assessments are performed by workplace health and safety professionals to provide the employer with an estimate of the likelihood of an illness or injury resulting from skin exposure to a chemical hazard. Risk assessment is essential for setting occupational safety and health priorities and for demonstrating health impairment when promulgating occupational standards. These resources contain information associated with skin exposure risk assessments.

Subtopic E.1. Guidelines for Risk Assessment or Analysis

The resources indicated in this column provide guidelines for or descriptions of risk assessments or analyses to determine if skin exposure to a chemical or chemicals is likely to cause a given effect, both localized health effects and systemic health effects.

Subtopic E.2. Example Risk Assessments

The resources identified in this column provide examples of risk assessments that have been conducted.

PROFESSIONAL AUDIENCE

Table 4E. Risk Assessment

Resource Type	ID	Title/Author	Yr	Subtopics	
				E1	E2
Book/monograph, chapter	500	Approaches for Occupational Dermal Exposure Assessment and Management, Fehrenbacher, M.C.; Arnold, F.; Marquardt, H.; Evans, P.G.	2003	√	
	518	Health risk assessment, Paustenbach, D.	1999	√	√
Book/monograph, whole	526	Dermatotoxicology, Zhai, H.	2004	√	
Brochure, Pamphlet	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	
Journal article - primary	249	A structured strategy for assessing chemical risks, suitable for small and medium-sized enterprises, Balsat, A.	2003	√	√
	304	Risk assessment and exposure control in an occupational setting, Packham, C.L.	1996	√	√
	373	An overview of human exposure modeling activities at the US EPA's National Exposure Research Laboratory, Furtaw, E.J., Jr.	2001		√
Journal article - review, meta-analysis	39	A toolkit for dermal risk assessment and management: an overview, Oppl, R.	2003	√	
	40	RISKOFDERM: risk assessment of occupational dermal exposure to chemicals. An introduction to a series of papers on the development of a toolkit, van Hemmen, J.J.	2003	√	
	71	Dermal absorption of benzene: implications for work practices and regulations, Kalnas, J.	2000	√	√
	200	A toolkit for dermal risk assessment: toxicological approach for hazard characterization, Schuhmacher-Wolz, U.	2003	√	
	201	Classification of dermal exposure modifiers and assignment of values for a risk assessment toolkit, Goede, H.A.	2003	√	
	202	Determinants of dermal exposure relevant for exposure modelling in regulatory risk assessment, Marquart, J.	2003	√	
	218	Temporal, personal and spatial variability in dermal exposure, Kromhout, H.	2001		√
	220	Assessment of dermal exposure--empirical models and indicative distributions, Phillips, A.M.	2001		√
	234	Percutaneous penetration studies for risk assessment, Sartorelli, P.	2000	√	
	244	Occupational contact dermatitis II: risk assessment and prognosis, Emmett, E.A.	2003	√	

E.1 = Guidelines for Risk Assessment or Analysis

E.2 = Example Risk Assessments

PROFESSIONAL AUDIENCE

Table 4E. Risk Assessment (continued)

Resource Type	ID	Title/Author	Yr	Subtopics	
				E1	E2
Journal article - review, meta-analysis (continued)	248	Deriving default dermal exposure values for use in a risk assessment toolkit for small and medium-sized enterprises, Warren,N.	2003	√	
	367	Misinterpretation and misuse of exposure limits, Hewett,P.	2001	√	
	376	Conservatism in pesticide exposure assessment, Ross,J.H.	2000	√	
	400	Quantitating Absorption of Complex Chemical Mixtures, Riviere,J.E.	2004		√
	470	Assessment of dermal absorption and penetration of components of a fuel mixture (JP-8), McDougal,J.N.	2002		√
Technical publication/report	486	CEFIC Workshop on methods to determine dermal permeation for human risk assessment, Jones,AD,et al	2004		√
Web Page	569	US Environmental Protection Agency - Office of Pollution Prevention and Toxics (OPPT) : Exposure Assessment Tools and Models, US Environmental Protection Agency - Office of Pollution Prevention and Toxics (OPPT)	2005	√	√
Website	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	
	539	Environmental Protection Agency (EPA) [Home page], Environmental Protection Agency	2005	√	√
	546	Dermatological Engineering, Enviroderm Services	2005	√	√
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	√
	570	HEROX - Human Exposure Research Organizations Exchange [Home page], Human Exposure Research Organizations Exchange	2005	√	
	607	The pioneer in the reduction of dermal exposure [Colormetric Laboratories, Inc. Home page], Colormetric Laboratories,Inc.	2005	√	

E.1 = Guidelines for Risk Assessment or Analysis

E.2 = Example Risk Assessments

Topic 4F. Risk Management

Risk management completes the process of identifying potential hazards in the workplace, assessing the risks associated with those hazards, and then controlling these hazards by either eliminating the hazard or controlling the hazard by various techniques. Control techniques can include changes in the process to reduce or eliminate the hazard, substituting a less harmful chemical for a more harmful one, isolating a process to minimize worker contact with the hazards, modifying the source to achieve less hazardous conditions/exposures, changing work practices to make the task less hazardous, putting in place administrative controls such as worker rotation, training and monitoring to lower each worker's exposure to the hazards; or using personal protective equipment to lower the exposure to the hazard. Risk management also involves evaluating whether controls taken are effective. The resources contain information associated with risk management.

Subtopic F. 1. Strategies for Exposure Control

These resources review strategies that can be used to control skin exposures to chemicals. The following categories of control strategies are discussed: substitution, engineering controls, work practices and administrative controls, personal protective equipment and the effectiveness of skin management programs using barrier creams, moisturizers, cleansers, and rubs.

Subtopic F.2. Protocols for Risk Management

These resources contain protocols for risk management programs. They may include protocols for the development of exposure reduction goals, protocols for the development of approaches to achieve exposure reduction goals, and evaluation tools to demonstrate program or intervention effectiveness.

PROFESSIONAL AUDIENCE					
Table 4F. Risk Management					
Resource Type	ID	Title/Author	Yr	Subtopics	
				F1	F2
Book/monograph, chapter	423	Chemical Protective Clothing and the Skin: Practical Considerations, Boeniger,M.	2002	√	
	500	Approaches for Occupational Dermal Exposure Assessment and Management, Fehrenbacher,M.C. ; Arnold,F.; Marquardt,H.; Evans,P.G.	2003	√	
	502	Personal Protective Clothing, Mansdorf,S.Z. ; Henry III,N.W.	2003	√	
	578	Occupational Skin Exposure-Absorption of Chemical Agents and Assessment of Exposures, Harris,R.	2000	√	
Book/monograph, whole	140	Occupational skin disease, Adams,R.M.	1999	√	
	141	Handbook of occupational dermatology, Kanerva,L.	2000	√	
	142	Protective gloves for occupational use, Boman,A.	2005	√	
	506	Surface and dermal monitoring for toxic exposures, Ness,S.A.	1994	√	
	526	Dermatotoxicology, Zhai,H.	2004	√	
Brochure, Pamphlet	520	Physician's Alert for Occupational Contact Dermatitis Among Construction Workers., Center to Protect Workers' Rights	2001	√	
	585	A Safety & Health Practitioner's Guide to Skin Protection, The Center to Protect Workers' Rights	2000	√	√
Guideline	474	Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America, Boyce,J.M.	2002	√	
	587	American National Standard for Hand Protection Selection Criteria, International Safety Equipment Association	2005	√	
Journal article - primary	121	Effect of personal hygiene on blood lead levels of workers at a lead processing facility, Askin,D.P.	1997	√	
	256	Skin cleansers for occupational use: testing the skin compatibility of different formulations, Klotz,A.	2003	√	
	304	Risk assessment and exposure control in an occupational setting, Packham,C.L.	1996	√	√

F.1 = Strategies for Exposure Control

F.2 = Protocols for Risk Assessment

PROFESSIONAL AUDIENCE

Table 4F. Risk Management (continued)

Resource Type	ID	Title/Author	Yr	Subtopics	
				F1	F2
Journal article - review, meta-analysis	37	Dermal toxicity due to industrial chemicals, Mathur,A.K.	2002	√	
	39	A toolkit for dermal risk assessment and management: an overview, Oppl,R.	2003		√
	45	Occupation-related allergies in dentistry, Hamann,C.P.	2005	√	
	48	Occupational contact dermatitis, Lushniak,B.D.	2004	√	
	50	The dermal toxicity of cement, Winder,C.	2002	√	
	52	Toxicity of methyl methacrylate in dentistry, Leggat,P.A.	2003	√	
	53	Occupational skin-protection products--a review, Kresken,J.	2003	√	
	70	Differences between the sexes with regard to work-related skin disease, Meding,B.	2000	√	
	103	Pesticide-related illness among migrant farm workers in the United States, Das,R.	2001	√	
	245	Cleansing without compromise: the impact of cleansers on the skin barrier and the technology of mild cleansing, Ananthapadmanabhan,K.P.	2004	√	
	250	Dermatological aspects of a successful introduction and continuation of alcohol-based hand rubs for hygienic hand disinfection, Kampf,G.	2003	√	
	255	Skin-conditioning products in occupational dermatology, Elsner,P.	2003	√	
	258	Effectiveness of skin protection creams as a preventive measure in occupational dermatitis: a critical update according to criteria of evidence-based medicine, Kutting,B.	2003	√	
	264	Skin protection programmes, Agner,T.	2002	√	√
	267	A critique of assumptions about selecting chemical-resistant gloves: a case for workplace evaluation of glove efficacy, Klingner,T.D.	2002	√	
	282	Occupational issues of irritant contact dermatitis, Chew,A.L.	2003	√	
	283	Occupational contact dermatitis, Antezana,M.	2003	√	
	286	Strategies for prevention: occupational contact dermatitis, Brown,T.	2004	√	√
299	The epidemiology of occupational contact dermatitis, Diepgen,T.L.	1999	√		
327	In-use testing and interpretation of chemical-resistant glove performance, Boeniger,M.F.	2002	√		

F.1 = Strategies for Exposure Control

F.2 = Protocols for Risk Assessment

PROFESSIONAL AUDIENCE

Table 4F. Risk Management (continued)

Resource Type	ID	Title/Author	Yr	Subtopics	
				F1	F2
Journal article - review, meta-analysis (continued)	367	Misinterpretation and misuse of exposure limits, Hewett,P.	2001		√
	468	Concepts of skin protection: considerations for the evaluation and terminology of the performance of skin protective equipment, Brouwer,D.H.	2005	√	
	475	Management of dermatitis in the rubber manufacturing industry, Toeppen-Sprigg,B.	1999	√	√
Other - Guideline from private lab	491	A Guide to Dermal Exposure Reduction, Colormetric Laboratories Inc.	1999	√	√
Technical publication/report	102	Epidemiology of skin and respiratory diseases among hairdressers, Leino,T.	2001	√	
	527	NIOSH Pocket Guide to Chemical Hazards (NPG) February 2004, National Institute for Occupational Safety and Health (NIOSH)	2004	√	
Web Page	542	HSDB - Hazardous Substances Data Bank, National Library of Medicine	2005	√	
	563	Emergency Response Guidebook, US Department of Transportation	2004	√	
	565	Skin disorders (Dermatitis) ; Safety & Health Assessment & Research for Prevention (SHARP), Washington State Department of Labor and Industries	2005	√	
Website	24	National Institute for Occupational Safety and Health (NIOSH) [Home page], National Institute for Occupational Safety and Health (NIOSH)	2005	√	
	528	Occupational Safety and Health Administration (OSHA) [Home page], Occupational Safety & Health Administration	2005	√	
	539	Environmental Protection Agency (EPA) [Home page], Environmental Protection Agency	2005	√	
	540	TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page], National Library of Medicine	2005	√	
	543	Agency for Toxic Substances and Disease Registry (ATSDR) [Home page], Agency for Toxic Substances and Disease Registry (ATSDR)	2005	√	
	545	International Labor Organization (ILO) [Home page], International Labor Organization (ILO)	2005	√	
	546	Dermatological Engineering, Enviroderm Services	2005	√	√
	551	Health and Safety Executive (HSE) [Home page], Health and Safety Executive (HSE)	2005	√	

F.1 = Strategies for Exposure Control

F.2 = Protocols for Risk Assessment

PROFESSIONAL AUDIENCE**Table 4F. Risk Management (continued)**

Resource Type	ID	Title/Author	Yr	Subtopics	
				F1	F2
Website (continued)	554	American Academy of Family Physicians [Home page], American Academy of Family Physicians	2005	√	
	558	Canadian Centre for Occupational Health and Safety [Home page], Canadian Centre for Occupational Health and Safety	2005	√	
	566	Oregon Worker Illness and Injury Prevention Program (OWIIPP), Oregon Department of Human Services	2005	√	
	575	Alliance for the Polyurethanes industry,	2006	√	
	588	ASTM International [Home page], ASTM International	2006	√	
	607	The pioneer in the reduction of dermal exposure [Colormetric Laboratories, Inc. Home page], Colormetric Laboratories, Inc.	2005	√	

F.1 = Strategies for Exposure Control

F.2 = Protocols for Risk Assessment

CHAPTER 5: OVERALL INFORMATION AVAILABILITY

5.1 Evaluation of Information Gaps

This guide of information resources for the anticipation, recognition, evaluation, and control of occupational skin exposures to chemicals is not intended to provide an exhaustive list of all publications. Rather, it includes books, review papers, regulations, and databases available to the public and credible information available on the internet. The search was limited to resources produced from 1995 on and to those dealing specifically with occupational exposures to chemicals. None of the information sources was evaluated for the accuracy of the information presented.

Within the limits of this effort, some trends were seen in the availability of resources for each topic and sub-topic. Additional primary research articles produced in 1995 or later and review articles or resources produced before 1995 may be available that were not considered in this evaluation.

Overall, several topic areas appeared to have limited information. These include:

- Information on conducting risk assessments for dermal exposure as compared to hazard identification.
- Guidance on the interpretation of quantitative exposure assessments and on dermal occupational exposure limits.
- Useable information on the effectiveness of dermal exposure control measures.
- Performing biological monitoring to assess the contribution of dermal exposure to overall exposures.
- Reviews of chemical mixtures and how different combinations of chemicals can affect exposures and health effects, as well as how to assess and manage exposures to chemical mixtures.
- Protocols for evaluating biological responses to mixtures.
- Reviews and guidance documents on assessing, both qualitatively and quantitatively, intervention effectiveness and intervention design.
- Reviews and guidance documents on how to implement control measures and on how to evaluate the effectiveness of control measures for dermal exposures.
- Brochures or other "educational" materials, particularly ones that deal with specific chemicals that are known skin hazards.
- Risk management strategies for particular chemicals or occupations/tasks. Construction and working with cement is an exception to this (see eLCOSH website) and a good example of what could be done for other exposures.
- Protocols and checklists for risk management, risk characterization, and surveillance.
- Exposure Control Plans designed specifically to prevent dermal hazards.

Below is a list of topics and subtopics for each audience for which few resources were identified.

General Audience

- "Specific chemicals." Information on specific chemicals was limited, but this type of information is usually found in the professional audience references.
- B.2. There were few resources with quantitative descriptions on how exposure intensity and frequency influence exposure conditions.

- B.3. There were not many guidance documents specific to skin hazards for qualitatively assessing skin exposure for non-experts, such as protocols or checklists to characterize exposure when exposure data are not available or checklists and other tools for identifying exposures to hazardous chemicals and for identifying workplace conditions that contribute to skin exposure.
- C.3. There were not many protocols and checklists specific to skin hazard exposure to use in identifying skin hazards on the workplace.
- D.1. There were not many protocols and checklists for qualitatively identifying risks from skin exposure.
- E.2. There were few protocols and checklists for qualitatively monitoring potential skin exposures.

Professional Audience

- C.2. There were few checklists and questionnaires for use to quantify skin exposure incidences.
- D.1. Little was available on assessing the contribution of dermal exposures to overall exposures.
- E.2. More examples of risk assessment for chemical mixtures are needed.
- F.2. Resources are needed to provide guidance on how to develop a dermal exposure reduction goal, both qualitative and quantitative based on the findings of a risk assessment.
- F.2. More is needed on guidance for developing an approach of dermal risk management and control to achieve exposure reduction goals based on considerations of requirements in the industrial process or tasks, consideration of regulatory requirements or guidance, or experiences in similar exposure situations.
- F.2. More guidance resources are need for designing, selecting and implementing methods of evaluation to demonstrate the effectiveness of intervention approaches for exposure control.

5.2 Future Research

Future research or product development should consider the gaps presented above and might include, but not be limited to:

General Audience

- Materials describing the concepts of exposure intensity and frequency with respect to skin hazards.
- Protocols or checklists for identifying skin hazards and qualitatively identifying risks and monitoring for skin exposures.

Professional Audience

- Development of educational materials on skin exposures and hazards for use in instruction and hazard communication.
- Development of guidance documents and examples of risk assessment of dermal hazards.
- Development of risk management approaches and controls for dermal exposure.
- Development of methods to evaluate the effectiveness of dermal hazard intervention approaches.

APPENDIX A

ACRONYMS

<u>Acronym</u>	<u>Meaning</u>
AAPS	American Association of Pharmaceutical Scientists
ACGIH	American Conference of Governmental Industrial Hygienists
AID	Allergic and Irritant Dermatitis
AIHA	American Industrial Hygiene Association
ANOM	Analysis of means
API	Alliance for the Polyurethanes Industry
ASA	American Skin Association
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BAT	Biological Tolerance Values
BEELs	Biological Environmental Exposure Limits
BEIs	Biological Exposure Indices
BLS	Bureau of Labor Statistics
CAS	Chemical abstract service
CBD	Chronic beryllium disease
CCOHS	Canadian Centre for Occupational Health and Safety
CCP	Carbonless copy paper
CD	Compact disc
CDC	Centers for Disease Control and Prevention
CEB	Chemical Engineering Branch of the Environmental Protection Agency's Office of Pollution Prevention and Toxics
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations
ChemIDplus	
CICADs	Concise International Chemical Assessment Documents
CIS	International Occupational Safety and Health Information Centre (Centre international d'informations de sécurité et santé au travail)
CMAQ	Community Multiscale Air Quality model
COSHH	Control of Substances Hazardous to Health Regulations
CPC	Chemical Protective Clothing
CPL	Compliance directives
CPWR	Center to Protect Workers' Rights
CrVI	Hexavalent Chromium
DEET	N,N-Diethyl-m-toluamide
DERMDAT	dermal exposure measurements
DERP	Dermal Exposure Research Program
DFP	diisopropylfluorophosphate

<u>Acronym</u>	<u>Meaning</u>
DLI	Department of Labor and Industries
DMF	N,N-dimethylformamide
DMSO	Dimethylsulfoxide
DOEL	dermal occupational exposure limit
DREAM	DeRmal Exposure AssessMent
EASE	Estimation Assessment of Substance Exposure mode
EPA	US Environmental Protection Agency
EPR	Electron Paramagnetic Resonance
ERDEM	Exposure-Related Dose-Estimating Model
ERG	Emergency Response Guidebook
ERPGs	Emergency Response Planning Guidelines
EVOH	Ethylene vinyl alcohol
EXTOXNET	EXTension TOXicology NETwork
FAQs	Frequently asked questions
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FRAMES-3MRA	Framework for Risk Analysis in Multimedia Environmental Systems-- Multimedia, Multipathway, Multireceptor Risk Assessment
HSC	Britain's Health and Safety Commission
HSDB	Hazardous Substances Data Bank
HSE	Britain's Health and Safety Executive
IARC	International Agency for Research on Cancer
ICCVAM	Interagency Coordinating Committee on the Validation of Alternative Methods
ICD	irritant contact dermatitis
ICSC	International Chemical Safety Card
ID	Identifier
IDLHs	Immediately Dangerous to Life and Health values
IH	Industrial Hygiene
ILO	International Labour Office
INRS	l'Institut National de Recherche et de Sécurité
IPCS	International Programme on Chemical Safety
IPPSF	Isolated Perfused Porcine Skin Flap
IRIS	Integrated Risk Information System
IT	intrinsic toxicity
LAS	linear alkibenzene sulfonate
LLNA	Local Lymph Node Assay
MAK	Maximum Allowable Concentration
MDA	4,4-methylene dianiline
MMA	Methyl methacrylate
MMGs	Medical Management Guidelines
NASD	National Ag Safety Database

<u>Acronym</u>	<u>Meaning</u>
NERL	The USEPA's National Exposure Research Laboratory
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NIOSH TIC	National Institute for Occupational Safety & Health Technical Information Center (database)
NLM	National Library of Medicine
NORA	National Occupational Research Agenda
NOSQ	Nordic Occupational Skin Questionnaire
NPL	National Priorities List
NRL	Natural rubber latex
NRMCA	National Ready Mix Concrete Association
OCD	occupational contact dermatitis
OECD	Organisation for Economic Co-operation and Development
OELs	occupational exposure limits
OH	Ohio
OPPTS	The USEPA's Office of Prevention, Pesticides and Toxic Substances
OPRA	Occupational Physicians Reporting Activity
OR	Oregon
OR-OSHA	Oregon Occupational Safety and Health Division
OSH	Occupational health and safety
OSHA	Occupational Safety and Health Administration
OWIIPP	Oregon Worker Illness and Injury Prevention Program
PAHs	Polyaromatic Hydrocarbons
PAR	Provisional acceptable residues
PBPK	Physiologically-based pharmacokinetic
PCBs	Polychlorinated Biphenyls
PDA	Personal Digital Assistant
PDF	Portable Document Format
PELs	Permissible Exposure Limits
PPE	Personal protective equipment
ppm	Part per million
PSFT	Porcine Skin flow Through
PVA	polyvinylalcohol
PVC	polyvinylchloride
QSARs	Quantitative structure-activity relationships
QSPRs	Quantitative Structure Property Relationships
RA	sulfate ricinolei acid
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RD	low-level sulfur mustard
REACH	regulatory framework for chemical risk assessment
RELs	Recommended Exposure Limits

<u>Acronym</u>	<u>Meaning</u>
RTECS	Registry of Toxic Effects of Chemical Substances
SCT	Secretariat of Communications and Transportation of Mexico
SENSOR	Sentinel Event Notification System for Occupational Risks
SHARP	Safety and Health Assessment and Research for Prevention Program
SHEDS	Stochastic Human Exposure and Dose Simulation
SMEs	Small and medium-sized enterprises
SMFT	silastic membrane flow through diffusion cell
SRC	Syracuse Research Corporation
SRP	Scientific Review Panel
STEL	Short term exposure limit
TCE	Trichloroethylene
TEHIP	Toxicology and Environmental Health Information Program
TER	Transcutaneous Electrical Resistance

Appendix B

Full Resource Citations and Summaries

This appendix contains the full citations and summary information for all the resources referenced in the dermal resource guide, listed in order of the assigned ID number.

Definition of Terms used in Appendix B Citations and Summaries

- Article ID:** The unique ID assigned to every resource found in the Dermal Resource Guide.
- Citation:** The information (author, title, journal, volume, etc) needed to obtain the reference.
- Resource type:** Type of resource (journal, book, magazine, webpage, etc.) NOTE: Websites may contain multiple types of resources not listed here. These will be summarized in the summary text.
- Educational material:** Whether or not the material seem to have been developed with the primary focus of educating the workforce or general audiences.
- Number of references:** The number of references cited by the reference (the total number for books was determined by summing the number of references in each chapter).
- Industries/Occupations:** The broad categories of occupations and industries to which the resource states that it pertains or specifically addresses (e.g., agriculture, construction, mining, etc.).
- Specific process:** Specific occupations, job or tasks, if any, addressed by the reference that are not listed or detailed in the Industries/Occupations drop down list.
- Chemical:** The broad chemical classes, whether raw, intermediate or final products, to which the resource pertains or specifically addresses (e.g., abrasives, pesticides, PCBs, etc.).
- Specific chemicals:** Specific chemicals to which the resource pertains or specifically addresses.
- Mixtures:** Whether or not the references addresses the topic of chemical mixtures and dermal exposure.
- Audiences:** Whether the reference was written primarily for a general or professional audience. General audience is defined as those who have limited technical background or formal training in identifying and controlling hazardous skin exposures. Professional audiences typically utilize technical information for evaluating, recognizing, and controlling harmful skin exposures.
- Topics addressed:** The list of broad topics addressed by the references (health effects, exposure characterization, etc). Most resources contain information about multiple topics and sub-topics. All topics listed here are those where the reference has been cited. This list provides an overview of the kinds of information that can be found within the resource. Specific topics for general audiences are explained in full in Chapter 3 and for professional audiences in Chapter 4.
- Summary:** A summary of the document written with a focus on occupational dermal exposures. The summary is not identical to the reference's abstract. Website summaries may summarize links to resources within the website.

Article ID: 2
Citation: Nash, James L. "Skin Care: Starting from Scratch." Occupational Hazards 62.4 (2000): 53-55
Resource Type: Magazine article
Educational Materials: Yes
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical: Other
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
E Risk Management
E.1 Overview of skin exposure control options
E.3 "Best practices"/guidelines/recommendations
E.3.A Substitution
E.3.B Engineering controls
E.3.C Work practice/administration controls
E.3.D PPE and PPE regulations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: Paper provides an overview of occupational skin disease, its underreporting, and prevention.

Article ID: 23

Citation: Semple, S. "Dermal exposure to chemicals in the workplace: just how important is skin absorption?" Occupational and Environmental Medicine 61.4 (2004): 376-82

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 31

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview, Solvents

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.2.E Uptake
- C.4 Direct methods to measure exposure
- C.4.B Skin
- C.4.C Biomonitoring
- C.5 Exposure modeling

Summary: The paper discusses the importance of occupational dermal exposure, factors that influence exposure and absorption, and methods for measuring and assessing dermal exposure.

Article ID: 24

Citation: National Institute for Occupational Safety and Health (NIOSH). "National Institute for Occupational Safety and Health (NIOSH) [Home page]." 2005. [http://www.cdc.gov/niosh/Home page.html](http://www.cdc.gov/niosh/Home%20page.html) Website

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations: General - overview, Agricultural, Cleaning/Janitorial/Maid, Service - Medical

Specific Process:

Chemical: General - overview, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Soaps and Detergents, Solvents

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.3 Investigation, intervention, and control of occupational skin exposures
 - A.6 Dermal regulations and skin notations
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.2 Loss of workdays and impact on productivity
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
 - C.2 Description of factors influencing exposure conditions
 - C.2.A Exposure intensity/frequency/duration
 - C.2.B Exposure concentration
 - C.2.C Skin area affected
 - C.4 Direct methods to measure exposure
 - C.4.A Surfaces
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.C Systemic toxicity
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The National Institute for Occupational Safety and Health (NIOSH) is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH's web site has a variety of

different web pages with information on dermal exposure to chemicals. Many of these resources can be accessed through the NIOSH Safety and Health Topic Page, "Skin Exposures and Effects." This web page contains links to many of the NIOSH resources on Dermal Exposure, including the NORA Dermal Exposure Research Program (DERP), as well as updates on ongoing research and conferences. Information on dermal exposure can also be accessed by chemical or by industry and occupation and then examined for dermal exposure related information.

Additional NIOSH resources on dermal exposure available from this website include:

- The Registry of Toxic Effects of Chemical Substances (RTECS): RTECS is a toxicological database of chemical data extracted from the open scientific literature. For each chemical, six types of toxicity data are included in the file: (1) primary irritation; (2) mutagenic effects; (3) reproductive effects; (4) tumorigenic effects; (5) acute toxicity; and (6) other multiple dose toxicity. Where available, it includes skin and eye irritation data. You must have a subscription from one of RTECS' database vendors, which are listed on the web page, in order to access the database.
- NIOSHTIC 2: This is a searchable bibliographic database of occupational safety and health publications, documents, grant reports, and journal articles supported in whole or in part by NIOSH.
- The Chemical Protective Clothing Database: This searchable database can be searched by chemical to find out whether skin contact should be avoided and see a list of recommended protective clothing barriers.
- International Chemical Safety Cards. This searchable database of basic health and safety information on (ultimately) 2000 chemicals can be searched by chemical and then information presented can be examined for potential dermal hazards.
- NIOSH Pocket Guide to Chemical Hazards. This searchable guide is a source of general industrial hygiene information on several hundred chemicals/classes for workers, employers, and occupational health professionals, including information on routes of exposure, target organs, symptoms and first aid procedures.
- The Skin Permeation Calculator: This is used to calculate the skin permeation coefficient (kp), a measure of the conductance of skin to a particular chemical from a particular vehicle.
- The National Occupational Research Agenda (NORA) Allergic and Irritant Dermatitis (AID) Team: NORA, which is a framework to guide occupational safety and health research into the next decade, created the AID Team to promote research in this area.
- Proceedings of the International Conference on Occupational & Environmental Exposures of Skin to Chemicals: Science & Policy, Spt. 2002
- Worker Health Chart Book 2004: Chapter 2 - Fatal and Nonfatal Injuries, and Selected Illnesses and Conditions, Skin

Diseases and Disorders: This presents national surveillance data on skin diseases and disorders.

- Occupational Dermatoses: A Program for Physicians: This is a slide show that presents an overview of occupational dermatitis, including both surveillance data and photographs of different types of dermatitis.

- A NIOSH Alert on Preventing Allergic Reactions to Natural Rubber Latex in the Workplace: This comprehensive document which provides information on the recognition, evaluation, and control of exposure to natural latex products. It includes a list of a number of products found in the workplace that may contain latex.

- Control of Exposure to Perchloroethylene in Commercial Dry Cleaning: This is a guide which includes a description of methods that can be used for exposure control.

Article ID: 25
Citation: Sartorelli, P. "Dermal exposure assessment in occupational medicine." *Occup.Med.(Lond)* 52.3 (2002): 151-56
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 16
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: A Overview
A.1 Occurrence of skin exposures in workplace
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake

Summary: The paper provides a discussion of various methods for assessing dermal exposure, including threshold limit values, [Q]SARs, and occupational exposure limit skin notations.

Article ID: 27
Citation: McDougal, J. N. and M. F. Boeniger. "Methods for assessing risks of dermal exposures in the workplace." Crit Rev.Toxicol. 32.4 (2002): 291-327
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 70
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.3 Investigation, intervention, and control of occupational skin exposures
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.5 Exposure modeling

Summary: The paper provides a comprehensive and comparative analysis of methods used to estimate both the amount of a chemical contacting the skin (external dose) and the amount that reaches internal organs (internal dose). The paper addresses each of steps in the process, describes the assumptions involved, assesses the model's strengths and weaknesses, and provides recommendations for further research. The paper discusses:

INTERNAL DOSE ASSESSMENT
Flux and permeability theory
Calculations based on empirical measurements and fraction absorbed
Calculations based on steady-state flux
Calculations adjusted for square root of time
Calculations based on biologically based models
Comparisons with short-term skin penetration data

ROUTE TO ROUTE EXTRAPOLATIONS
Extrapolation factor approach
Biologically based models

DERMAL EXPOSURE LEVELS
"Skin" notation
Banding approach to dermal exposure risks
Dermal occupational exposure levels
Skin absorption time

RISK CHARACTERIZATION

Article ID: 30
Citation: Garrod, A. N. and R. Rajan-Sithamparanadarajah. "Developing COSHH Essentials: dermal exposure, personal protective equipment and first aid." *Ann.Occup.Hyg.* 47.7 (2003): 577-88
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 20
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.E Uptake
C.5 Exposure modeling

Summary: This paper discusses how to apply Control of Substances Hazardous to Health Regulation (COSHH) Essentials, originally developed in the UK to control inhalation exposures in the workplace, to control dermal exposures. It examines the factors affecting skin exposure, and the outlines options to band chemical hazards for emergency planning according to a minimum of information, i.e. the danger symbol on a product label. It also discusses European dermal hazard classification.

Article ID: 33
Citation: Boeniger, M. F. and H. W. Ahlers. "Federal government regulation of occupational skin exposure in the USA." Int.Arch.Occup.Environ.Health 76.5 (2003): 387-99
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 40
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed: A Overview
A.4 Dermal regulations and skin notations

Summary: This paper provides an overview of federal regulations of dermal exposure. An analysis of the 14 federal regulations and 3 agencies that regulate occupational skin exposure in the US is presented. EPA requires reporting of chemical health effects information which it uses to assess exposure risk. FDA regulates the labeling of cosmetics and requires safety data on new health products. OSHA regulates workplace safety and assesses compliance through field inspections. The paper evaluates how well the regulations prevent exposure and recommend measures to further protect workers from occupational skin hazards.

Article ID: 34
Citation: Lushniak, B. D. "The importance of occupational skin diseases in the United States." Int.Arch.Occup.Environ.Health 76.5 (2003): 325-30
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 22
Industries/Occupations: General - overview
Specific Process: Provides data by major occupational categories
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in workplace
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.2 Loss of workdays and impact on productivity

Summary: This epidemiological study presents occupational skin disease and disorder surveillance data for the US and three states (OH, OR, and WA). It describes trends, data by occupation, lost time and other data.

Article ID: 35
Citation: Wester, R. C. and H. I. Maibach. "Understanding percutaneous absorption for occupational health and safety." Int.J.Occup.Environ.Health 6.2 (2000): 86-92
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 16
Industries/Occupations:
Specific Process:
Chemical: General - overview, Heavy Metals/Inorganic Compounds, Pesticides, PAHs, PCBs
Specific Chemicals: DDT
Benzopyrene
Chlordane
Pentachlorophenol
PCBs
2,4 D
Arsenic
Cadmium
Mercury
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.5 Exposure modeling
Summary: This paper describes percutaneous absorption, factors affecting absorption and exposure monitoring methods. It also provides percutaneous absorption rates for several chemicals.

Article ID: 36
Citation: Vermeulen, R., P. Stewart, and H. Kromhout. "Dermal exposure assessment in occupational epidemiologic research." Scand.J.Work Environ.Health 28.6 (2002): 371-85
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 110
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.5 Exposure modeling

Summary: This paper presents the results of a literature survey conducted to identify dermal exposure assessment methods. Variables discussed include intensity, frequency, and duration of exposure, the exposed surface area, and personal, temporal and spatial variability in dermal exposure and uptake. Methods include qualitative, quantitative, and semi-quantitative techniques. The paper focuses on dermal exposure assessment in relation to systemic effects, but local effects are also considered.

Article ID: 37
Citation: Mathur, A. K. and S. K. Khanna. "Dermal toxicity due to industrial chemicals." *Skin Pharmacol. Appl. Skin Physiol* 15.3 (2002): 147-53
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 21
Industries/Occupations:
Specific Process:
Chemical: Cleaning Agents, Coolants, Heavy Metals/Inorganic Compounds, Latex, Organic Dyes, Plastics and Resins, Rubber Additives, Soaps and Detergents, Solvents, Other: Florescent whitening agents
Dyes
Adhesives
Perfume
Preservatives
Specific Chemicals: Dozens of specific chemicals are addressed
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity
D.1.D Other health effects
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The paper discusses potential health effects from exposure to metals, florescent whitening agents, dyes, adhesives and resins, preservatives and disinfectants, plastics and rubbers, perfume, soaps and detergents, and cutting oils and solvents.

Article ID: 39

Citation: Oppl, R., F. Kalberlah, P. G. Evans, and J. J. van Hemmen. "A toolkit for dermal risk assessment and management: an overview." *Ann.Occup.Hyg.* 47.8 (2003): 629-40

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 15

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.5 Exposure modeling
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects
- E.1.B Systemic health effects
- F Risk Management
- F.2 Protocols for risk management
- F.2.A Development of exposure reduction goal (qualitative or quantitative)

Summary: This article is the 2nd article of a 6-part series on RISKOFDERM, a tool for conducting risk assessments. The series was published in the *Annals of Occupational Hygiene* in 2003. The following briefly summarizes each paper in the series:

- 1) Database ID 40 - Outlines a "toolkit" for conducting dermal occupational risk assessment
- 2) Database ID 39 - Describes the assumptions in the toolkit and describes approach to exposure assessment used by the toolkit.
- 3) Database ID 202 - Describes the determinants relevant for dermal exposure models in the scope of regulatory risk assessment.
- 4) Database ID 201 - Describes how default dermal exposure values can be adjusted for specific work situations.
- 5) Database ID 248 - Describes the derivation of the toolkit's default task-based dermal exposure values.
- 6) Database ID 200 - Describes the development of "intrinsic toxicity" (IT) scores used for hazard characterization.

Article ID: 40

Citation: van Hemmen, J. J., J. Auffarth, P. G. Evans, B. Rajan-Sithamparanadarajah, H. Marquart, and R. Oppl. "RISKOFDERM: risk assessment of occupational dermal exposure to chemicals. An introduction to a series of papers on the development of a toolkit." *Ann.Occup.Hyg.* 47.8 (2003): 595-98

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 9

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed: E Risk Assessment
 E.1 Guidelines for risk assessment or analysis
 E.1.A Localized health effects
 E.1.B Systemic health effects

Summary: This article is the 1st article of a 6-part series on RISKOFDERM, a tool for conducting risk assessments. The series was published in the *Annals of Occupational Hygiene* in 2003. The following briefly summarizes each paper in the series:

- 1) Database ID 40 - Outlines a "toolkit" for conducting dermal occupational risk assessment
- 2) Database ID 39 - Describes the assumptions in the toolkit and describes approach to exposure assessment used by the toolkit.
- 3) Database ID 202 - Describes the determinants relevant for dermal exposure models in the scope of regulatory risk assessment.
- 4) Database ID 201 - Describes how default dermal exposure values can be adjusted for specific work situations.
- 5) Database ID 248 - Describes the derivation of the toolkit's default task-based dermal exposure values.
- 6) Database ID 200 - Describes the development of "intrinsic toxicity" (IT) scores used for hazard characterization.

Article ID: 41
Citation: Cherrie, J. W., D. H. Brouwer, M. Roff, R. Vermeulen, and H. Kromhout. "Use of qualitative and quantitative fluorescence techniques to assess dermal exposure." *Ann.Occup.Hyg.* 44.7 (2000): 519-22
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 16
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin

Summary: This paper reviews the literature on both quantitative and qualitative methods of dermal exposure using fluorescent tracers to estimate chemical uptake through the skin.

Article ID: 42
Citation: Schneider, T., J. W. Cherrie, R. Vermeulen, and H. Kromhout. "Dermal exposure assessment." Ann.Occup.Hyg. 44.7 (2000): 493-99
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 35
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.4.C Biomonitoring
C.5 Exposure modeling

Summary: The authors propose a theoretical strategy to assess dermal exposure based on a conceptual model for airborne contaminants. Many different skin and surface measurement are evaluated.

Article ID: 43

Citation: Bos, P. M., D. H. Brouwer, H. Stevenson, P. J. Boogaard, W. L. de Kort, and J. J. van Hemmen. "Proposal for the assessment of quantitative dermal exposure limits in occupational environments: Part 1. Development of a concept to derive a quantitative dermal occupational exposure limit." *Occup. Environ. Med.* 55.12 (1998): 795-804

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 48

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals: cyclophosphamide
4,4-methylene dianiline (MDA)

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.6 Dermal regulations and skin notations
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.2.D Other
- C.2.E Uptake
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects

Summary: The authors argue that quantitative dermal occupational exposure limits (DOEL) should be developed, similar to respiratory occupational exposure limits (OELs), to replace today's qualitative "skin notation" warnings. The authors present a procedure for developing DOELs for the total dose deposited on the skin during a working shift and use their procedure to develop a DOEL for cyclophosphamide and 4,4-methylene dianiline (MDA). They conclude that the DOEL that they developed is relevant and useful, but further research is needed to show whether the procedure is applicable to other chemicals.

Article ID: 44

Citation: [No Author] . "Skin lesions and environmental exposures. An overview for the occupational health nurse. Agency for Toxic Substances and Disease Registry." AAOHN J. 44.11 (1996): 529-
Journal article - review, meta-analysis

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 0

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- A.4 Skin physiology and functions as a barrier to chemical insults
- B Surveillance and Clinical Aspects
- B.4 Clinical protocols for recognition of skin exposure health effects
- C Exposure Characterization
- C.4 Direct methods to measure exposure
- C.4.B Skin
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- D.1.D Other health effects

Summary: This paper presents a detailed discussion of pathophysiology, etiologies, diagnosis and treatment for 7 skin conditions associated with environmental exposures: irritant contact dermatitis, allergic contact dermatitis, photosensitivity contact dermatitis, chloracne, pigment alterations, contact urticaria, and malignant neoplasms. There is also a discussion of a few diagnostic procedures including patch testing, photopatch testing, and skin biopsy.

Article ID: 45

Citation: Hamann, C. P., L. G. DePaola, and P. A. Rodgers. "Occupation-related allergies in dentistry." J.Am.Dent.Assoc. 136.4 (2005): 500-10

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 73

Industries/Occupations: Other: Dentistry

Specific Process:

Chemical: Latex, Plastics and Resins, Rubber Additives, Other: Adhesives
Antiseptics
Artificial fingernails
Dental bonding agents
Disinfectants
Equipment sterilization solutions
Skin care products
Rubber gloves
Radiographic and photo chemical

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This paper presents the health effects associated with occupation-related allergies in dentistry. Natural rubber latex (NRL) protein allergy, allergic contact dermatitis, and irritant contact dermatitis are discussed. Topic include diagnosis, exposure measuring, and management and prevention, and some surveillance information.

Article ID: 46

Citation: Rowse, D. H. and E. A. Emmett. "Solvents and the skin." Clin.Occup.Environ.Med. 4.4 (2004): 657-730, vi

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 331

Industries/Occupations:

Specific Process:

Chemical: PAHs, Solvents

Specific Chemicals: Table 1 provides applications, volatility, potential routes of entry, toxicity rating, skin lesions type, and health effects for 80 specific chemicals.
Table 2 provides regulatory/guideline limits for 80 specific chemicals from IARC, ACGIH TWA, ACGIH STEL, ACGIH TLV, NIOSH, OSHA, and the Montreal protocol.
Describes health effects, permeability, and other information on 40 specific alcohols, aldehydes, aliphatic and alicyclic hydrocarbons, amides, amines, aromatic hydrocarbons, chlorinated hydrocarbons, esters, ethers, glycol ethers, ketones, phenols, and terpenes.

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- A.4 Skin physiology and functions as a barrier to chemical insults
- A.6 Dermal regulations and skin notations
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- D.1.D Other health effects
- D.2 Summaries of health effects, dose-response relationships
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects

Summary: The paper examines skin structure, permeability and chemical uptake, injuries caused by solvents: Included are reviews of solvent dermal health effects and the potential for systemic toxicity from dermal absorption.

Article ID: 48

Citation: Lushniak, B. D. "Occupational contact dermatitis." *Dermatol. Ther.* 17.3 (2004): 272-77

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 32

Industries/Occupations: General - overview, Agricultural, Construction, Forestry/Fisheries, Manufacturing - Chemical, Mining, Service - Medical, Transportation/Communications/Utility

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.3 Investigation, intervention, and control of occupational skin exposures
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.2 Loss of workdays and impact on productivity
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.D Other health effects
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.D PPE and PPE regulations

Summary: This paper presents an overview of issues involved in the study of occupational contact dermatitis, including importance, incidence, economic impact, at-risk occupations, diagnosis, and prevention.

Article ID: 50

Citation: Winder, C. and M. Carmody. "The dermal toxicity of cement." *Toxicol.Ind.Health* 18.7 (2002): 321-31

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 102

Industries/Occupations: Construction

Specific Process:

Chemical: Heavy Metals/Inorganic Compounds, Other: Cement
Alkalines

Specific Chemicals: Chromium [III]
Chromium [VI]
Lime (Anhydrous Calcium Hydroxide)

Mixtures: No

Audience: Professional

Topics Addressed:

- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.B Skin exposure minor focus
 - B.2 Loss of workdays and impact on productivity
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.D Other health effects
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.C Work practice/Administrative controls

Summary: Contact dermatitis is one of the most frequently reported health problems among construction workers. Cement's alkaline ingredients (such as lime) produce irritant contact dermatitis. Ingredients such as chromium produce allergic contact dermatitis. The paper lists steps to reduce exposures which have been proven to reduce allergic (but not irritant) dermatitis.

Article ID: 52
Citation: Leggat, P. A. and U. Kedjarune. "Toxicity of methyl methacrylate in dentistry." Int.Dent.J. 53.3 (2003): 126-31
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 50
Industries/Occupations: Service - Medical, Other: Dentistry
Specific Process:
Chemical: Plastics and Resins
Specific Chemicals: Methyl methacrylate (MMA)
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.B Skin exposure minor focus
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.C Systemic toxicity
F Risk Management
F.1 Strategies for exposure control
F.1.B Engineering controls
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations

Summary: This paper presents health effects associated with exposure to Methyl Methacrylate (MMA) in dentistry. It includes a discussion of control strategies to use to reduce exposure to MMA.

Article ID: 53
Citation: Kresken, J. and A. Klotz. "Occupational skin-protection products-
-a review." Int.Arch.Occup.Environ.Health 76.5 (2003): 355-58
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 34
Industries/Occupations:
Specific Process:
Chemical: Hand Cleansers, Other: Water
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The paper evaluates the use of skin protection products, specifically or including barrier creams in preventing occupational dermal exposures. They conclude barrier creams do not replace PPE and should only be used against low-grade irritants such as water, detergents, and cutting fluids.

Article ID: 58
Citation: Romano-Woodward, D. "Safe use of glutaraldehyde." Nurs.Stand. 14.32 (2000): 47-51
Resource Type: Magazine article
Educational Materials: No
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical: Cleaning Agents
Specific Chemicals: glutaraldehyde
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
E Risk Management
E.2 Protocols/checklists to monitor potential exposures
E.3 "Best practices"/guidelines/recommendations
E.3.A Substitution
E.3.B Engineering controls
E.3.D PPE and PPE regulations
E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The article explains what precautions should be used for handling glutaraldehyde, a chemical used in many healthcare settings to sterilize instruments.

Article ID: 61
Citation: Kimber, I., J. S. Pichowski, C. J. Betts, M. Cumberbatch, D. A. Basketter, and R. J. Dearman. "Alternative approaches to the identification and characterization of chemical allergens." *Toxicol. In Vitro* 15.4-5 (2001): 307-12
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 29
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.3 Characterization protocols
D.3.B Irritation potential
D.3.C Sensitization potential

Summary: This paper describes some of the general requirements of in vitro test methods for skin sensitization, and progress that has been made in developing suitable approaches with particular emphasis on the utility of dendritic cell culture systems.

Article ID: 67
Citation: Brouwer, D. H., M. F. Boeniger, and Hemmen J. van. "Hand wash and manual skin wipes." Ann.Occup.Hyg. 44.7 (2000): 501-10
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 39
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin

Summary: This paper reviews both hand wash and skin wipe techniques of dermal exposure sampling for sampling efficiency. Sampling protocols hamper comparisons of study results. The authors conclude harmonization of sampling protocols will be a first step in creating a database for better understanding the influence of sampling parameters on the performance of removal techniques to assess dermal exposure.

Article ID: 68
Citation: Graves, C. G., G. M. Matanoski, and R. G. Tardiff. "Carbonless copy paper and workplace safety: a review." Regul.Toxicol.Pharmacol. 32.1 (2000): 99-117
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 122
Industries/Occupations:
Specific Process:
Chemical: Cleaning Agents, PCBs, Other: Carbonless copy paper (CCP)
Specific Chemicals: Formaldehyde
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in workplace
A.2 Health hazards resulting from skin exposure to chemicals
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.3 Characterization protocols
D.3.B Irritation potential
D.3.C Sensitization potential

Summary: The paper presents a meta-analysis of 121 papers published on carbonless copy paper (CCP) since 1987. CCP has been alleged to cause skin irritation, however, this weight-of-evidence analysis concludes that no irritation or sensitization from CCP should be expected under normal conditions of manufacture and use.

Article ID: 70
Citation: Meding, B. "Differences between the sexes with regard to work-related skin disease." *Contact Dermatitis* 43.2 (2000): 65-71
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 41
Industries/Occupations: Beauty/Cosmetology, Cleaning/Janitorial/Maid, Service - Food, Service - Medical
Specific Process: Shows high-risk occupations by major group in 1990
Chemical: Heavy Metals/Inorganic Compounds
Specific Chemicals: Nickel
Mixtures: No
Audience: Professional
Topics Addressed:

- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations

Summary: This paper reviews gender differences in work-related skin disease. Women report skin disease more often than men. They are more often affected than men, and they work in female dominated occupations, e.g., hairdressing, catering, cleaning and health-care work, which are more likely to involve wet work. For these occupations, work-related skin disease is common and usually presents as hand eczema, typically, irritant contact dermatitis. Nickel allergy is the most common contact allergy. Control strategy discussion includes a focus on reducing wet work.

Article ID: 71

Citation: Kalnas, J. and D. T. Teitelbaum. "Dermal absorption of benzene: implications for work practices and regulations." Int.J.Occup.Environ.Health 6.2 (2000): 114-21

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 49

Industries/Occupations:

Specific Process:

Chemical: Solvents

Specific Chemicals: Benzene

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in workplace
- A.6 Dermal regulations and skin notations
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.5 Exposure modeling
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.B Systemic health effects
- E.2 Example risk assessments

Summary: This paper provides an overview of occupational dermal exposure to benzene. Topics discussed include estimates of the amount of benzene absorbed through the skin and the increased likelihood of developing leukemia at low exposure levels, the development of permissible exposure limits for benzene, and proposed exposure limits from the National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH).

Article ID: 72
Citation: Thrall, K. D., T. S. Poet, R. A. Corley, H. Tanojo, J. A. Edwards, K. K. Weitz, X. Hui, H. I. Maibach, and R. C. Wester. "A real-time in-vivo method for studying the percutaneous absorption of volatile chemicals." *Int.J.Occup.Environ.Health* 6.2 (2000): 96-
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 24
Industries/Occupations:
Specific Process:
Chemical: Solvents
Specific Chemicals: Methyl chloroform
Trichloroethylene
Benzene
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.B Skin
C.5 Exposure modeling
D Hazard Identification
D.2 Summaries of health effects, dose-response relationships
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects

Summary: This paper presents estimates of percutaneous absorption of volatile chemicals. Dermal uptake of solvents under non-steady-state conditions was determined using real-time breath analysis in rats, monkeys, and humans. Physiologically-based pharmacokinetic (PBPK) models were used to estimate dermal permeability. The effects of exposure matrix, occlusion versus non-occlusion, and species differences were compared for methyl chloroform, trichloroethylene, and benzene. The method was found to be sufficiently sensitive for animal and human dermal studies at low exposure concentrations over small body surface areas, for short periods, and using non-steady-state exposure conditions.

Article ID: 73
Citation: Boman, A. and H. I. Maibach. "Percutaneous absorption of organic solvents." Int.J.Occup.Environ.Health 6.2 (2000): 93-95
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 37
Industries/Occupations:
Specific Process:
Chemical: Solvents
Specific Chemicals: n-butanol
Toluene
1,1,1-trichloroethane
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.5 Exposure modeling
D Hazard Identification
D.2 Summaries of health effects, dose-response relationships

Summary: This paper discusses factors affecting percutaneous absorption of organic solvents including pathway, toxicity, and environmental factors. Absorption rates vary considerably. Amphiphilic solvents have higher absorption rates. Unoccluded repeated exposures results in less absorption than continuous contact. Ventilation reduces absorption.

Article ID: 74
Citation: Hatch, K. L. and H. I. Maibach. "Textile dye allergic contact dermatitis prevalence." *Contact Dermatitis* 42.4 (2000): 187-95
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 20
Industries/Occupations: Manufacturing - Other
Specific Process:
Chemical: Organic Dyes
Specific Chemicals: Paper examines over 60 dyes for prevalence data including disperse orange 3, yellow 3, red 1, blue 124, black 1, brown 1, and reactive green 12.
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin

Summary: This paper summarizes textile dye allergic contact dermatitis prevalence studies and makes recommendations for future work.

Article ID: 86
Citation: Mellstrom, G. A., K. Wrangsjo, J. E. Wahlberg, and B. Fryklund. "The value and limitations of protective gloves in medical health service: Part III." *Dermatol.Nurs.* 8.5 (1996): 345-55
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 14
Industries/Occupations: Service - Medical
Specific Process:
Chemical: Latex
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations

Summary: This paper presents the benefits and problems associated with glove protection from dermal exposures. Describes problems of permeability and side effects (latex allergy).

Article ID: 94
Citation: Diepgen, T. L. and P. J. Coenraads. "What can we learn from epidemiological studies on irritant contact dermatitis?"
Curr.Probl.Dermatol. 23 (1995): 18-27
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 18
Industries/Occupations: General - overview, Beauty/Cosmetology, Construction, Manufacturing - Other, Medical Services
Specific Process: Electroplaters
Metalworkers
Bricklayers
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.3 Surveillance study protocols/procedures for gathering data
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
Summary: This paper presents irritant contact dermatitis surveillance data and describes how age, gender, and race, affect incidence and prevalence of irritant contact dermatitis.

Article ID: 98
Citation: Baynes, R. E. Dermal absorption of cutting fluid mixtures. Crisp.Data Base.National.Institutes.of Health PB2005107482. 2003. National Institute for Occupational Safety and Health (NIOSH).
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 38
Industries/Occupations: Manufacturing - Other, Other: Machining industry
Specific Process:
Chemical: Coolants, Heavy Metals/Inorganic Compounds, Petroleum Products & Lubricants, Solvents, Other: Cutting fluid additives
Specific Chemicals: Linear alkylbenzene sulfonate (LAS)
Sulfate ricinolei acid (RA)
Triazine
Nickel
Trichloroethylene
Triethanolamine
N-nitrosodiethanolamine
Mixtures: Yes
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects
Summary: This document reports results from the testing of several cutting fluid additives and contaminants to ascertain the influence of chemical mixtures on the dermal disposition and cutaneous toxicity. The research examined three specific additives: linear alkylbenzene sulfonate (LAS), sulfate ricinolei acid (RA), and triazine with regard to dermal absorption, physiochemical interactions, and the effect on solvent (TCE) permeability.

Article ID: 100
Citation: Van-Wendel-de-Joode, B., D. H. Brouwer, R. Vermeulen, J. J. van Hemmen, D. Heederik, and H. Kromhout. "DREAM: A method for semi-quantitative dermal exposure assessment." *Annals of Occupational Hygiene* 47.1 (2003): 71-87

Resource Type: Journal article - primary
Educational Materials: No
Number of References: 42
Industries/Occupations: Manufacturing - Other
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling

Summary: This paper describes the DeRmal Exposure AssessMent (DREAM) model for accessing and evaluating occupational dermal exposure to chemical and biological agents. DREAM provides an initial assessment of dermal exposure levels to liquids and solids, a framework for measuring strategies, and a basis for implementing control strategies. Two examples from the car construction are discussed in detail.

Article ID: 102
Citation: Leino, T. "Epidemiology of Skin and Respiratory Diseases Among Hairdressers." Diss. Finnish Institute of Occupational Health, 2001
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 298
Industries/Occupations: Beauty/Cosmetology
Specific Process: Hairdressers
 salons
Chemical: Organic Dyes, Soaps and Detergents
Specific Chemicals: Ammonium persulfate
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- B.3 Surveillance study protocols/procedures for gathering data
- C Exposure Characterization
- C.1 Workplace factors associated with harmful skin exposures
- C.4 Direct methods to measure exposure
- C.4.B Skin
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.D Other health effects
- F Risk Management
- F.1 Strategies for exposure control
- F.1.B Engineering controls

Summary: This paper includes the following: Section 1 presents introductory material on dermal and respiratory exposure among hairdressers (15 pages). Section 2 presents findings of literature review (27 pages). Section 3 to 7 present methods, results, discussion and conclusions regarding 20 Finnish salons (50 pages). Section 8 is the reference list (32 pages).

In addition to an extensive literature review, the paper presents five epidemiologic studies of skin and respiratory disorders among hairdressers. Study I focuses on the working conditions in salons and the perceived health of the hairdressers. Studies II, III and IV focus on the prevalence, incidence and risk of skin and respiratory symptoms and diseases among hairdressers. Study V focuses on the risks and causes of leaving the profession. Environmental data were collected at 20 Finnish salons. Health data was collected by questionnaire, phone interviews and medical examinations. The hairdressing salons meet Finnish indoor air criteria, but high peak concentrations of certain chemicals, including ammonium persulfate, were found to cause skin and

respiratory diseases. Hairdressers incur an increased incidence of asthma and chronic bronchitis. Local exhaust ventilation was recommended.

Ammonium persulfate is used as polymerization initiator in polymer chemistry, etchant and cleaner in manufacture of printed circuit boards, booster in hair bleaching formulations in cosmetics, and secondary oil recovery systems as a polymerization initiator and a gel breaker.

DRAFT-Do not cite, reference or distribute

Article ID: 103

Citation: Das, R., A. Steege, S. Baron, J. Beckman, and R. Harrison. "Pesticide-related illness among migrant farm workers in the United States." *International Journal of Occupational and Environmental Health* 7.4 (2001): 303-12

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 79

Industries/Occupations: Agricultural

Specific Process: Migrant farm workers

Chemical: Pesticides

Specific Chemicals: organophosphates
carbamates
inorganic compounds
pyrethroids

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- F Risk Management
- F.1 Strategies for exposure control
- F.1.A Substitution
- F.1.C Work practice/Administrative controls

Summary: This paper reviews a few pesticides categories (organophosphates, carbamates, inorganic compounds, and pyrethroids) account for over half of all acute occupational illness cases among migrant farm workers in U.S. Most are dermal exposures. Pesticide risk assessment should be based on acute toxicity, chronic toxicity, carcinogenic potency, volume applied, and magnitude of worker poisonings. Also discussed are the hierarchy of control measures, with focus on substitution, establishing effective protections, enforcement, and education. This paper also contains a considerable amount of surveillance data.

Article ID: 107

Citation: [No Author] . Did you know about the health hazards of benzene? 2000. Republic of Singapore, Ministry of Manpower, Occupational Health Department, Republic of Singapore.

Resource Type: Brochure, Pamphlet

Educational Materials: Yes

Number of References: 0

Industries/Occupations:

Specific Process:

Chemical: Solvents

Specific Chemicals: benzene

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- C Hazard Identification
- C.1 Risk phrases, hazard symbols, skin designations
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
 - E.3.A Substitution
 - E.3.B Engineering controls
 - E.3.C Work practice/administration controls
 - E.3.D PPE and PPE regulations

Summary: This brochure from the Singapore Department of Industrial Health presents the hazards of benzene. It describes properties, main uses, exposure hazards, acute effects (narcotic effect, drying effect on skin and mucous membranes), chronic effects (anemia, leukemia), technical control measures (substitution, engineering controls, personal protection), and medical control measures (pre-employment examinations, periodic medical examinations).

Article ID: 108
Citation: [No Author]. Did you know the hazards of solvents? 2000. Republic of Singapore, Ministry of Manpower, Occupational Health Department, Republic of Singapore.
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical: Solvents
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals
E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.B Engineering controls
E.3.C Work practice/administration controls

Summary: This leaflet from the Singapore Department of Industrial Health presents the hazards of solvents. It describes where solvents are used, why solvents are hazardous (volatility, flammability, explosivity, reactivity), their acute health effects (irritation of eyes, nose and throat, headache, nausea, poor coordination, arrhythmia), and their chronic health effects (skin dryness, allergic reactions, neurobehavioral changes, liver damage, limitation of exposure, safe working methods, medical supervision, and first-aid measures.

Article ID: 109
Citation: Soutar, A., S. Semple, R. J. Aitken, and A. Robertson. "Use of patches and whole body sampling for the assessment of dermal exposure." *Annals of Occupational Hygiene* 44.7 (2000): 511-18
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 37
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin
C.5 Exposure modeling

Summary: This paper details the principles underlying patch and whole body sampling and their advantages and disadvantages. This paper takes a recent conceptual model for dermal exposure and the role that the various techniques may play in the application of this model.

Article ID: 121
Citation: Askin, D. P. and M. Volkmann. "Effect of personal hygiene on blood lead levels of workers at a lead processing facility." American Industrial Hygiene Association Journal 58.10 (1997): 752-53

Resource Type: Journal article - primary
Educational Materials: No
Number of References: 3
Industries/Occupations: Other: waste management
Specific Process:
Chemical: Heavy Metals/Inorganic Compounds
Specific Chemicals: Lead
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
C.4 Direct methods to measure exposure
C.4.B Skin
F Risk Management
F.1 Strategies for exposure control
F.1.C Work practice/Administrative controls

Summary: Lead was measured for 24 workers at a lead processing plant who were confident that their hands were clean. Samples were obtained by cleaning one hand with a wipe. Workers with more than 1 year's experience had a significantly positive correlation between lead on their hand and blood lead level, suggesting that lead on the skin enters the bloodstream. The route of entry was not investigated.

Article ID: 124
Citation: Crassweller, Ian. "Helping hands. skin care for the hands."
Occupational Hazards 61.8 (1999): 58
Resource Type: Magazine article
Educational Materials: No
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical: Cleaning Agents
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed: E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: Industrial workers exposed to harsh chemicals or who perform frequent hand-washing are susceptible to occupational skin diseases. This paper provides an overview of skin care and outlines the correct method of cleaning hands.

Article ID: 134
Citation: Sarkis, Karen. "Protecting hands against chemical exposures." Occupational Hazards 62.8 (2000): 53-56
Resource Type: Magazine article
Educational Materials: Yes
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical: Latex
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed: E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations

Summary: The paper discusses how gloves prevent skin exposures, as well as how to select gloves based upon the material being handled, the hazard involved, the task being performed, and comfort. It also discusses the pros and cons of latex, nitrile, neoprene, polyvinylchloride (PVC), polyvinylalcohol (PVA), butyl, and Viton gloves.

Article ID: 136
Citation: Chen, Ching K., United States Environmental Protection Agency Office of Pollution Prevention and Toxics, and Science Applications International Corporation. Occupational dermal exposure assessment : a review of methodologies and field data : final report. EPA 600-R-96-000. 9-30-1996. Washington, D.C., U.S. Environmental Protection Agency, Economics, Exposure and Technology Division, Office of Pollution Prevention and Toxics. Technical publication/report
Resource Type:
Educational Materials: No
Number of References: 108
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.5 Exposure modeling
D Hazard Identification
D.2 Summaries of health effects, dose-response relationships

Summary: This paper summarizes a literature review on dermal exposure assessment and sampling methods. It includes a review of monitoring data on dermal exposure and identifies other methods used for predicting dermal exposure when monitoring data is not available. It evaluates the CEB method (Chemical Engineering Branch of the Environmental Protection Agency's Office of Pollution Prevention and Toxics) for predicting dermal exposure under various scenarios and revises or identifies additional values and input parameters (e.g. quantity remained on skin, skin surface area). This review also makes recommendations to improve the CEB method.

Article ID: 140

Citation: Adams, Robert M. Occupational Skin Disease. Philadelphia: Saunders, 1999

Resource Type: Book/monograph, whole

Educational Materials: No

Number of References: 5112

Industries/Occupations: General - overview, Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Forestry/Fisheries, Manufacturing - Chemical, Manufacturing - Other, Medical Services, Service - Food, Service - Medical, Service - Other, Transportation/Communications/Utility

Specific Process: Describes the occupation and risks, lists irritants, standard allergens and additional allergens for the following occupations: Air hammer operators, abattoir workers, aircraft workers, anodizers, artists, asphalt workers, athletes, automobile mechanics, bakers, barbers, bartenders, bath attendants, battery makers, beekeepers, blueprint makers, bookbinders, brake lining workers, butchers, poultry processors, cabinet makers, candle makers, cannery workers, carpenters, cashiers, caulkers, cement workers, ceramic workers, chemists, cigarette and cigar makers, construction workers, cosmetologists, dairy workers, dentists and dental personnel, dry cleaners, electricians, electron microscopy workers, electroplaters, embalmers, engravers, firefighters, floor layers, florists, food preparation workers, forest workers and loggers and foresters, foundry workers, fur processors, glaziers, health care workers, highway construction workers, histology technicians, house workers, insulation workers, jewelers, laundry workers, locksmiths, machinists, medical personnel, metal polishers, musicians, office workers, optical technicians, painters and paperhangers, papermakers, performing artists, pest control workers, pharmacists, photographers, plastics assembler and fabricator, plumbers and pipe fitters, police officers and detectives, postal workers, pottery and porcelain makers, printers, radio and television repairers, railroad shop workers, roofers, semiconductor and electronics workers, sheet-metal workers, shoe repairers, silk-screening workers, solderers and brazers, stonemasons, swimming pool personnel, tannery workers, tattoo artists, taxidermists, textile workers, theatrical artists, tile setters, tobacco workers, veterinarians, welders, wine makers, and wire drawing operators.

Chemical: General - overview, Heavy Metals/Inorganic Compounds, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, Rubber Additives, Soaps and Detergents, Solvents, Other: Semiconductors, plants, steroids, paints,

Specific Chemicals:

Mixtures: Yes

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.2.B Exposure concentration

- C.2.C Skin area affected
- C.2.E Uptake
- C.4 Direct methods to measure exposure
 - C.4.A Surfaces
 - C.4.B Skin
 - C.4.C Biomonitoring
- C.5 Exposure modeling
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.C Systemic toxicity
 - D.1.D Other health effects
 - D.3 Characterization protocols
 - D.3.E Measurement of skin permeation rates and reservoir effects
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary:

This comprehensive book is a standard reference on occupational skin diseases. It provides an overview as well as an in-depth discussion of skin diseases associated with dozens of specific occupations, their causes and health effects. Each chapter was written by national and international researchers and is individually referenced. It includes step-by-step guide for making precise diagnoses, considerations for differential diagnosis, and practical solutions for skin disease problems.

CHAPTER HEADINGS: Irritants / Allergic Contact Dermatitis: General Principles and Causes / Physical Causes of Occupational Skin Disease / Systemic Toxicity from Percutaneous Absorption / Biological Causes / Contact Urticaria Due to Occupational Exposure / Acne and Folliculitis Caused By Mechanical Factors "Chloracne" / Occupational Skin Cancer / Occupational Nail Disorders / Phototoxicity and Photosensitivity Reactions / Occupational Nail Disorders / Diagnosis and Differential Diagnosis / Atopy, Atopic Dermatitis and Occupational Skin Disease / Diagnostic Patch Testing / The Computer in Occupational Skin Disease / Multiple Chemical Sensitivities / Prevention, Rehabilitation, Treatment / Health Risk Assessment and Occupational Dermatology / Workers Compensation / Plant Inspection / Industrial Processes Commonly Associated with Skin Disease / Soaps and Detergents / Cosmetics / Corticosteroids / Metals / Plastics and Platicizers / Semiconductor Industry / Paints, Varnishes and Lacquers / Solvents / Occupational Skin Problems from Natural and Synthetic Rubber / Petroleum and Petroleum Derivatives / Occupational Dermatitis from Plants and Woods / Pesticides and Other Agriculture Chemicals / Job Descriptions with Their Irritants and Allergens.

Article ID: 141
Citation: Kanerva, L. Handbook of Occupational Dermatology. Berlin, New York: Springer, 2000
Resource Type: Book/monograph, whole
Educational Materials: No
Number of References: 8205
Industries/Occupations: Beauty/Cosmetology, Construction, Manufacturing - Other
Specific Process: Aircraft Industry
Air Hammer Operators
Aromatherapists
Asphalt Workers (Paving)
Automobile Mechanics
Bakers
Barbers and Hairdressers
Bartenders
Bath Attendants
Batik Manufacturing Workers
Battery Makers
Beekeepers
Biotechnical Industry Workers
Boat Builders
Brake-Lining Workers
Butchers and Slaughterhouse Workers
Cabinet Makers
Candle Makers
Confectionery and Candy Makers
Carpenters Car Industry
Cement Workers
Ceramic and Pottery Workers
Cheese Makers
Chemists
Child Daycare Workers
Cigarette and Cigar Makers
Construction Workers
Cosmetologists
Dental Personnel
Detergent Workers
Divers
Electron Microscopy Workers
Electronic Workers
Electroplaters
Embalmers
Engravers
Farmers and Farm Workers
Floor Layers
Florists
Forestry Workers
Foundry Workers
Fur Farming and the Fur Industry
Furniture Manufacture
Gardeners

Glass Workers
Grinders and Brazers of Hard Metal
Hairdressers
Health Care Workers
Highway Construction Workers
Histology Technicians
House Workers
Insulation Workers
Jewelers
Laboratory Technicians
Leather Industry
Locksmiths
Machinists
Masseurs
Mechanics
Metal Industry
Metal Polishers
Military Personnel
Mining (Tunneling)
Musicians
Office Workers
Oil-Rig Workers
Operating-Room Staff
Painters, Lacquerers and Varnishers
Paper and Pulp Workers, and Paper Dermatitis
The Pharmaceutical and Cosmetic Industries
Photographers and Other Photo-Lab Workers
Poultry Processors
Pitch Workers
Plumbers and Pipe Fitters
Printers and Lithographers
Professional Sports: Skin Disorders in Athletes
Railroad Shop Workers
Reindeer Herding
Roofers
Shoe Manufacturers and Repairers
Silk-Screen Workers
Stonemasons
Sugar Artists
Swimming Pool Workers
Tattoo Artists
Textile Workers
Veterinary Surgeons
Welding
Winemaker

Chemical:

Hand Cleansers, Heavy Metals/Inorganic Compounds, Latex, Pesticides, Plastics and Resins, Rubber Additives, Solvents, Other: Disinfectants, formaldehyde, pharmaceuticals, fragrances, enzymes, cement, textiles, leather, adhesives, electronics, paints, polymers, cutting fluids, rubber, plants, spices, and woods.

Specific Chemicals:

Mixtures: No
Audience: Professional
Topics Addressed: D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity
F Risk Management
F.1 Strategies for exposure control
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This comprehensive handbook is comprised of dozens of separate articles on occupation skin exposures and is designed to provide information to health care professionals for dealing with patients. Diseases covered include: allergic and irritant dermatitis; contact urticaria; photodermatoses; infectious diseases; skin tumors; systematic reactions due to percutaneous absorption; predisposed diseases and occupational skin problems. The handbook I divided into four sections.
Part 1 - Epidemiology, Treatment, and Prognosis (57 articles).
Part 2 - Substances and Products (articles on chemical substances) (36 articles)
Part 3 - Job Descriptions with their Irritants and Allergens (94 articles)
Part 4 - Chemistry and Concentrations of Patch test Allergens (3 articles)

Article ID: 142
Citation: Boman, Anders. Protective Gloves for Occupational Use. Boca Raton: CRC Press, 2005
Resource Type: Book/monograph, whole
Educational Materials: No
Number of References: 1014
Industries/Occupations: Service - Medical
Specific Process:
Chemical: Latex, Pesticides
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
F Risk Management
F.1 Strategies for exposure control
F.1.D PPE and PPE regulations

Summary: This book covers quality standards and requirements related to the side effects of glove use, advanced technical standard test method results, permeation and penetration test data, medical reports on side effects, and applications in the glove selection process. It discusses protective glove use safety and use directives, regulations and requirements in Europe and the U.S., standard quality control test methods, in vivo testing with animals, clinical diagnostic testing in patients, and the advantages and disadvantages of glove use.

Article ID: 147
Citation: [No Author] . Assessing and Managing Risks at Work From Skin Exposure to Chemical Agents : Guidance for Employers and Health and Safety Specialists. Sudbury: HSE Books, 2001
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 10
Industries/Occupations: General - overview
Specific Process: List some occupational groups of concern including hairdressers.
Chemical: General - overview
Specific Chemicals: Methylenebis discussed briefly
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals
A.4 Dermal regulations and skin notations
B Exposure Characterization
B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
C Hazard Identification
C.3 Protocols/checklists to identify skin hazards in the workplace
E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.A Substitution
E.3.B Engineering controls
E.3.C Work practice/administration controls
E.3.D PPE and PPE regulations

Summary: This guidance from the UK provides practical advice for employers and the self-employed to reduce the risk to skin exposures from chemicals. The guidance explains how health effects can be caused by skin exposure to chemicals, provides examples of chemicals known to causes health effects, and offers advice for assessing and reducing the risk of skin exposures.

Article ID: 149
Citation: European Centre for Ecotoxicology and Toxicology of Chemicals.
Skin and Respiratory Sensitisers : Reference Chemicals Data
Bank. Brussels, Belgium: ECETOC, 1999
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 292
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization

Summary: This paper takes a list of skin and respiratory sensitizers which may be used for the validation of in vivo or in vitro toxicological tests and identifies chemicals that will facilitate the evaluation and validation of proposed predictive test methods for skin and/or respiratory sensitization potential. It documents those chemicals that are recommended for use as positive and negative controls in the assessment of new predictive tests for skin or respiratory sensitization potential and assesses the utility and accuracy of "novel" test methods.

Article ID: 154
Citation: United States., Environmental Protection Agency., Risk, Assessment Forum, Eastern Research Group, Inc., and Workshop on Issues Associated with Dermal Exposure and Uptake. Summary report for the workshop on issues associated with dermal exposure and uptake U.S. Environmental Protection Agency, Bethesda, MD, December 10-11, 1998. EPA/630/R-00/003 PB2001-108368. 2000. Washington, DC, Risk Assessment Forum, U.S. Environmental Protection Agency.

Resource Type: Technical publication/report
Educational Materials: No
Number of References: 22
Industries/Occupations: Other: Waste Management
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake

Summary: This paper is a summary of a December 1998 workshop that discussed issues concerning dermal uptake, permeability, and absorbed dose to chemicals.

Article ID: 156
Citation: Hubal, Elaine Cohen, United States., Environmental Protection Agency., Human Exposure Analysis Branch., Human Exposure & Atmospheric Sciences Division., and National Exposure, Research Laboratory. Dermal and non-dietary ingestion exposure workshop: NERL Human Exposure Research Program. 1998. Research Triangle Park, N.C., Human Exposure Analysis Branch, Human Exposure & Atmospheric Sciences Division, National Exposure Research Laboratory, U.S. Environmental Protection Agency.
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 125
Industries/Occupations:
Specific Process:
Chemical: Pesticides
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.4.C Biomonitoring
C.5 Exposure modeling

Summary: This paper presents a summary of the dermal and non-dietary ingestion exposure workshop sponsored by U.S. EPA's National Exposure Research Laboratory (NERL) on September 17, 1998. The workshop evaluated methods of measuring and assessing children's exposures to pesticides via dermal contact with contaminated surfaces and objects, non-dietary ingestion, characterizing concentrations of pesticides on surfaces, and quantifying the transfer of contaminants to the skin surface or mouth. The workshop's objectives included identification of exposure assessment methods, determination of best approach, and evaluation of their strengths and weaknesses. Dermal assessment methods reviewed include microactivity approach, macroactivity approach, biomonitoring, passive dosimetry, environmental exposure and activity pattern, florescent tracer, and dermal wash/rinse/wipe.

Article ID: 158
Citation: Guy, Richard and California Univ San Diego La Jolla. Prediction & Assessment of Dermal Exposure. AD-a358 903. 1998. United States, California Univ San Diego La Jolla.
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 13
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.5 Exposure modeling

Summary: This paper presents the basis for algorithms developed to predict the rate of absorption of chemicals following dermal exposure. These algorithms are necessary for performing risk assessments. The paper includes the results of a literature review as well as the algorithm test results. Also included is a review of 13 uptake articles.

Article ID: 179
Citation: Chang H., Tsai C., Lin Y., Shih T., and Lin W. "Total body burden arising from a week's repeated dermal exposure to N,N-dimethylformamide." Occupational and Environmental Medicine 62.3 (2005): 151-56
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 39
Industries/Occupations:
Specific Process:
Chemical: Solvents
Specific Chemicals: N,N-dimethylformamide (DMF)
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.B Skin
C.4.C Biomonitoring
D Hazard Identification
D.2 Summaries of health effects, dose-response relationships

Summary: This paper presents the results of a study designed to estimate the contribution of skin absorption to total body burden of N,N-dimethylformamide (DMF). The study monitored 45 industrial workers and 20 non-DMF exposed subjects for DMF exposure via respiratory and dermal routes. The control group showed no detectable exposure. The study concluded that dermal exposure to DMF can result in significant accumulation of DMF.

Article ID: 185
Citation: Wester RC. and Maibach HI. "Understanding percutaneous absorption for occupational health and safety." International Journal of Occupational and Environmental Health 6.2 (2000): 86-
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 16
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.5 Exposure modeling

Summary: This article describes the skin's barrier properties, percutaneous absorption, in-vivo and in-vitro methods to determine it, and factors that can affect it.

Article ID: 199
Citation: Shum, K. W., J. D. Meyer, Y. Chen, N. Cherry, and D. J. Gawkrödger. "Occupational contact dermatitis to nickel: experience of the British dermatologists (EPIDERM) and occupational physicians (OPRA) surveillance schemes." *Occup. Environ. Med.* 60.12 (2003): 954-57

Resource Type: Journal article - primary
Educational Materials: No
Number of References: 31
Industries/Occupations: Beauty/Cosmetology, Service - Medical
Specific Process: The study focused on the following occupational categories:
hairdressers
bar staff
chefs/cooks
retail cash and checkout operators
catering assistants
counter clerks/cashiers
cleaners
nurses
metal workers
sales assistants
secretaries

Chemical: Heavy Metals/Inorganic Compounds
Specific Chemicals: Nickel
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus

Summary: This study used occupational surveillance reporting databases (EPIDERM and OPRA) to determine to what extent nickel caused occupational contact dermatitis in the UK. The study concluded that up to 12% of total estimated cases of occupational contact dermatitis were due in part to nickel exposure.

Article ID: 200
Citation: Schuhmacher-Wolz, U., F. Kalberlah, R. Oppl, and J. J. van Hemmen. "A toolkit for dermal risk assessment: toxicological approach for hazard characterization." *Ann.Occup.Hyg.* 47.8 (2003): 641-52
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 34
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects

Summary: This article is the 6th article of a 6-part series on RISKOFDERM, a tool for conducting risk assessments. The series was published in the *Annals of Occupational Hygiene* in 2003. The following briefly summarizes each paper in the series:

- 1) Database ID 40 - Outlines a "toolkit" for conducting dermal occupational risk assessment
- 2) Database ID 39 - Describes the assumptions in the toolkit and describes approach to exposure assessment used by the toolkit.
- 3) Database ID 202 - Describes the determinants relevant for dermal exposure models in the scope of regulatory risk assessment.
- 4) Database ID 201 - Describes how default dermal exposure values can be adjusted for specific work situations.
- 5) Database ID 248 - Describes the derivation of the toolkit's default task-based dermal exposure values.
- 6) Database ID 200 - Describes the development of "intrinsic toxicity" (IT) scores used for hazard characterization.

Article ID: 201
Citation: Goede, H. A., S. C. Tijssen, H. J. Schipper, N. Warren, R. Oppl, F. Kalberlah, and J. J. van Hemmen. "Classification of dermal exposure modifiers and assignment of values for a risk assessment toolkit." *Ann.Occup.Hyg.* 47.8 (2003): 609-18
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 39
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects

Summary: This article is the 4th article of a 6-part series on RISKOFDERM, a tool for conducting risk assessments. The series was published in the *Annals of Occupational Hygiene* in 2003. The following briefly summarizes each paper in the series:

- 1) Database ID 40 - Outlines a "toolkit" for conducting dermal occupational risk assessment
- 2) Database ID 39 - Describes the assumptions in the toolkit and describes approach to exposure assessment used by the toolkit.
- 3) Database ID 202 - Describes the determinants relevant for dermal exposure models in the scope of regulatory risk assessment.
- 4) Database ID 201 - Describes how default dermal exposure values can be adjusted for specific work situations.
- 5) Database ID 248 - Describes the derivation of the toolkit's default task-based dermal exposure values.
- 6) Database ID 200 - Describes the development of "intrinsic toxicity" (IT) scores used for hazard characterization.

Article ID: 202

Citation: Marquart, J., D. H. Brouwer, J. H. Gijbbers, I. H. Links, N. Warren, and J. J. van Hemmen. "Determinants of dermal exposure relevant for exposure modeling in regulatory risk assessment." *Ann.Occup.Hyg.* 47.8 (2003): 599-607

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 71

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.1 Workplace factors associated with harmful skin exposures
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.5 Exposure modeling
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects
- E.1.B Systemic health effects

Summary: This article is the 3rd article of a 6-part series on RISKOFDERM, a tool for conducting risk assessments. The series was published in the *Annals of Occupational Hygiene* in 2003. The following briefly summarizes each paper in the series:

- 1) Database ID 40 - Outlines a "toolkit" for conducting dermal occupational risk assessment
- 2) Database ID 39 - Describes the assumptions in the toolkit and describes approach to exposure assessment used by the toolkit.
- 3) Database ID 202 - Describes the determinants relevant for dermal exposure models in the scope of regulatory risk assessment.
- 4) Database ID 201 - Describes how default dermal exposure values can be adjusted for specific work situations.
- 5) Database ID 248 - Describes the derivation of the toolkit's default task-based dermal exposure values.
- 6) Database ID 200 - Describes the development of "intrinsic toxicity" (IT) scores used for hazard characterization.

Article ID: 218
Citation: Kromhout, H. and R. Vermeulen. "Temporal, personal and spatial variability in dermal exposure." Ann.Occup.Hyg. 45.4 (2001): 257-73
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 28
Industries/Occupations: Agricultural, Construction, Manufacturing - Other
Specific Process: Rubber manufacturing
Asphalt paving
Coke production
Chemical: Pesticides, PAHs, Other: Paint
Specific Chemicals:
Mixtures: Yes
Audience: Professional
Topics Addressed: C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.C Skin area affected
C.5 Exposure modeling
E Risk Assessment
E.2 Example risk assessments

Summary: A database of dermal exposure measurements (DERMDAT) comprising data from 20 surveys was created from agricultural and industrial workers containing 6400 observations. Analyses of variability showed median values of the total, within- and between-worker geometric standard deviations to be similar to that published previously for respiratory exposure.

Article ID: 220
Citation: Phillips, A. M. and A. N. Garrod. "Assessment of dermal exposure--empirical models and indicative distributions." Appl.Occup.Environ.Hyg. 16.2 (2001): 323-28
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 12
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling
E Risk Assessment
E.2 Example risk assessments

Summary: This article by the UK's Health and Safety Executive proposes an exposure assessment mechanism, the "indicative distribution approach," to use when little or no direct dermal exposure data are available. It allows one to conduct a risk assessment using a simple 12-box matrix based upon two variables: profile (narrow, medium or wide Geometric Standard Deviation) and deposition level (1-4 mg/minute).

Article ID: 224
Citation: Cherry, N., J. D. Meyer, A. Adisesh, R. Brooke, V. Owen-Smith, C. Swales, and M. H. Beck. "Surveillance of occupational skin disease: EPIDERM and OPRA." Br.J.Dermatol. 142.6 (2000):
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 19
Industries/Occupations: General - overview
Specific Process: Presents data from several large occupational groups, such as chemical operatives, metal assemblers, machine tool operatives, glass manufacturers, and printers.
Chemical: General - overview
Specific Chemicals: Presents data by several chemical agents, such as rubber, soaps, wet work, petroleum, and nickel.
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in workplace
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
Summary: This paper presents UK summary surveillance data from the Occupational Physicians Reporting Activity, OPRA, and its predecessor EPIDERM. OPRA is a voluntary surveillance mechanism that has collected UK occupational skin disease data from dermatologists and occupational physicians since 1993. Incidences by gender, age, occupational group, and chemical group are presented.

Article ID: 227

Citation: Brondeau, M. T., A. Hesbert, C. Beausoleil, and O. Schneider. "To what extent are biomonitoring data available in chemical risk assessment?" *Hum.Exp.Toxicol.* 18.5 (1999): 322-26

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 58

Industries/Occupations:

Specific Process:

Chemical: Solvents

Specific Chemicals: styrene, trichloroethylene, acrylonitrile, buta-1,3-diene, cyclohexane, 1,4-dichlorobenzene, hydrogen fluoride, 2-(2-methoxyethoxy)ethanol, alkanes-C10-13-chloro, benzene-C10-13-alkyl derivatives, bis(pentabromophenyl)ether, diphenylether - octabromo derivative.

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.4 Direct methods to measure exposure
- C.4.C Biomonitoring

Summary: Biomonitoring information is helpful in assessing chemical exposure and would result in more accurate risk assessments. The availability of biomonitoring and metabolism animal data, skin penetration ability, and atmospheric threshold limits were examined for 12 substances: styrene, trichloroethylene, acrylonitrile, buta-1,3-diene, cyclohexane, 1,4-dichlorobenzene, hydrogen fluoride, 2-(2-methoxyethoxy)ethanol, alkanes-C10-13-chloro, benzene-C10-13-alkyl derivatives, bis(pentabromophenyl)ether, and diphenylether - octabromo derivative. The availability of biomonitoring data varied from widely available (for styrene and trichloroethylene) to lacking or scarce.

Article ID: 234
Citation: Sartorelli, P., H. R. Andersen, J. Angerer, J. Corish, H. Drexler, T. Goen, P. Griffin, S. A. Hotchkiss, F. Larese, L. Montomoli, J. Perkins, M. Schmelz, Sandt J. van de, and F. Williams. "Percutaneous penetration studies for risk assessment." *Environ.Toxicol.Pharmacol.* 8.2 (2000): 133-52
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 77
Industries/Occupations:
Specific Process:
Chemical: Soaps and Detergents, Solvents
Specific Chemicals: Dimethylsulfoxide (DMSO)
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.3 Investigation, intervention, and control of occupational skin exposures
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- D Hazard Identification
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects

Summary: This paper by the Percutaneous Penetration Subgroup of the European Community's Dermal Exposure Network presents issues related to percutaneous penetration (uptake) rates for important chemicals, factors affecting those update rates, and gaps in knowledge in the field of percutaneous penetration. Sections include:

- 1) Introduction
- 2) The use of percutaneous penetration data in risk assessment
- 3) Factors influencing the choice of cell characteristics for percutaneous penetration in vitro studies
- 4) Factors influencing the choice of the donor phase for percutaneous penetration in vitro studies
- 5) Factors influencing the choice of skin and membrane for percutaneous penetration in vitro studies
- 6) Factors influencing the choice of receptor fluids for percutaneous penetration in vitro studies
- 7) The presentation of in vitro percutaneous penetration results
- 8) Existing guidelines on percutaneous penetration in vitro studies
- 9) Prediction of plasma levels from penetration data
- 10) The influence of cutaneous metabolism on skin absorption
- 11) Criteria for the selection of reference compounds for in vitro percutaneous penetration
- 12) Correlation between in vitro and in vivo experiments
- 13) The use of microdialysis for the determination of dermal

penetration of hazardous substances in vivo

DRAFT-Do not cite, reference or distribute

Article ID: 243
Citation: Nielsen, J. B. and P. Grandjean. "Criteria for skin notation in different countries." Am.J.Ind.Med. 45.3 (2004): 275-80
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 19
Industries/Occupations:
Specific Process:
Chemical: Solvents
Specific Chemicals: Ethylamine
Cyanamide
Methacrylic acid
Sodium azide
Acrolein
Xylene
N-hexane
Toluene
Perchloroethylene
Benzene
1,3-butadiene
Ethylbenzene
Mixtures: No
Audience: Professional
Topics Addressed: A Overview
A.6 Dermal regulations and skin notations

Summary: This paper compared skin notations on lists of exposure limits for industrial chemicals in six countries: the US, Netherlands, Denmark, Poland, Slovakia, and Germany, and found that one-third of industrial chemicals listed had a skin notation. Differences in criteria for assigning skin notation did not explain discrepancies between countries that otherwise had comparable occupational exposure limits (OELs).

Article ID: 244

Citation: Emmett, E. A. "Occupational contact dermatitis II: risk assessment and prognosis." *Am.J.Contact Dermat.* 14.1 (2003): Journal article - review, meta-analysis

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 51

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.3 Investigation, intervention, and control of occupational skin exposures
- A.4 Skin physiology and functions as a barrier to chemical insults
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- B.4 Clinical protocols for recognition of skin exposure health effects
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.2.E Uptake
- C.4 Direct methods to measure exposure
- C.4.B Skin
- C.4.C Biomonitoring
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.2 Summaries of health effects, dose-response relationships
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects

Summary:

This is the second article in a 2-part series. Both articles are summarized below:

Part 1 (#311): Describes changes in the incidence of recorded occupational skin disease from 1972 to 1999 and suggests explanations for periodic changes. It also examines trends for some specific industries. The authors argue for a more sophisticated approach to prevention and management to reduce the burden of occupational skin disease.

Part 2 (#244): Presents the present state of risk assessment (including components of hazard identification, dermal exposure measurement, absorption, dose-response, and risk characterization) and the prognosis for occupational contact dermatitis.

Article ID: 245
Citation: Ananthapadmanabhan, K. P., D. J. Moore, K. Subramanyan, M. Misra, and F. Meyer. "Cleansing without compromise: the impact of cleansers on the skin barrier and the technology of mild cleansing." *Dermatol.Ther.* 17. Suppl 1 (2004): 16-25
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 40
Industries/Occupations:
Specific Process:
Chemical: Hand Cleansers
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This review discusses the benefits and health impacts of skin cleansers and compares different kinds of skin cleansing products.

Article ID: 248
Citation: Warren, N., H. A. Goede, S. C. Tijssen, R. Oppl, H. J. Schipper, and J. J. van Hemmen. "Deriving default dermal exposure values for use in a risk assessment toolkit for small and medium-sized enterprises." *Ann.Occup.Hyg.* 47.8 (2003): 619-27

Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 30
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling
E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects

Summary: This article is the 5th article of a 6-part series on RISKOFDERM, a tool for conducting risk assessments. The series was published in the *Annals of Occupational Hygiene* in 2003. The following briefly summarizes each paper in the series:

- 1) Database ID 40 - Outlines a "toolkit" for conducting dermal occupational risk assessment
- 2) Database ID 39 - Describes the assumptions in the toolkit and describes approach to exposure assessment used by the toolkit.
- 3) Database ID 202 - Describes the determinants relevant for dermal exposure models in the scope of regulatory risk assessment.
- 4) Database ID 201 - Describes how default dermal exposure values can be adjusted for specific work situations.
- 5) Database ID 248 - Describes the derivation of the toolkit's default task-based dermal exposure values.
- 6) Database ID 200 - Describes the development of "intrinsic toxicity" (IT) scores used for hazard characterization.

Article ID: 249
Citation: Balsat, A., Graeve J. de, and P. Mairiaux. "A structured strategy for assessing chemical risks, suitable for small and medium-sized enterprises." *Ann.Occup.Hyg.* 47.7 (2003): 549-56
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 26
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.B Systemic health effects
E.2 Example risk assessments

Summary: The authors present Regetox, a two-step approach for assessing chemical health risks. The first step uses the method developed in France by the l'Institut National de Recherche et de Sécurité (INRS) to rank potential risk. The second step uses the COSHH method and EASE model established by the UK Health & Safety Executive to assess chemical risk using occupational exposure limits. The authors call Regetox a useful tool for chemical risk assessment in mall and medium-sized enterprises (SMEs).

Article ID: 250
Citation: Kampf, G. and H. Loffler. "Dermatological aspects of a successful introduction and continuation of alcohol-based hand rubs for hygienic hand disinfection." J.Hosp.Infect. 55.1 (2003):
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 61
Industries/Occupations: Service - Medical
Specific Process:
Chemical: Cleaning Agents, Hand Cleansers, Soaps and Detergents
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This review of alcohol-based hand rubs in hospitals found that after years of hand washing, 30% of healthcare workers incur occupational hand dermatitis, mostly contact dermatitis (allergic reactions were rare). Steps to prevent irritant contact dermatitis are also presented.

Article ID: 251
Citation: Brown, J. W., III. "Chemical hand protection." Occup.Health Saf 71.2 (2002): 56-68
Resource Type: Magazine article
Educational Materials: Yes
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical: Solvents, Other: Ketones
Acids
Esters
Specific Chemicals: Benzene
Mixtures: Yes
Audience: General
Topics Addressed: E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The articles summarizes the merits of various work gloves including natural rubber, nitrile, neoprene, Hypalon, butyl, Viton, and ethylene vinyl alcohol (EVOH). This article also discusses selection criteria including chemical resistance, finish and lining, and glove comfort and dexterity. The article also briefly discusses skin conditions and PPE training.

Article ID: 255
Citation: Elsner, P. and W. Wigger-Alberti. "Skin-conditioning products in occupational dermatology." *Int.Arch.Occup.Environ.Health* 76.5 (2003): 351-54
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 20
Industries/Occupations:
Specific Process:
Chemical: Hand Cleansers
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
F Risk Management
F.1 Strategies for exposure control
F.1.D PPE and PPE regulations
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This review discusses the chemistry and mode of action of moisturizers in their prevention of occupational contact dermatitis.

Article ID: 256
Citation: Klotz, A., M. Veeger, and W. Rocher. "Skin cleansers for occupational use: testing the skin compatibility of different formulations." *Int.Arch.Occup.Environ.Health* 76.5 (2003): 367-
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 17
Industries/Occupations:
Specific Process:
Chemical: Abrasives, Hand Cleansers, Solvents
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This article presents an overview of skin-cleansing products and their ingredients and discusses skin compatibility and cleansing effectiveness. The authors advocate a range of skin cleansers depending upon the degree of contamination. They also recommend avoiding solvents and abrasives to prevent occupational dermatitis, and stress the importance of worker education.

Article ID: 257
Citation: Zeliger, H. I. "Toxic effects of chemical mixtures."
Arch.Environ.Health 58.1 (2003): 23-29
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 47
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: Yes
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects

Summary: Exposures to chemical mixtures have reportedly produced unexpected effects. Examination of new case studies, as well as those previously reported, shows that when the human body is exposed to mixtures of chemicals that include lipophilic and hydrophilic species, the lipophiles facilitate the absorption of the hydrophiles at enhanced levels and produce effects that are not expected from individual chemicals. These effects include enhanced acute and chronic responses, low-level concentration response, and unexpected target organ attack. Octanol:water partition coefficients are predictive of relative lipophilicity and hydrophilicity. The findings have implications for safe drinking water standards, air quality standards, safe industrial and environmental exposure levels, product formulation, product labeling, and protocols for toxicity testing of chemical products.

Article ID: 258
Citation: Kutting, B. and H. Drexler. "Effectiveness of skin protection creams as a preventive measure in occupational dermatitis: a critical update according to criteria of evidence-based medicine." Int.Arch.Occup.Environ.Health 76.4 (2003): 253-59
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 63
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This paper reviews the literature to answer the questions: 1) Can a skincare regimen effectively reduce or eliminate work-related poor skin conditions 2) Do protective creams prevent harmful substances from penetrating and adhering to the skin 3) Is the differentiation between pre-exposure and post-exposure products justified by reliable data? The authors also address the merit of the traditional three-step skin protection program: skin protection before work, cleaning, and skin-care after work. The paper concludes that not enough data have been accumulated to prove the benefit of skin protection measures under real workplace conditions.

Article ID: 264
Citation: Agner, T. and E. Held. "Skin protection programmes." Contact Dermatitis 47.5 (2002): 253-56
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 46
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
F Risk Management
F.1 Strategies for exposure control
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs
F.2 Protocols for risk management
F.2.B Development of approach to achieve exposure reduction goal

Summary: The paper discusses 10 recommendations for skin protection involving washing, gloves, moisturizers, and behavioral changes.

Article ID: 267

Citation: Klingner, T. D. and M. F. Boeniger. "A critique of assumptions about selecting chemical-resistant gloves: a case for workplace evaluation of glove efficacy." *Appl.Occup.Enviro.Hyg.* 17.5 (2002): 360-67

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 48

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: Yes

Audience: Professional

Topics Addressed:

- A Overview
- A.6 Dermal regulations and skin notations
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- F Risk Management
- F.1 Strategies for exposure control
- F.1.D PPE and PPE regulations

Summary: Those selecting gloves should not only rely upon the manufacturers' laboratory-generated chemical permeation data, for this data may not reflect conditions in the actual workplace (e.g., elevated temperature, flexing, pressure, and product variation between suppliers). This article presents glove selection criteria and recommends dermal monitoring to evaluate glove performance under actual-use conditions.

Article ID: 269
Citation: Del, Rosso J. "Protecting the hand-skin barrier in the workplace."
Occup.Health Saf 70.9 (2001): 116-20
Resource Type: Magazine article
Educational Materials: No
Number of References: 3
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This article recommends steps for proper skin care, including gloves and barrier creams.

Article ID: 270
Citation: Wigger-Alberti, W. and P. Elsner. "Occupational contact dermatitis in the textile industry." *Curr.Probl.Dermatol.* 31 (2003):
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 68
Industries/Occupations: Manufacturing - Other, Other: Textile industry
Specific Process: Dyeing
Finishing
Chemical: Organic Dyes, Plastics and Resins
Specific Chemicals: Formaldehyde
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization

Summary: The paper discusses irritant and allergic contact dermatitis in the textile industry, primarily from resins, formaldehyde and dyes, as well as tasks with exposure potential.

Article ID: 278
Citation: Susitaival, P., M. A. Flyvholm, B. Meding, L. Kanerva, M. Lindberg, A. Svensson, and J. H. Olafsson. "Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure." *Contact Dermatitis* 49.2 (2003): 70-76
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 46
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.3 Surveillance study protocols/procedures for gathering data

Summary: This paper describes the Nordic Occupational Skin Questionnaire (NOSQ-2002) (both short and long versions) for use in getting more survey data on the epidemiology of occupational skin diseases.

Article ID: 282
Citation: Chew, A. L. and H. I. Maibach. "Occupational issues of irritant contact dermatitis." *Int.Arch.Occup.Environ.Health* 76.5 (2003): 339-46

Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 62
Industries/Occupations: Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Manufacturing - Other, Service - Food, Service - Medical

Specific Process: Includes table of job categories and associated irritants
Chemical: Cleaning Agents, Corrosives, Pesticides, Soaps and Detergents, Solvents

Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- B.2 Loss of workdays and impact on productivity
- B.4 Clinical protocols for recognition of skin exposure health effects
- C Exposure Characterization
- C.4 Direct methods to measure exposure
- C.4.B Skin
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- F Risk Management
- F.1 Strategies for exposure control
- F.1.D PPE and PPE regulations
- F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This paper reviews the various types of occupational irritant contact dermatitis (ICD), along with epidemiological data, risk factors, pathophysiology, diagnosis and management of ICD.

Article ID: 283

Citation: Antezana, M. and F. Parker. "Occupational contact dermatitis." Immunol.Allergy Clin.North Am. 23.2 (2003): 269-90, vii

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 43

Industries/Occupations: Agricultural, Beauty/Cosmetology, Construction, Forestry/Fisheries, Manufacturing - Other, Service - Medical

Specific Process: Painting
Printing
Forestry
Electronics

Chemical: Heavy Metals/Inorganic Compounds, Organic Dyes, Pesticides, Rubber Additives, Other: Adhesives, paints

Specific Chemicals: Paraphenylenediamine
Nickel
Chromium
Ethylenediamine
Thimerosal

Mixtures: No

Audience: Professional

Topics Addressed: A Overview
A.2 Health hazards resulting from skin exposure to chemicals
B Surveillance and Clinical Aspects
B.4 Clinical protocols for recognition of skin exposure health effects
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
F Risk Management
F.1 Strategies for exposure control
F.1.D PPE and PPE regulations
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This paper presents the epidemiology, pathophysiology, and symptomology of occupational dermatitis, as well as diagnostic tests for dermatitis. There is some discussion of at-risk occupations, common allergens and irritants, and preventive management.

Article ID: 286
Citation: Brown, T. "Strategies for prevention: occupational contact dermatitis." *Occup.Med.(Lond)* 54.7 (2004): 450-57
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 109
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.2 Loss of workdays and impact on productivity
B.3 Surveillance study protocols/procedures for gathering data
F Risk Management
F.1 Strategies for exposure control
F.1.A Substitution
F.1.B Engineering controls
F.1.D PPE and PPE regulations
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs
F.2 Protocols for risk management
F.2.B Development of approach to achieve exposure reduction goal

Summary: This paper presents strategies for preventing occupational contact dermatitis (OCD) including elimination/substitution, engineered/technical controls, personal protective equipment (PPE), identifying susceptible individuals, education, training and surveillance.

Article ID: 290
Citation: Andersen, K. E. "Occupational issues of allergic contact dermatitis." Int.Arch.Occup.Environ.Health 76.5 (2003): 347-50
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 28
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.4 Clinical protocols for recognition of skin exposure health effects
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin
C.4.C Biomonitoring
D Hazard Identification
D.2 Summaries of health effects, dose-response relationships

Summary: This review addresses occupational allergic contact dermatitis. The paper discusses epidemiological data, diagnosis, exposure assessment, and dose-response relationship. Preventive measures are also discussed, though in general terms.

Article ID: 297
Citation: Koch, P. "Occupational contact dermatitis. Recognition and management." Am.J.Clin.Dermatol. 2.6 (2001): 353-65
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 84
Industries/Occupations: Beauty/Cosmetology, Construction, Manufacturing - Other, Service - Food, Service - Medical
Specific Process: Hairdressers, dental laboratory technicians, healthcare workers, metal workers, leather and shoe workers, bakers, caterers, confectioners, and cook
Chemical: Latex, Organic Dyes, Pesticides, Rubber Additives, Solvents, Other: Concrete, glues, leather
Specific Chemicals: Use, concentration, associated industry, and health effects are presented for dozens of chemicals.
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.B Exposure concentration
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis

Summary: This paper primarily focuses on 8 broad occupational categories at-risk for occupational contact dermatitis (OCD) and dozens of their associated chemical irritants and sensitizers. The categories are hairdressers, dental laboratory technicians, healthcare workers, construction industry workers, metal workers, leather and shoe workers, florists and gardeners, and food service (bakers, caterers, confectioners, and cooks).

Article ID: 299
Citation: Diepgen, T. L. and P. J. Coenraads. "The epidemiology of occupational contact dermatitis." *Int.Arch.Occup.Environ.Health* 72.8 (1999): 496-506

Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 75
Industries/Occupations: General - overview
Specific Process: Discussion of frequency of occupational contact dermatitis (OCD) among certain occupational categories.

Chemical:
Specific Chemicals: Dichromate
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.3 Characterization protocols
- D.3.B Irritation potential
- D.3.C Sensitization potential
- F Risk Management
- F.1 Strategies for exposure control
- F.1.D PPE and PPE regulations
- F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This review article discusses the lack of epidemiologic data on occupational contact dermatitis (OCD). It also discusses case ascertainment and bias, distribution of occupational allergic and irritant contact dermatitis, interrelationship between exogenous (allergens, irritants) and endogenous factors, the prognosis of OCD, the social and economic impact of OCD, and the need for intervention studies.

Article ID: 304
Citation: Packham, C. L. "Risk assessment and exposure control in an occupational setting." Curr.Probl.Dermatol. 25 (1996): 133-44
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects
E.2 Example risk assessments
F Risk Management
F.1 Strategies for exposure control
F.1.B Engineering controls
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations
F.2 Protocols for risk management
F.2.B Development of approach to achieve exposure reduction goal

Summary: This paper presents a process by which managers can identify dermal risks of greatest concern, a necessary step prior to invoking risk management strategies.

Article ID: 306
Citation: Diepgen, T. L. "Epidemiological studies on the prevention of occupational contact dermatitis." Curr.Probl.Dermatol. 25 (1996): 1-9
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 13
Industries/Occupations: Beauty/Cosmetology
Specific Process: Provides incidence among several occupational categories.
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.2 Summaries of health effects, dose-response relationships

Summary: This paper answers the following questions about occupational contact dermatitis (OCD):
1) What is its public health importance?
2) How large are prevalence and incidence?
3) What industries are associated with higher risk
4) What are the occupational exposures that cause it?
5) Who is at risk?
6) What is the prognosis for patients?
7) What preventative measures and interventions are effective?

Article ID: 307
Citation: Lushniak, B. D. "The epidemiology of occupational contact dermatitis." *Dermatol.Clin.* 13.3 (1995): 671-80
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 66
Industries/Occupations: Agricultural, Construction, Forestry/Fisheries, Manufacturing - Chemical, Manufacturing - Other, Mining, Service - Food, Service - Medical, Service - Other, Transportation/Communications/Utility, Other: Trade, finance/insurance/realty, meat products, leather, motorvehicles

Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- B.2 Loss of workdays and impact on productivity
- B.3 Surveillance study protocols/procedures for gathering data
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis

Summary: This article reviews occupational contact dermatitis epidemiologic data sources for important information on the prevalence, diagnosis, public health importance, risk factors, etiologic agents, prognosis, and preventive measures. It also provides incidences for different occupational group.

Article ID: 311
Citation: Emmett, E. A. "Occupational contact dermatitis I: incidence and return to work pressures." Am.J.Contact Dermat. 13.1 (2002):
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 8
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.2 Loss of workdays and impact on productivity

Summary: This is the first article in a 2-part series. Both articles are summarized below:
Part 1 (#311): Describes changes in the incidence of recorded occupational skin disease from 1972 to 1999 and suggests explanations for periodic changes. It also examines trends for some specific industries. The authors argue for a more sophisticated approach to prevention and management to reduce the burden of occupational skin disease.
Part 2 (#244): Presents the present state of risk assessment (including components of hazard identification, dermal exposure measurement, absorption, dose-response, and risk characterization) and the prognosis for occupational contact dermatitis.

Article ID: 314
Citation: Rietschel, R. L. "Clues to an accurate diagnosis of contact dermatitis." *Dermatol. Ther.* 17.3 (2004): 224-30
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 23
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.2 Summaries of health effects, dose-response relationships

Summary: This paper discusses historical, morphologic, and diagnostic steps one can take to accurately diagnosis contact both allergic and irritant dermatitis. A comprehensive assessment of the patient's environment is needed to obtain a correct diagnosis.

Article ID: 315
Citation: Tupker, R. A. "Prediction of irritancy in the human skin irritancy model and occupational setting." *Contact Dermatitis* 49.2 (2003): 61-69
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 64
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.4 Direct methods to measure exposure
C.4.B Skin

Summary: This review presents findings in the field of skin irritancy testing and discusses factors that determine irritancy testing outcome, including extrinsic and intrinsic factors, such as genetics and prior exposure. This review also discusses the results from prospective cohort studies as they relate to factors influencing the development of occupational dermatitis.

Article ID: 320
Citation: Byrne, M. A. "Suction methods for assessing contamination on surfaces." Ann.Occup.Hyg. 44.7 (2000): 523-28
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 21
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.5 Exposure modeling

Summary: This paper reviews commonly employed sampling techniques for occupational surfaces reported in the literature, removal efficiency, and applicability to dermal exposure assessment.

Article ID: 321
Citation: Semple, S., D. H. Brouwer, F. Dick, and J. W. Cherrie. "A dermal model for spray painters. Part II: estimating the deposition and uptake of solvents." *Ann.Occup.Hyg.* 45.1 (2001): 25-33
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 26
Industries/Occupations: Construction
Specific Process: Spray painting
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake

Summary: Part 2 of 2. The paper presents a model based upon "a process-based, structured approach" that both estimates occupational dermal exposure and uptake of solvents - using airless spray painters as an example. Estimates are based upon spray technique, object shape, workers' individual work practices, droplet formation and deposition. Predicted exposure showed reasonable correlation with the actual measured exposure and the authors conclude that a structured, process-based approach has the potential to produce reliable estimates of dermal exposure, and they call for additional field studies. Part 2 identifies the determinants of exposure, calculates the flux of solvent through the stratum corneum, and total dermal uptake using a range of exposure scenarios.

Article ID: 322
Citation: Brouwer, D. H., S. Semple, J. Marquart, and J. W. Cherrie. "A dermal model for spray painters. Part I: subjective exposure modeling of spray paint deposition." *Ann.Occup.Hyg.* 45.1 (2001): 15-23
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 21
Industries/Occupations: Construction
Specific Process: Spray painting
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.5 Exposure modeling

Summary: Part 1 of 2. The paper presents a model based upon "a process-based, structured approach" that both estimates occupational dermal exposure and uptake of solvents - using airless spray painters as an example. Estimates are based upon spray technique, object shape, workers' individual work practices, droplet formation and deposition. Predicted exposure showed reasonable correlation with the actual measured exposure and the authors conclude that a structured, process-based approach has the potential to produce reliable estimates of dermal exposure, and they call for additional field studies.
Part 1 presents this "structured, subjective assessment" of dermal exposure estimation and evaluates its reliability.

Article ID: 323
Citation: Schneider, T., R. Vermeulen, D. H. Brouwer, J. W. Cherrie, H. Kromhout, and C. L. Fogh. "Conceptual model for assessment of dermal exposure." *Occup. Environ. Med.* 56.11 (1999): 765-73
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 47
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.B Skin

Summary: This paper presents a multicompartment model for dermal exposure assessment. The model describes the transport of contaminant mass from the source of the hazardous substance to the surface of the skin. The model also offers a standardized methods of measurement using consistent terminology. The merits of existing models are also discussed.

Article ID: 327
Citation: Boeniger, M. F. and T. D. Klingner. "In-use testing and interpretation of chemical-resistant glove performance." Appl.Occup.Environ.Hyg. 17.5 (2002): 368-78
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 49
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.2 Loss of workdays and impact on productivity
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.B Skin
C.5 Exposure modeling
F Risk Management
F.1 Strategies for exposure control

Summary: This article reviews methods for testing glove performance during actual use and offers a method for estimating acceptable exposure guidance criteria for evaluation of chemicals that are systemically absorbed.

Article ID: 331
Citation: Basketter, D. A., P. Evans, G. F. Gerberick, and I. A. Kimber.
"Factors affecting thresholds in allergic contact dermatitis: safety
and regulatory considerations." *Contact Dermatitis* 47.1 (2002): 1-6
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 39
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
D Hazard Identification
D.2 Summaries of health effects, dose-response relationships
D.4 Other

Summary: This article examines the nature of thresholds in allergic contact dermatitis. These thresholds vary according to whether skin exposure is transient or prolonged, open or occluded and single or repeated, as well as the condition of the skin, the presence of inflammation and the vehicle in which a chemical sensitizer comes into contact with the skin. Recommendations are provided for safety evaluation and dermal regulations. Allergic potencies also are provided for 38 chemicals using both guinea pig and lymph node assay data.

Article ID: 335
Citation: Schlede, E., W. Aberer, T. Fuchs, I. Gerner, H. Lessmann, T. Maurer, R. Rossbacher, G. Stropp, E. Wagner, and D. Kayser. "Chemical substances and contact allergy--244 substances ranked according to allergenic potency." *Toxicology* 193.3 (2003): 219-
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 15
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.3 Characterization protocols
D.3.C Sensitization potential

Summary: In 2001, 30 experts including university dermatologists, industry representatives, and regulators, concluded a 15 year project to rank 244 chemicals by contact allergenic potency, based on clinical and experimental data on humans and animals. The chemicals were assigned to one of three categories. Category A (98 substances) includes potent contact allergens with significant allergenic properties. Category B (77 substances) includes substances with a solid-based indication of a contact allergenic potential and substances with the capacity of cross-reactions. Category C (69 substances) includes substances with insignificant or questionable allergenic effects.

Article ID: 338
Citation: Gerberick, G. F., C. A. Ryan, P. S. Kern, R. J. Dearman, I. Kimber, G. Y. Patlewicz, and D. A. Basketter. "A chemical dataset for evaluation of alternative approaches to skin-sensitization testing." *Contact Dermatitis* 50.5 (2004): 274-88
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 45
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.3 Characterization protocols
D.3.C Sensitization potential

Summary: This article presents a list of 244 chemicals listed and their relative sensitization potency, as determined by the local lymph node assay (LLNA). The authors state this dataset can be used to evaluate and calibrate novel approaches to skin sensitization testing.

Article ID: 340
Citation: Basketter, D. A., M. A. Flyvholm, and T. Menne. "Classification criteria for skin-sensitizing chemicals: a commentary." *Contact Dermatitis* 40.4 (1999): 175-82
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 35
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.3 Investigation, intervention, and control of occupational skin exposures
A.6 Dermal regulations and skin notations
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity

Summary: This article reviews the benefits and limitations of systems to classify substances with high dermal potency (either significant skin sensitizers or important contact allergens). Included are discussions of strategies used by the European Union, World Health Organization, and the US. Such information is necessary for proper risk assessment and management of skin sensitizers.

Article ID: 347
Citation: Fitzpatrick, D., J. Corish, and B. Hayes. "Modelling skin permeability in risk assessment--the future." *Chemosphere* 55.10 (2004): 1309-14
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 31
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.5 Exposure modeling
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects
D.3.F [Q]SARs – development, validation, and application

Summary: This article presents recent progress in skin permeability modeling and compares two methods of assessing skin permeability: quantitative structure-activity relationships (QSARs) and mathematical modeling based on analytical or numerical solutions to partition and transport equations. It also proposes steps that can be taken for future advancements in this field.

Article ID: 348
Citation: Smith Pease, C. K. "From xenobiotic chemistry and metabolism to better prediction and risk assessment of skin allergy." Toxicology 192.1 (2003): 1-22
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 63
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.B Allergic contact dermatitis/sensitization
- D.2 Summaries of health effects, dose-response relationships
- D.3 Characterization protocols
- D.3.C Sensitization potential
- D.3.F [Q]SARs – development, validation, and application

Summary: This review explores general chemical and metabolic processes involved in the process of skin sensitization to chemicals. It also discusses recent work using xenobiotics to explore sensitization mechanisms.

Article ID: 349
Citation: Hostynek, J. J. "Factors determining percutaneous metal absorption." Food Chem.Toxicol. 41.3 (2003): 327-45
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 157
Industries/Occupations:
Specific Process:
Chemical: Heavy Metals/Inorganic Compounds
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake

Summary: This review article describes factors affecting the permeability of metals through the skin including dose, vehicle, volume, counter ion, chemical bond and polarity, valence, protein reactivity, solubility, age of skin, anatomical site, homeostatic controls, skin layers, and oxidation/reduction.

Article ID: 350
Citation: Moss, G. P., J. C. Dearden, H. Patel, and M. T. Cronin.
"Quantitative structure-permeability relationships (QSPRs) for percutaneous absorption." *Toxicol. In Vitro* 16.3 (2002): 299-317
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 123
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects
D.3.F [Q]SARs – development, validation, and application

Summary: This article reviews the use and validity of the current state-of-the-art in Quantitative Structure Property Relationships (QSPRs), and more specifically, Quantitative Structure Activity Relationship (QSARs) used in modeling the absorption of chemicals through the skin.

Article ID: 351
Citation: Poet, T. S. "Assessing dermal absorption." Toxicol.Sci. 58.1 (2000): 1-2
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 7
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake

Summary: This short article summarizes environmental and non-environmental factors that contribute to dermal absorption.

Article ID: 353
Citation: Fenske, R. A. "Dermal exposure: a decade of real progress."
Ann.Occup.Hyg. 44.7 (2000): 489-91
Resource Type: Other - Editorial
Educational Materials: No
Number of References: 17
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: A Overview
A.3 Investigation, intervention, and control of occupational skin exposures

Summary: This letter to the editor introduces an issue of the journal which features recent work on workplace dermal exposure assessment. It summarizes the history of progress made in dermal exposure assessment through 2000.

Article ID: 354
Citation: Kissel, J. and R. Fenske. "Improved estimation of dermal pesticide dose to agricultural workers upon reentry." Appl.Occup.Environ.Hyg. 15.3 (2000): 284-90
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 19
Industries/Occupations: Agricultural
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.5 Exposure modeling

Summary: This article presents a method for agricultural worker dermal dose estimation which accounts for the effect of delay in post-shift washing on dose.

Article ID: 356
Citation: Fenske, R. A. "Dermal exposure assessment techniques." Ann.Occup.Hyg. 37.6 (1993): 687-706
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 94
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.4.C Biomonitoring
C.5 Exposure modeling

Summary: This article discusses three primary pathways to exposure: immersion, deposition of aerosol or uptake of vapor through the skin, and contact with contaminated surfaces. It also discusses three primary sampling methods: surrogate skin, chemical removal, and fluorescent tracers. The paper also presents a dermal exposure sampling strategy which addresses issues associated with the sampling method, representative sampling and sample duration. Finally, it recommends the development of dermal occupational exposure limits (DOELs) for selected workplaces and chemical agents.

Article ID: 359

Citation: Benford, D. J., J. Cocker, P. Sartorelli, T. Schneider, Hemmen J. van, and J. G. Firth. "Dermal route in systemic exposure." Scand.J.Work Environ.Health 25.6 (1999): 511-20

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 31

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.4 Direct methods to measure exposure
- C.4.A Surfaces
- C.4.B Skin
- C.4.C Biomonitoring
- C.5 Exposure modeling
- D Hazard Identification
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects
- D.3.F [Q]SARs – development, validation, and application

Summary: This article discusses methods for measuring skin and surface contamination, biological monitoring and estimating dermal uptake via in vivo and in vivo methods. The article also discusses how standardized components of exposure characterization can be developed and how they can be used to support a generic approach to dermal risk assessment and allow for the development of workplace-appropriate assessment strategies.

Article ID: 362
Citation: Nygren, O. "New approaches for assessment of occupational exposure to metals using on-site measurements." J.Environ.Monit. 4.5 (2002): 623-27
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 10
Industries/Occupations:
Specific Process:
Chemical: Heavy Metals/Inorganic Compounds
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin

Summary: This article compares the accuracy of XRF florescent tracers to the traditional use of membrane filters followed by laboratory analysis. Tests were performed using dust, cobalt, nickel, and molybdenum.

Article ID: 367
Citation: Hewett, P. "Misinterpretation and misuse of exposure limits."
Appl.Occup.Environ.Hyg. 16.2 (2001): 251-56
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 28
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects
F Risk Management
F.2 Protocols for risk management
F.2.B Development of approach to achieve exposure reduction goal

Summary: This article discusses occupational exposure limits (OELs) and distinguishes between how they should be used in risk assessment and exposure risk management and how they can be misused in each.

Article ID: 368
Citation: Marquart, H., S. Maidment, J. L. McClaflyn, and M. C. Fehrenbacher. "Harmonization of future needs for dermal exposure assessment and modeling: a workshop report." *Appl.Occup.Environ.Hyg.* 16.2 (2001): 218-27
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 42
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.5 Exposure modeling

Summary: This article is a summary of the 1999 International Symposium on Occupational Exposure Databases and Their Application for the Next Millennium held in London. The workshop was organized in an effort to harmonize future needs in this area. It discusses what is known about methods to measure the amount of contaminant on the skin and surfaces, the amount of contaminant absorbed through the skin, and merits of these approaches. It also discusses what is needed in the field, including raising awareness among occupational health practitioners, and creating simple tools for small and medium-sized businesses to use in risk assessment and management activities.

Article ID: 373
Citation: Furtaw, E. J., Jr. "An overview of human exposure modeling activities at the USEPA's National Exposure Research Laboratory." *Toxicol.Ind.Health* 17.5-10 (2001): 302-14
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 18
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling
E Risk Assessment
E.2 Example risk assessments

Summary: This article reviews the following risk assessment models developed by the US EPA's National Exposure Research Laboratory (NERL). NERL modeling efforts, though directed at environmental exposures, are applicable to occupational exposures as well. Modeling has focused on understanding the factors that influence exposure through to dose, and have been designed for use in risk assessments and for risk management. Specific models reviewed include:

- Community Multiscale Air Quality model (Models-3/CMAQ) for pollutant concentrations in ambient (outdoor) air
- Computational Fluid Dynamics (CFD) for air flow and pollutant concentrations
- Stochastic Human Exposure and Dose Simulation (SHEDS) for human inhalation exposure to airborne particulates, toxics, or pesticides.
- Framework for Risk Analysis in Multimedia Environmental Systems--Multimedia, Multipathway, Multireceptor Risk Assessment (FRAMES-3MRA) for human and ecological exposure and risk assessments of hazardous waste sites
- Exposure-Related Dose-Estimating Model (ERDEM) for physiologically based pharmacokinetic (PBPK) modeling of pesticides and VOCs.

Article ID: 376
Citation: Ross, J. H., M. H. Dong, and R. I. Krieger. "Conservatism in pesticide exposure assessment." Regul.Toxicol.Pharmacol. 31.1 (2000): 53-58
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 39
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.E Uptake
E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects

Summary: This article discusses three exposure assessment factors that, in combination, could overestimate exposure to pesticides by as much as two orders of magnitude. They are dermal absorption from animal studies, daily dose extrapolated from partial day monitoring, and nonbolus dose from dermal or inhalation exposure. The authors recommend the generation of more appropriate data to minimize exposure overestimation, specifically human dermal absorption data, as well as conducting full-day exposure monitoring studies, and if feasible, generating dermal rather than oral toxicology data in those cases where the dermal route predominates.

Article ID: 379
Citation: [No Author] . Health Effects Test Guidelines: OPPTS 870.2500, Acute Dermal Irritation. PB2005-102081/XAB EPA-712-C-98-196, -12. 1998. Environmental Protection Agency, Washington, DC. Office of Prevention, Pesticides and Toxic Substances.
Resource Type: Guideline
Educational Materials: No
Number of References: 14
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: D Hazard Identification
D.3 Characterization protocols
D.3.A Corrosivity
D.3.B Irritation potential

Summary: This guideline specifies a procedure for testing acute dermal irritation of pesticides on animals. It is intended to meet testing requirements of both the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. 136, et seq.) and the Toxic Substances Control Act (TSCA) (15 U.S.C. 2601). The source materials used in developing this harmonized OPPTS test guideline are 40 CFR 798.4470 Primary Dermal Irritation; OPP 81-5 Primary Dermal Irritation (Pesticide Assessment Guidelines, Subdivision F-Hazard Evaluation; Human and Domestic Animals) EPA report 540/09-82-025, 1982; and OECD 404 Acute Dermal Irritation/ Corrosion.

Article ID: 384
Citation: Riviere, J. E. Percutaneous Absorption of Chemical Mixtures Relevant to the Gulf War Final rept. 1 Feb 1999-31 Jan 2002. ADA409100/XAB, -163. 2002. North Carolina State Univ. at Raleigh.
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 38
Industries/Occupations: Other: US Military
Specific Process:
Chemical: Pesticides
Specific Chemicals: N,N-Diethyl-m-toluamide (DEET), Permethrin, pyridostigmine bromide, diisopropylfluorophosphate (DFP), low-level sulfur mustard (RD), DFP, JP-8 jet fuel
Mixtures: Yes
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.3 Characterization protocols
D.3.D Potential to cause systemic effects
D.3.E Measurement of skin permeation rates and reservoir effects
Summary: The report quantifies the dermal absorption and cutaneous toxicity of chemical mixtures associated with Gulf War Illness. The research focuses on how (14)C-permethrin, pyridostigmine bromide, diisopropylfluorophosphate (DFP), low-level sulfur mustard (RD), DFP, and JP-8 jet fuel affects exposure to N,N-Diethyl-m-toluamide (DEET). These data demonstrate an effect of systemic drugs on dermal absorption, and underscore the complexity of risk assessments of complex chemical mixtures.

Article ID: 386

Citation: Riviere, J. E., Baynes, R. E., and Smith, C. Quantitating the Percutaneous Absorption of Mechanistically Defined Chemical Mixtures Final rept. 15 Nov 1997-14 Nov 2000. ADA386659/XAB, -109. 2001. North Carolina State Univ. at Raleigh. Cutaneous Pharmacology and Toxicology Center. Technical publication/report

Resource Type: No

Educational Materials: No

Number of References: 7

Industries/Occupations: Transportation/Communications/Utility, Other: Jet aircraft

Specific Process:

Chemical: Petroleum Products & Lubricants

Specific Chemicals: Jet fuels, Jet A, JP-8, JP-8 +100, jet fuel hydrocarbons, naphthalene, dodecane, hexadecane, jet fuel performance additives, DIEGME, 8Q2I, Stadis 450

Mixtures: Yes

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- D Hazard Identification
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects

Summary: This report discusses the percutaneous absorption and cutaneous toxicity of jet fuels (Jet A, JP-8, JP-8 +100), jet fuel hydrocarbons (naphthalene, dodecane, hexadecane), and performance additives (DIEGME, 8Q2I, Stadis 450). The report cites 7 journal articles (authored or co-authored by Jim E. Riviere) which are included in full. They are:

- Riviere JE, Monteiro-Riviere NA, Brooks JD, Budsaba K, Smith CE: Dermal absorption and distribution of topically dosed jet fuels Jet A, JP-8, and JP-8(100). *Toxicol. Appl. Pharmacol.* 160: 60-75, 1999.
- Allen DG, Riviere JE, Monteiro-Riviere NA: Induction of early biomarkers of inflammation produced by keratinocytes exposed to jet fuels Jet-A, JP-8 and JP-8(100). *J. Biochemical Molecular Toxicology* 14: 231-237, 2000.
- Budsaba K, Smith CE, Riviere JE: Compass Plots: A combination of star plot and analysis of means (ANOM) to visualize significant interactions in complex toxicology studies. *Toxicol. Methods* 10: 313-332, 2000.
- Riviere JE, Brooks JD, and Qiao GL: Methods for assessing the percutaneous absorption of volatile chemicals in isolated perfused skin: Studies with chloropentafluorobenzene (CPFB) and dichlorobenzene (DCB). *Toxicol. Methods* 10: 265-281, 2000.
- Baynes RE, Martin T, Craigmill AL, Riviere JE: Strategies for estimating provisional acceptable residues (PAR) for drug use in livestock. *Regulatory Toxicol. Pharmacol.* 29: 287-299, 1999.
- Allen DG, Riviere JE, Monteiro-Riviere NA: Cytokine induction as

a measure of cutaneous toxicity in primary and immortalized porcine keratinocytes exposed to jet fuels and their relation to normal human keratinocytes. Toxicology Letters 119: 209-217, 2001.

- Rhyne BN, Pirone JR, Monteiro-Riviere NA: The use of enzyme histochemistry in detecting cutaneous toxicity of three topically applied jet fuel mixtures. Toxicology Mechanisms and Methods 12: 17-34, 2002.

DRAFT-Do not cite, reference or distribute

Article ID: 398
Citation: Riviere, J. E., Monteiro-Riviere, N. A., Baynes, R. E., Xia, X., and Smith, C. Quantitating the Percutaneous Absorption of Mechanistically-Defined Chemical Mixtures Final rept. 15 Dec 2000-14 Dec 2003. ADA422081/XAB, -33. 2004.
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 11
Industries/Occupations: Transportation/Communications/Utility, Other: Jet aircraft
Specific Process:
Chemical: Petroleum Products & Lubricants
Specific Chemicals: Jet fuel, Jet A, JP-8, JP-8(100)
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.C Systemic toxicity
D.2 Summaries of health effects, dose-response relationships

Summary: The report assesses the dermal absorption and skin toxicity of topically applied jet fuels and their additives by using pigs, in vitro porcine skin and inert membrane models, as well as human keratinocyte cell cultures.

Article ID: 400
Citation: Riviere, J. E. Quantitating Absorption of Complex Chemical Mixtures. PB2005-101509/XAB, -32. 2004. North Carolina State Univ. at Raleigh. Coll. of Veterinary Medicine.
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 73
Industries/Occupations:
Specific Process:
Chemical: Corrosives, Pesticides
Specific Chemicals: atrazine, chlorpyrifos, methylparathion, nonylphenol, pentachlorophenol, phenol, p- nitrophenyl, fenthion, propazine, simazine, triazine
Mixtures: Yes
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects
E Risk Assessment
E.2 Example risk assessments

Summary: Although exposure to complex mixtures of chemicals is typical, estimating exposure for risk assessment is difficult because available databases are based on single chemical exposure. This paper presents the results of tests on chemical mixture interactions that affect percutaneous absorption to define the physical chemical characteristics of the mixture. Includes discussion of several dermal models including QSPR, IPPSF, SMFT, and PSFT.

Article ID: 402
Citation: [No Author] . What You Need to Know About Occupational Exposure to Metalworking Fluids. PB99-129405/XAB DHHSPUB/NIOSH-98-116, -52. 1998. National Inst. for Occupational Safety and Health, Cincinnati, OH.

Resource Type: Guideline
Educational Materials: Yes
Number of References: 96
Industries/Occupations:
Specific Process:
Chemical: Heavy Metals/Inorganic Compounds, Petroleum Products & Lubricants

Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
- B.2 Factors that influence exposure conditions
- B.2.B Exposure controls
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
- E.3.B Engineering controls
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This document summarizes the findings of the NIOSH Criteria Document: NIOSH Criteria for a Recommended Standard: Occupational Exposure to Metalworking Fluids (NIOSH Publication Number 98-102). It also provides a critical review of the scientific and technical information available on the subject as well as a scientific basis for the recommendations. It is an educational document intended to communicate basic information.

Article ID: 423

Citation: Boeniger, M. "Chemical Protective Clothing and the Skin: Practical Considerations." Chemical Protective Clothing Series. Ed. Daniel H Anna. 2002. 1-48.

Resource Type: Book/monograph, chapter

Educational Materials: No

Number of References: 170

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.4 Skin physiology and functions as a barrier to chemical insults
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- F Risk Management
- F.1 Strategies for exposure control
- F.1.D PPE and PPE regulations

Summary: This chapter describes environmental and non-environmental factors affecting dermal absorption and how PPE reduces absorption. Factors affecting dermal absorption that are covered include: anatomical differences, inter-individual differences, physical damage to skin and temperature, humidity, the chemical vehicle, and skin occlusion.

Article ID: 456
Citation: Boeniger, M. F. "Exposure and absorption of hazardous materials through the skin." Int J Occup Environ Health 6.2 (2000): 148-50
Resource Type: Other - Commentary
Educational Materials: No
Number of References: 19
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake

Summary: This letter to the editor from NIOSH summarizes the history of attempts to quantify dermal permeation rates. Rates, based upon LD50 or permeation coefficients from saturated aqueous solutions, form the bases for OSHA skin notations, ACGIH Threshold Limit Values (TLVs), OSHA Permissible Exposure Limits (PELs), and NIOSH Recommended Exposure limits (RELs). As a result of differing laboratory methodologies, these limits may vary by several orders of magnitude. The letter offers recommendations for those offering additional skin exposure guidance and permeation criteria.

Article ID: 458
Citation: Burnett-CA, Lushniak-BD, and McCarthy-. "Occupational dermatitis causing days away from work in U.S. private industry, 1993." Am J Ind Med 34.6 (1998): 568-73

Resource Type: Journal article - primary
Educational Materials: No
Number of References: 15
Industries/Occupations: Agricultural, Cleaning/Janitorial/Maid, Construction, Manufacturing - Other, Service - Food, Service - Medical, Transportation/Communications/Utility, Other: Groundskeepers, gardeners, mechanics, printing press operators, repairmen

Specific Process: Provides risk data from many occupational groups.
Chemical: General - overview, Cleaning Agents, Petroleum Products & Lubricants, Plastics and Resins, Solvents

Specific Chemicals: Calcium hydroxide
Provides risk data for several chemical classes

Mixtures: No
Audience: Professional

Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.2 Loss of workdays and impact on productivity
B.3 Surveillance study protocols/procedures for gathering data

Summary: The authors examined the 8835 cases of dermal exposure in the 1993 Annual Survey of Occupational Injuries and Illnesses from the Bureau of Labor Statistics. The article presents considerable surveillance data including rates of occupational dermatitis, identifies the service sector with the greatest number of cases, the sectors with the highest exposure rates, and the chemicals causing the greatest number of exposures.

Article ID: 468

Citation: Brouwer, D. H., R. J. Aitken, R. Oppl, and J. W. Cherrie.
 "Concepts of skin protection: considerations for the evaluation and terminology of the performance of skin protective equipment."
 J.Occup.Environ.Hyg. 2.9 (2005): 425-34

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 24

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.3 Investigation, intervention, and control of occupational skin exposures
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.2.E Uptake
- C.5 Exposure modeling
- F Risk Management
- F.1 Strategies for exposure control
- F.1.D PPE and PPE regulations

Summary: This article proposes a common dermal exposure glossary, including processes involved in transport, loading, uptake, and personal protective equipment. It presents both exposure loading and skin protective equipment models, and presents performance data for skin protective equipment.

Article ID: 469
Citation: McArthur, B. "Dermal Measurement and Wipe Sampling Methods: A Review." Applied Occupational and Environmental Hygiene, 7.9 (1992): 599-606
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 81
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.4.C Biomonitoring

Summary: This article discusses various methods for directly measuring dermal exposures to hazardous materials deposited on the skin or clothing, and on work surfaces, such as by patches, skin swabs, rinses, and radioactive or fluorescent tracers. This article also discusses biological monitoring (measuring biomarkers for blood, urine, or exhaled air).

Article ID: 470

Citation: McDougal, J. N. and P. J. Robinson. "Assessment of dermal absorption and penetration of components of a fuel mixture (JP-8)." *Sci.Total Environ.* 288.1-2 (2002): 23-30

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 20

Industries/Occupations:

Specific Process:

Chemical: Petroleum Products & Lubricants

Specific Chemicals: JP-8 jet fuel, Undecane, Dodecane, Decane, Tridecane, Tetradecane, Methyl naphthalenes, Trimethyl benzene, Nonane, Pentadecane, Dimethyl naphthalene, Dimethyl benzene (xylene), Naphthalene, Ethyl benzene, Methyl benzene (toluene)

Mixtures: Yes

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- E Risk Assessment
- E.2 Example risk assessments

Summary: This article discusses methods for assessing the risks from dermal exposures to complex mixtures, specifically JP-8 jet fuel, a volatile mixture which varies radically in composition depending on the phase of the mixture - vapor, liquid or aerosol. The article assesses absorption (into the skin) and penetration (through the skin) of components in the mixture and discusses why absorption and penetration can differ. Permeability coefficients for 12 components in JP-8 jet fuel were calculated. The authors suggest that absorption and penetration methodologies similar to those used for JP-8 jet fuel could be used to estimate systemic toxicity of other mixtures.

Article ID: 471
Citation: Schnuch, A., H. Lessmann, K. H. Schulz, D. Becker, T. L. Diepgen, H. Drexler, S. Erdmann, M. Fartasch, H. Greim, P. Kricke-Helling, R. Merget, H. Merk, D. Nowak, A. Rothe, G. Stropp, W. Uter, and G. Wallenstein. "When should a substance be designated as sensitizing for the skin ('Sh') or for the airways ('Sa')?" *Hum.Exp.Toxicol.* 21.8 (2002): 439-44
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 10
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: A Overview
A.6 Dermal regulations and skin notations
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization

Summary: The article reviews the criteria for determining when a substance should be deemed airway sensitizers ("Sa") or skin sensitizer ("Sh") according to the List of MAK and BAT Values published annually by the Commission of the Deutsche Forschungsgemeinschaft for the Investigation of Health Hazards of Chemical Compounds in the Work Area (MAK Commission). The authors conclude that the MAK and BAT values make the classification of substances more rational, consistent, comprehensible, and transparent, but their application may not be necessary or possible in some cases.

Article ID: 474
Citation: Boyce, J. M. and D. Pittet. "Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America." MMWR Recomm.Rep. 51.RR-16 (2002): 1-45, quiz
Resource Type: Guideline
Educational Materials: No
Number of References: 423
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
C Exposure Characterization
C.5 Exposure modeling
F Risk Management
F.1 Strategies for exposure control
F.1.C Work practice/Administrative controls
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The Guideline for Hand Hygiene in Health-Care Settings provides health care workers with a review of data regarding handwashing, hand antisepsis, and barrier creams as well as recommendations to improve hand-hygiene practices and reduce transmission of pathogenic microorganisms.

Article ID: 475

Citation: Toeppen-Sprigg, B. "Management of dermatitis in the rubber manufacturing industry." *Occup.Med.* 14.4 (1999): 797-818

Resource Type: Journal article - review, meta-analysis

Educational Materials: No

Number of References: 51

Industries/Occupations: Manufacturing - Other, Other: Rubber manufacturing

Specific Process:

Chemical: Latex, Rubber Additives

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- A.3 Investigation, intervention, and control of occupational skin exposures
- B Surveillance and Clinical Aspects
- B.1 Surveillance study reporting incidences of occupational skin exposures
- B.1.A Skin exposure major focus
- F Risk Management
- F.1 Strategies for exposure control
- F.1.A Substitution
- F.1.D PPE and PPE regulations
- F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs
- F.2 Protocols for risk management
- F.2.B Development of approach to achieve exposure reduction goal

Summary: The article examines dermatitis in the rubber industry. Contributing agents include both natural rubber and the various additives used in its manufacture. The paper reviews prevention and control measures such as substitution, PPE, barriers creams, monitoring. It also includes a discussion of the diagnosis and treatment of dermatitis.

Article ID: 478

Citation: Packham, C. L. Essentials of Occupational Skin Management. Limited Edition Press, 1999

Resource Type: Book/monograph, whole

Educational Materials: No

Number of References: 95

Industries/Occupations: General - overview, Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Manufacturing - Chemical, Manufacturing - Other, Service - Food, Service - Medical, Transportation/Communications/Utility, Other: aerospace, dentistry, pharmaceuticals, printing, textiles,

Specific Process:

Chemical: General - overview, Plastics and Resins, Rubber Additives

Specific Chemicals:

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in the workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.4 Dermal regulations and skin notations
- B Exposure Characterization
 - B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
 - B.2 Factors that influence exposure conditions
 - B.2.A Exposure intensity/frequency
 - B.2.B Exposure controls
- C Hazard Identification
 - C.3 Protocols/checklists to identify skin hazards in the workplace
- D Risk Assessment
 - D.1 Protocols/checklists to identify risk from exposure
- E Risk Management
 - E.1 Overview of skin exposure control options
 - E.2 Protocols/checklists to monitor potential exposures
 - E.3 "Best practices"/guidelines/recommendations
 - E.3.A Substitution
 - E.3.B Engineering controls
 - E.3.C Work practice/administration controls
 - E.3.D PPE and PPE regulations
 - E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
 - E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: This comprehensive book combines elements of dermatology, occupational hygiene, and engineering, and provides practical examples and solutions. It is clearly written and appears to be useful to both professionals and other users. Although the book is more focused on practical application rather than presenting scientific argument, it addresses many complex subjects, such as uptake, in a straightforward manner. Chapter headings are not self-evident, but the book contains an extensive index. Chapters are:

1. Dermatological Engineering
2. Legislation and the skin at work
3. The skin as a barrier

4. Occupational skin disease
 5. Occupations and occupational skin disease
 6. Risk assessment for non-respiratory hazards
 7. Exposure Control – engineering
 8. Exposure control through Protective Equipment
 9. Selection and use of gloves
 10. Barrier Creams – Myth or magic answer?
 11. Skin care
 12. Cross infection and the skin
 13. Creating an effective skin management system
 14. Investigating a problem at work
 15. Technology and skin management
- The author also has a website (<http://www.enviroderm.co.uk>) where this book and other resources reviewed in this guide can be purchased.

Article ID: 480
Citation: The Center to Protect Workers' Rights. "An Employer's Guide To Skin Protection." 2005.
<http://www.cdc.gov/elcosh/docs/d0400/d000457/d000457.html>
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 25
Industries/Occupations: Construction
Specific Process: Bricklayers
carpenters
masons
hod carrier
plasterer
terrazzo worker
tile setters
Chemical: Corrosives
Specific Chemicals: Portland cement, hexavalent chromium
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals
B Exposure Characterization
B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
B.2 Factors that influence exposure conditions
B.2.A Exposure intensity/frequency
B.2.B Exposure controls
E Risk Management
E.1 Overview of skin exposure control options
E.3 "Best practices"/guidelines/recommendations
E.3.C Work practice/administration controls
E.3.D PPE and PPE regulations
E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: This handbook for employers in the cement product industry (concrete, mortar, plaster, grout, stucco, and terrazzo) covers issues associated with dermal exposure identification, evaluation, control and prevention. It offers recommendations to prevent employee skin problems.

Article ID: 485
Citation: Ness, Shirley A. "Surface and Dermal Monitoring." Encyclopedia of Analytical Chemistry. Ed. R. A. Meyers. Wiley, 2000. 4824-43.
Resource Type: Book/monograph, chapter
Educational Materials: No
Number of References: 61
Industries/Occupations: General - overview
Specific Process:
Chemical: Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Pesticides, PCBs
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.C Skin area affected
- C.2.E Uptake
- C.3 Checklists/questionnaires to quantify skin exposure incidences
- C.4 Direct methods to measure exposure
- C.4.A Surfaces
- C.4.B Skin
- C.5 Exposure modeling

Summary: This chapter provides an overview of current methods used to perform surface and dermal monitoring for chemicals. The chapter describes methods for measuring surface contamination as well as discusses surface sampling media and sampling strategies. It also covers dermal monitoring methods which directly assess chemical contamination on a worker's skin or clothing. In addition, it contains a table listing guidelines and standards for surface sampling results for 20 different chemicals groups.

Article ID: 486
Citation: Jones, AD et al. CEFIC Workshop on methods to determine dermal permeation for human risk assessment Held in Utrecht 13-15th June 2004. 2004.

Resource Type: Technical publication/report
Educational Materials: No
Number of References: 40
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.5 Exposure modeling
- D Hazard Identification
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects
- D.3.F [Q]SARs – development, validation, and application
- E Risk Assessment
- E.2 Example risk assessments

Summary: This Workshop's aim was to develop recommendations for methods for determining dermal permeation rates for use in human risk assessments. This was proposed to be done within the context of the possible future regulatory framework for chemical risk assessment (REACH). The main outcomes of the meeting were:

- A definition of a standardized protocol for an in vitro method for measuring dermal absorption of industrial chemicals after infinite and finite doses, to be used to produce data for the development of predictive relationships.
- Recommendations on the existing status and reliability of QSAR data.
- Recommendations on the role of model predictions in generating absorption data for risk assessment.
- Recommendations for a strategy for using measurements and predictions of dermal permeation to meet the requirements of REACH.
- Suggestions on the steps that will be needed to develop this strategy.

Article ID: 488
Citation: [No Author] . Cost and Effectiveness of Chemical Protective Gloves for the Workplace. Sudbury, UK: HSE Books, 2001, -24
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 8
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed: E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations

Summary: This UK publication, provides employers in industries where employees incur risk from dermal exposure to chemicals, with advice on cost, and effectiveness of gloves and personal protective equipment (PPE). It is available for purchase on the HSE website (<http://www.hse.gov.uk/>).

Article ID: 489
Citation: [No Author] . Choice of Skin Care Products for the Workplace. Sudbury, UK: HSE Books, 2001, -12
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This UK publication, provides employers in industries where employees incur risk from dermal exposure to chemicals, with information on skin care products, their selection, and how they fit into an overall skin care program. This is available for purchase on the HSE website (<http://www.hse.gov.uk/>).

Article ID: 490
Citation: [No Author] . Selecting Protective Gloves for Work With Chemicals. Sudbury, UK: HSE Books, 2000
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 3
Industries/Occupations:
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed: E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations

Summary: This leaflet, for employers and the self-employed, provides basic advice on selecting gloves to protect the wearer from chemical agents. It discusses UK law, chemical resistance of protective gloves and selection of gloves. A PDF version of this leaflet is available on their website (<http://www.hse.gov.uk/>).

Article ID: 491
Citation: Colormetric Laboratories Inc. A Guide to Dermal Exposure Reduction. 1999. Des Plaines, Illinois, Colormetric Laboratories Inc.
Resource Type: Other - Guideline from private lab
Educational Materials: No
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
F Risk Management
F.1 Strategies for exposure control
F.1.D PPE and PPE regulations
F.2 Protocols for risk management
F.2.B Development of approach to achieve exposure reduction goal

Summary: This pamphlet briefly outlines the benefit and contents of a dermal exposure reduction program. This pamphlet is available for download on their website (www.clilabs.com/).

Article ID: 493
Citation: Occupational Safety and Health Administration (OSHA). SAMPLING FOR SURFACE CONTAMINATION. TED 01-00-015 [TED 1-0.15A]. 2005. Occupational Safety and Health Administration (OSHA).
Resource Type: Guideline
Educational Materials: No
Number of References: 7
Industries/Occupations:
Specific Process:
Chemical: Plastics and Resins, Other: Isocyanates
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin

Summary: Section II, Chapter 2 of the OSHA Technical Manual describes surface sampling protocols for OSHA inspectors, but is applicable to a wider audience. Substances with skin notations are listed in the appendix.

Article ID: 494
Citation: American Industrial Hygiene Association (AIHA and). 2005
Emergency Response Planning Guidelines (ERPG) and Workplace
Environmental Exposure Level (WEEL) Handbook. 2005.
American Industrial Hygiene Association.
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 15
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed: A Overview
A.4 Dermal regulations and skin notations

Summary: This pocket-sized emergency reference guide presents an overview of two sets of exposure limits: the AIHA ERPGs (114) and WEELs (108). It contains recommended values for each series. In addition to a glossary, both ERPG and WEEL sections include background information, user guidance, value rationale, sample documents, and values. There is also an explanation on Biological Environmental Exposure Limits (BEELs).

Article ID: 495
Citation: ENVIRONMENT DIRECTORATE JOINT MEETING OF THE CHEMICALS COMMITTEE AND THE WORKING PARTY ON CHEMICALS. Detailed Review Document on Classification Systems for Skin Irritation/Corrosion in OECD Member Countries. 16. 1999. Organisation for Economic Co-operation and Development. OECD SERIES ON TESTING AND
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 22
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: A Overview
A.6 Dermal regulations and skin notations

Summary: This report compares the dermal irritation/corrosion hazard classification procedures used in Canada, the US, OECD, European Union, and Norway. Issues requiring resolution are discussed.

Article ID: 496
Citation: ENVIRONMENT DIRECTORATE JOINT MEETING OF THE CHEMICALS COMMITTEE AND THE WORKING PARTY ON CHEMICALS, PESTICIDES AND BIOTECHNOLOGY. GUIDANCE DOCUMENT FOR THE CONDUCT OF SKIN ABSORPTION STUDIES. ENV/JM/MONO(2004)2 Number 28. 2004. Organisation for Economic Co-operation and Development. OECD SERIES ON TESTING AND ASSESSMENT.

Resource Type: Guideline
Educational Materials: No
Number of References: 59
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects

Summary: The OECD Guidance Document for the conduct of skin absorption studies was published by the Organisation for Economic Co-operation and Development (OECD), an intergovernmental organization which representatives 30 industrialized countries in North America, Europe and the Pacific, as well as the European Commission. It provides guidance developed by OECD at Research Triangle Park, North Carolina, USA in October 1997 called "Percutaneous Absorption Methods as Test Guidelines" for in vitro and in vivo studies.

Article ID: 500

Citation: Fehrenbacher, M. Cathy et al. "Approaches for Occupational Dermal Exposure Assessment and Management." The Occupational Environment: Its Evaluation, Control, and Management. Ed. Salvatore R DiNardi. 2nd ed. Fairfax, VA: American Industrial Hygiene Association, 2003.

Resource Type: Book/monograph, chapter

Educational Materials: No

Number of References: 53

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals: 2,4-Dichlorophenol

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
 - C.2 Description of factors influencing exposure conditions
 - C.2.A Exposure intensity/frequency/duration
 - C.2.B Exposure concentration
 - C.2.C Skin area affected
 - C.2.E Uptake
 - C.4 Direct methods to measure exposure
 - C.4.A Surfaces
 - C.4.B Skin
 - C.4.C Biomonitoring
 - C.5 Exposure modeling
- E Risk Assessment
 - E.1 Guidelines for risk assessment or analysis
 - E.1.A Localized health effects
 - E.1.B Systemic health effects
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: Chapter 17 - Approaches for Occupational Dermal Exposure Assessment and Management discusses dermal exposure monitoring methods, the process of dermal absorption, methods to measure dermal uptake, a tiered approach to performing dermal exposure assessments, and the control and management of occupational dermal exposures.

Article ID: 501
Citation: Weber, Lutz W and J. Thomas Pierce. "Development of Occupational Skin Disease." The Occupational Environment: Its Evaluation, Control, and Management. Ed. Salvatore R DiNardi. 2nd ed. Fairfax, VA: American Industrial Hygiene Association, 2003.
Resource Type: Book/monograph, chapter
Educational Materials: No
Number of References: 54
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
B Surveillance and Clinical Aspects
B.4 Clinical protocols for recognition of skin exposure health effects
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization

Summary: Chapter 18 - Development of Occupational Skin Disease gives a brief description of skin physiology, and conditions that effect dermal exposure. It also discusses for the industrial hygienist the medical evaluation of the skin for occupational skin disease.

Article ID: 502
Citation: Mansdorf, S. Zack and Norman W. Henry III. "Personal Protective Clothing." The Occupational Environment: Its Evaluation, Control, and Management. Ed. Salvatore R DiNardi. 2nd ed. Fairfax, VA: American Industrial Hygiene Association, Book/monograph, chapter
Resource Type:
Educational Materials: No
Number of References: 42
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: F Risk Management
F.1 Strategies for exposure control
F.1.D PPE and PPE regulations

Summary: Chapter 35 - Personal Protective Clothing discusses PPE for chemical as well as thermal, mechanical, radiologic, and biological hazards. It discusses performance characteristics, ergonomics, cost, maintenance, training, for different types of personal protective equipment used to control dermal hazards.

Article ID: 506
Citation: Ness, SA. Surface and Dermal Monitoring for Toxic Exposures. New York, NY: Wiley & Sons, 1994
Resource Type: Book/monograph, whole
Educational Materials: No
Number of References: 1303
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview, Heavy Metals/Inorganic Compounds, Organic Dyes, Pesticides, PCBs, Other: TCDD
Specific Chemicals: Sampling methods listed for dozens of specific chemicals
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- A.3 Investigation, intervention, and control of occupational skin exposures
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.2.E Uptake
- C.3 Checklists/questionnaires to quantify skin exposure incidences
- C.4 Direct methods to measure exposure
- C.4.A Surfaces
- C.4.B Skin
- F Risk Management
- F.1 Strategies for exposure control
- F.1.D PPE and PPE regulations

Summary: This definitive book was one of the first comprehensive guides to surface and dermal sampling methods. The book is divided into four parts, with accompanying chapters in each part, as described below:

Part I - Chemical Hazards

- Ch. 1. Identifying Chemicals as Hazards
- Ch. 2 Factors Affecting Chemical Permeation
- Ch. 3 Chemical Protective Clothing

Part II - Developing Strategies for Sampling

- Ch.4 Assessment of Workplace Exposures
- Ch. 5 Assessment of Community Exposures

Part III - Surface Monitoring

- Ch. 6 Introduction to Surface Monitoring
- Ch. 7 Surface Sampling for Chemicals
- Ch. 8 Surface Sampling for microorganisms
- Ch. 9 Surface Sampling for low level radiation
- Ch. 10 Decontamination

Part IV - Dermal Sampling Techniques

- Ch. 11 Introduction to Dermal Monitoring
- Ch. 12 Skin Sampling, Part 1, Wiping Swabbing and Washing
- Ch. 13 Skin Sampling Methods, Part 2 Direct Reading

Ch. 14 Pad Dosimetry Methods

Ch. 15 Clothing for Dosimetry and Protection

The book also includes appendices on methods and studies of amines, metals, polychlorinated biphenyls, tetrachlorodibenzodioxins and pesticides.

DRAFT-Do not cite, reference or distribute

Article ID: 508
Citation: Leung H-W and Paustenbach DJ. "Techniques for Estimating the Percutaneous Absorption of Chemicals due to Occupational and Environmental Exposure." Applied Occupational and Environmental Hygiene 9.3 (1994): 187-97
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 92
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.5 Exposure modeling
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects

Summary: This paper reviewed techniques for estimating the percutaneous absorption of chemicals following occupational exposure. It discusses factors influencing percutaneous absorption including number of exposures, nature of broken skin, exposure site, chemical uptake, and skin surface area. The latter was considered to be the most important factor. Discusses absorption studies, modeling, calculating exposure, and the interpretation of wipe sample data.

Article ID: 511
Citation: [No Author] . Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). 2001.
Resource Type: Technical publication/report
Educational Materials: No
Number of References: 93
Industries/Occupations: Other: hazardous waste management
Specific Process:
Chemical:
Specific Chemicals: Contains permeability coefficients for 28 inorganic compounds including 12 chromiums
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.5 Exposure modeling

Summary: Supplemental Guidance (Part E) to the Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (RAGS) incorporates and updates the principles of the EPA interim report, Dermal Exposure Assessment: Principles and Applications, released in 1992. Part E contains methods for conducting dermal risk assessments. Chapters include Introduction and Flowchart, Hazard Identification, Exposure Assessment, Toxicity Assessment, Risk Characterization, and Conclusion/Recommendations.

Article ID: 517
Citation: Andersen, Klaus E. "Systemic Toxicity From Percutaneous Absorption." Occupational skin disease. Ed. Robert M. Adams. Philadelphia: Saunders, 1999. 69-85.
Resource Type: Book/monograph, chapter
Educational Materials: No
Number of References: 147
Industries/Occupations:
Specific Process:
Chemical: Heavy Metals/Inorganic Compounds, Pesticides, Rubber Additives, Solvents, Other: Phosphate esters, Chlorinated hydrocarbons, Topical drugs and toiletries, Pharmaceuticals
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.1.B Skin exposure minor focus
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity

Summary: This comprehensive reference by over 40 clinician-contributors discusses diagnosis, treatment, and prevention of occupational skin disease. This chapter addresses uptake, biotransformation, exposure/reaction patterns, and affects of specific chemicals.

Article ID: 518
Citation: Paustenbach, Dennis, Hon-Wing Leung, and Julie A Rothrock. "Health Risk Assessment." Occupational skin disease. Ed. Robert M. Adams. Philadelphia: Saunders, 1999. 291-323.
Resource Type: Book/monograph, chapter
Educational Materials: No
Number of References: 210
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: Yes
Audience: Professional
Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.2.E Uptake
- C.4 Direct methods to measure exposure
- C.4.A Surfaces
- C.5 Exposure modeling
- D Hazard Identification
- D.2 Summaries of health effects, dose-response relationships
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects
- E.1.B Systemic health effects
- E.2 Example risk assessments

Summary: This comprehensive reference by over 40 clinician-contributors discusses diagnosis, treatment, and prevention of occupational skin disease. This chapter addresses the four phases of risk assessment: hazard identification, dose-response assessment, exposure assessment, and risk characterization, as well as uptake, fate of chemicals, exposure pathways, models and modeling, exposure measuring, sensitization, and risk reduction.

Article ID: 520
Citation: Center to Protect Workers' Rights. Physician's Alert for Occupational Contact Dermatitis Among Construction Workers. 2001.
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References:
Industries/Occupations: General - overview, Construction
Specific Process:
Chemical: Corrosives, Hand Cleansers
Specific Chemicals: Portland cement, hexavalent chromium, lanolin
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in workplace
A.2 Health hazards resulting from skin exposure to chemicals
B Surveillance and Clinical Aspects
B.4 Clinical protocols for recognition of skin exposure health effects
F Risk Management
F.1 Strategies for exposure control
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: Developed by the Center to Protect Workers' Rights, this Physician's Alert pamphlet was designed as information construction workers could bring with them on visits to a physician's office for skin-related disorders. The pamphlet contains a table of skin disorders; possible work-related causes; skin presentation and diagnostic aids; and intervention and treatment options.
This pamphlet can be found on line at the eLCOSH website (<http://www.cdc.gov/elcosh/index.html>).

Article ID: 521
Citation: Walker, J. D., R. Rodford, and G. Patlewicz. "Quantitative structure-activity relationships for predicting percutaneous absorption rates." Environ.Toxicol.Chem. 22.8 (2003): 1870-84
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 50
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: D Hazard Identification
D.3 Characterization protocols
D.3.F [Q]SARs – development, validation, and application

Summary: This article reviews quantitative structure-activity relationships (QSARs) for predicting percutaneous absorption rates from existing experimental data. It also provides estimated number of exposed workers for about 25 specific chemicals and permeability coefficients (K_p values) for 83 chemicals.

Article ID: 522
Citation: Patlewicz, G., R. Rodford, and J. D. Walker. "Quantitative structure-activity relationships for predicting skin and eye irritation." Environ.Toxicol.Chem. 22.8 (2003): 1862-69
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 46
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: D Hazard Identification
D.3 Characterization protocols
D.3.F [Q]SARs – development, validation, and application

Summary: This paper reviewed quantitative structure-activity relationships (QSARs) for predicting of skin and eye irritation from existing experimental data.

Article ID: 523
Citation: Rodford, R., G. Patlewicz, J. D. Walker, and M. P. Payne.
"Quantitative structure-activity relationships for predicting skin
and respiratory sensitization." Environ.Toxicol.Chem. 22.8 (2003):
1855-61

Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 28
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals: Solubility data provided for 15 chemicals
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.3 Characterization protocols
D.3.F [Q]SARs – development, validation, and application

Summary: This paper reviewed quantitative structure-activity relationships (QSARs) for predicting skin and respiratory sensitization from existing experimental data.

Article ID: 525
Citation: Forsberg, Krister and S. Z. Mansdorf. Quick Selection Guide to Chemical Protective Clothing. 4th ed. vii, 147 p vols. New York: J. Wiley, 2002
Resource Type: Brochure, Pamphlet
Educational Materials: Yes
Number of References: 0
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals: Index includes over 700 chemicals
Mixtures: No
Audience: General
Topics Addressed:

- A Overview
- A.4 Dermal regulations and skin notations
- C Hazard Identification
- C.1 Risk phrases, hazard symbols, skin designations
- C.2 Tables/charts/lists of hazards for specific chemicals
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
- E.3.D PPE and PPE regulations

Summary: This pocket-sized field guide for spill responders, safety engineers, industrial hygienists, chemists and chemical engineers, and other workers presents information on 700 chemicals, additional synonyms, CAS numbers, risk codes and special notations to alert the user. It also discusses 16 PPE barrier materials used.

CONTENTS

1. Introduction
2. Selection and Use of Chemical Protective Clothing.
3. Chemical Index: Contains the Chemical Class Numbers, Chemical Names and Synonyms, chemical abstract service (CAS) numbers, Risk Codes, and special "skin" and "caution" notations.
4. Selection Recommendations: Provides color coded recommendations organized numerically by chemical class based on 11,000 permeation and 3,000 degradation test data.
5. Glossary
6. Standards for Chemical protective Clothing
7. Manufacturers of Chemical Protective Clothing: Includes the names, addresses, and phone numbers of the suppliers and manufacturers of the chemical protective clothing materials.

Article ID: 526
Citation: Zhai, Hongbo and Howard I. Maibach. Dermatotoxicology. 6th ed ed. CRC Press, 2004
Resource Type: Book/monograph, whole
Educational Materials: No
Number of References: 3518
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- A Overview
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.5 Exposure modeling
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- D.1.D Other health effects
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects
- E.1.B Systemic health effects
- F Risk Management
- F.1 Strategies for exposure control
- F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: Dermatotoxicology 6th edition is a comprehensive reference book that includes information on the mechanisms of action of toxic substances on the skin, practical information on the various methods to evaluating dermal toxicity, and the latest developments in skin toxicology. The sixth edition contains 56 chapters, including a number of chapters covering factors influencing absorption and hazard characterization protocols, such as:

1. Skin Permeability
3. Percutaneous Absorption of Complex Chemical Mixtures
4. Anatomical Factors Affecting Barrier Function
8. Sensitive Skin
11. Irritant Dermatitis (Irritation)
12. Allergic Contact Dermatitis
13. Irritant Contact Dermatitis versus Allergic Contact Dermatitis
14. Molecular Basis of Allergic Contact Dermatitis
15. Systemic Contact Dermatitis
16. Permeability of Human Skin to Metals and Paths for Their Diffusion
27. Barrier Creams

- 29. Tape Stripping Method and Stratum Corneum
- 36. Animal, Human, and In Vitro Test Methods for Predicting Skin Irritation
- 38. Test Methods for Allergic Contact Dermatitis in Animals
- 39. Test Methods for Allergic Contact Dermatitis in Humans
- 52. Evaluating Efficacy of Barrier Creams: In Vitro and In Vivo Models
- 53. Light-Induced Dermal Toxicity: Effects on the Cellular and Molecular Level

DRAFT-Do not cite, reference or distribute

Article ID: 527

Citation: National Institute for Occupational Safety and Health (NIOSH). NIOSH Pocket Guide to Chemical Hazards (NPG) September 2005. NIOSH Publication No. 97-140. 2005. National Institute for Occupational Safety and Health (NIOSH).

Resource Type: Technical publication/report

Educational Materials: No

Number of References: 0

Industries/Occupations:

Specific Process:

Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Food Products, Hand Cleansers, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Soaps and Detergents, Solvents

Specific Chemicals: 398 chemicals included

Mixtures: No

Audience: General

Topics Addressed:

- C Hazard Identification
- C.2 Tables/charts/lists of hazards for specific chemicals
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
- E.3.D PPE and PPE regulations
- E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The NIOSH Pocket Guide is a source of general industrial hygiene information on several hundred chemicals/classes for workers, employers, and occupational health professionals. Provides exposure limits, exposure routes, respirator recommendations, PPE suggestions and first aid for many of the 398 chemicals reviewed. It presents key information and data in abbreviated or tabular form for chemicals or substance groupings (e.g. cyanides, fluorides, manganese compounds) that are found in the work environment. This portable reference book helps in response to workplace emergencies and preventing exposure to workers. It is designed to help users recognize and control occupational chemical hazards. It does not present data analysis. It is available on-line, on a CD or as a hard copy spiral bound document. It contains chemical-specific information on: the [skin] designation - which indicates the potential for dermal absorption; skin exposure should be prevented as necessary through the use of good work practices and gloves, coveralls, goggles, and other appropriate equipment.

Article ID: 528

Citation: Occupational Safety & Health Administration. "Occupational Safety and Health Administration (OSHA) [Home page]." 2005. Occupational Safety & Health Administration <http://www.osha.gov>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview, Agricultural, Cleaning/Janitorial/Maid, Construction, Manufacturing - Chemical, Manufacturing - Other, Medical Services, Mining, Service - Medical

Specific Process:

Chemical: General - overview, Coolants, Corrosives, Heavy Metals/Inorganic Compounds, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, Solvents

Specific Chemicals: acrylonitrile, benzene, 1, 3- butadiene, dry cleaning chemicals , hexavalent chromium, formaldehyde, isocyanates, methylene chloride, acrylonitrile, benzene, 1, 3- butadiene, dry cleaning chemicals , hexavalent chromium, formaldehyde, isocyanates, methylene chloride, among others.

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- A.6 Dermal regulations and skin notations
- C Exposure Characterization
- C.1 Workplace factors associated with harmful skin exposures
- C.2 Description of factors influencing exposure conditions
- C.2.A Exposure intensity/frequency/duration
- C.2.B Exposure concentration
- C.2.C Skin area affected
- C.4 Direct methods to measure exposure
- C.4.A Surfaces
- C.4.B Skin
- C.4.C Biomonitoring
- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects
- E.1.B Systemic health effects
- F Risk Management
- F.1 Strategies for exposure control
- F.1.A Substitution
- F.1.B Engineering controls
- F.1.C Work practice/Administrative controls
- F.1.D PPE and PPE regulations
- F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The Occupational Safety and Health Administration (OSHA) is the Federal agency under the Department of Labor that publishes and enforces safety and health regulations for most businesses and industries in the United States. In recent years OSHA's focus has

been on enforcement; as well as outreach, education, compliance assistance; and partnerships and cooperative programs. The OSHA website provides information and links to information on dermal exposure, including:

- Health and Safety Topics: This web page includes a link to OSHA's dermal exposure web page as well as web pages for specific chemicals with dermal exposure potential, such as acrylonitrile, benzene, 1, 3- butadiene, dry cleaning chemicals, hexavalent chromium, formaldehyde, isocyanates, methylene chloride, metalworking fluids, solvents. There are also links to information on surface contamination associated with chemicals that have skin designations, an up-to-date list of the OSHA standards that address dermal exposure, how to recognize hazardous dermal exposures, how to evaluate dermal exposures and how to control dermal exposures.
- OSHA Technical Manual: This manual is used by OSHA compliance officers as a reference for technical information on occupational safety and health issues. It includes a number of chapters with information relevant to dermal exposure, including dermal exposure hazards specific to chemicals or processes, methods for sampling for surface contamination, chemical protective clothing guidelines and a list of substances listed with skin notations or designations by ACGIH TLV's and/or OSHA PEL's.
- Evaluation Guidelines for Surface Sampling Methods: A document developed to provide chemists with uniform means for evaluating surface sampling methods with regards to sampling media, sampling techniques and sample preparation for analysis.
- The Chemical Sampling Information: This webpage provides data on a large number of chemical that may be encountered in industrial hygiene investigations. It is meant as a basic reference for OSHA personnel. For select chemicals it contains OSHA wipe sampling methods.
- OSHA Standards: Dermal exposures are addressed in specific standards for the general industry, shipyard employment, marine terminals, the construction industry, and identification, classification, and regulation of carcinogens, in addition to being covered in Section 5(a)(1) of the OSH Act, the General Duty Clause, which requires employers to "furnish to each of his

employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees". Below is a highlight of OSHA standards, and directives (instructions for compliance officers). This is only a partial list of references to skin exposure in OSHA standards, guidelines, and chemical sampling methods. For more and up-to-date information, see this website.

- General Industry (29 CFR 1910)
 - 1910 Subpart H, Hazardous materials
 - 1910.120, Hazardous waste operations and emergency response
 - 1910 Subpart I, Personal protective equipment
 - 1910 Subpart Z, Toxic and hazardous substances
 - 1910.1028, Benzene
 - 1910.1044, 1,2-dibromo-3-chloropropane
 - 1910.1045, Acrylonitrile
 - 1910.1048, Formaldehyde
 - 1910.1050, Methylenedianiline.
 - 1910.1051, 1,3-Butadiene
 - 1910.1052, Methylene chloride
 - 1910.1200, Hazard communication
- Shipyard Employment (29 CFR 1915)
 - 1915 Subpart I, Personal protective equipment
 - 1915 Subpart I Appendix A, Non-mandatory guidelines for hazard assessment, personal protective equipment (PPE) selection, and PPE training program
- Marine Terminals (29 CFR 1917)
 - 1917 Subpart B, Marine terminal operations
 - 917.28, Hazard communication
- Construction (29 CFR 1926)
 - 1926 Subpart D, Occupational health and environmental controls
 - 1926.60, Methylenedianiline
 - 1926.65, Hazardous waste operations and emergency response
- Identification, Classification, and Regulation of Carcinogens (29 CFR 1990.103, Definitions)
- Directives:
 - Enforcement Procedure for Occupational Exposure to Formaldehyde. CPL 02-02-052 [CPL 2-2.52], (1990, November 20).
 - Benzidine - Based Dyes: Direct Black 38, Direct Brown 95 and Direct Blue 6 Dyes. CPL 02-02-027 [CPL 2-2.27], (1980, February 22).

Article ID: 533

Citation: National Institute for Occupational Safety and Health. "International Chemical Safety Cards (ICSCs): US National Version." 2005. <http://www.cdc.gov/niosh/ipcs/nicstart.html> Web Page

Resource Type: Web Page

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Heavy Metals/Inorganic Compounds, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PCBs, Solvents, Other: comprehensive list of chemicals used occupational settings

Specific Chemicals: There are currently cards for over 1500 chemicals.

Mixtures: No

Audience: General

Topics Addressed:

- C Hazard Identification
- C.1 Risk phrases, hazard symbols, skin designations
- C.2 Tables/charts/lists of hazards for specific chemicals
- E Risk Management
- E.1 Overview of skin exposure control options
- E.3 "Best practices"/guidelines/recommendations
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The International Chemical Safety Card (ICSC) project is an undertaking of the International Programme on Chemical Safety (IPCS). The IPCS is a joint activity of three cooperating International Organizations: the United Nations Environment Programme (UNEP), the International Labour Office (ILO), and the World Health Organization (WHO). Each ICSC summarizes essential health and safety information on chemicals for their use by workers and employers in factories, agriculture, construction and other work places. They consist of a series of standard phrases, mainly summarizing health and safety information collected, verified and peer reviewed by internationally recognized experts, taking into account advice from manufacturers and Poison Control Centres.

The U.S. National version of the ICSCs† cited here have been modified by the National Institute for Occupational Safety and Health (NIOSH) to include the following:

- Occupational Safety and Health Administration Permissible Exposure Limits (OSHA PELs).
- National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH RELs).
- Immediately Dangerous to Life and Health values (IDLHs)
- Links to the Appendices in the NIOSH Pocket Guide to Chemical Hazards

Each cards briefly lists the routes of exposure, potential acute

skin hazards and symptoms for each specific chemical, as well as general prevention and first aid measures.

DRAFT-Do not cite, reference or distribute

Article ID: 534
Citation: National Institute for Occupational Safety and Health.
"Recommendations for Chemical Protective Clothing A
Companion to the NIOSH Pocket Guide to Chemical Hazards."
2005. <http://www.cdc.gov/niosh/ncpc/ncpc1.html>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and
other fibers, Heavy Metals/Inorganic Compounds, Organic Dyes,
Particulates, Pesticides, Petroleum Products & Lubricants,
Plastics and Resins, Solvents
Specific Chemicals: Includes all chemicals in the NIOSH Pocket Guide to Chemical
Hazards (ID 527)
Mixtures: No
Audience: General
Topics Addressed: E Risk Management
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations
Summary: This webpage provides chemical protective clothing
recommendations for all chemicals listed in the NIOSH Pocket
Guide to Chemical Hazards, June 1997 Edition (NIOSH
Publication No. 97-140). These recommendations are based on
another published work, Quick Selection Guide to Chemical
Protective Clothing, Third Edition, by Krister Forsberg and S.Z.
Mansdorf (1997).
The Pocket Guide provides general recommendations in table
format for skin protection according to the following designations:
- Prevent skin contact, meaning that there is a dermal hazard
potential.
- Frostbite, meaning there is the potential for freezing of the skin
from direct contact with the liquified gas through rapid
evaporation.
- N.R. means that no recommendation can be made either because
the chemical is not a demonstrated dermal hazard or inadequate
information is available.

Article ID: 535
Citation: The Interagency Coordinating Committee on the Validation of Alternative Methods. "Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM) [Home page]." 2005. <http://iccvam.niehs.nih.gov>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations:
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.3 Characterization protocols
D.3.A Corrosivity
D.3.B Irritation potential
D.3.C Sensitization potential

Summary: The Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM) was established by the Director of the National Institute of Environmental Health Sciences (NIEHS) to implement NIEHS directives to develop and validate new test methods, and to establish criteria and processes for the validation and regulatory acceptance of toxicological testing methods. To date the following dermal assays and associated documents were submitted to ICCVAM for review and evaluation:
- The Dermal Corrosivity and Irritation Assays: CORROSITEX, EPISKIN, EpiDerm (EPI-200) and the Rat Skin Transcutaneous Electrical Resistance (TER) Assay
- Murine Local Lymph Node Assay (LLNA) -A test Method for Assessing the Allergic Contact Dermatitis Potential of Chemicals/Compounds

Article ID: 539

Citation: Environmental Protection Agency. "Environmental Protection Agency (EPA) [Home page]." 2005. <http://www.epa.gov> Website

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview, Agricultural, Manufacturing - Other

Specific Process: autobody painting

Chemical: General - overview, Pesticides, Petroleum Products & Lubricants, Solvents

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.2 Loss of workdays and impact on productivity
 - B.3 Surveillance study protocols/procedures for gathering data
- C Exposure Characterization
 - C.2 Description of factors influencing exposure conditions
 - C.2.A Exposure intensity/frequency/duration
 - C.2.E Uptake
 - C.4 Direct methods to measure exposure
 - C.4.A Surfaces
 - C.4.B Skin
 - C.4.C Biomonitoring
 - C.5 Exposure modeling
- D Hazard Identification
 - D.3 Characterization protocols
 - D.3.B Irritation potential
 - D.3.C Sensitization potential
 - D.3.D Potential to cause systemic effects
 - D.3.E Measurement of skin permeation rates and reservoir effects
- E Risk Assessment
 - E.1 Guidelines for risk assessment or analysis
 - E.1.A Localized health effects
 - E.1.B Systemic health effects
 - E.2 Example risk assessments
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations

Summary: The US Environmental Protection Agency is the Federal Agency tasked with protecting human health and the environment. In addition to developing and enforcing regulations, the EPA also performs environmental research, sponsors voluntary partnerships and programs, advances environmental education and publishes information associated with the environment. Although EPA's work deals more with environmental exposures than occupational exposures(except n the case of pesticides), some resources are

designed for occupational settings and some are applicable to both. The EPA has produced a variety of different resources related to dermal exposure to chemicals that can be found on their website, including:

- Series 875 - Occupational and Residential Exposure Test Guidelines Post Application Exposure Guidelines Group B. – These guidelines provide information on: background for application exposure monitoring test guidelines, dermal exposure-outdoor, dermal exposure-indoor, biological monitoring, and data reporting and calculations.
- Cleaner Technologies Substitutes Assessment - A Methodology and Resource Guide – This contains guidelines on evaluating chemical substitution, though not specific to dermal exposures, recommendations that may be applicable can be found here.
- Choosing the right gloves for painting cars. This covers how to select chemical resistant gloves for automobile paint work.
- Dermal Exposure Assessment: Principles and Applications – This 1992 guidance document covers the principles of dermal absorption and outlines procedures on how to apply these principles to actual dermal exposure assessments involving contact with chemical vapors, air, soil and water.
- Summary Report for the Workshop on Issues Associated With Dermal Exposure and Uptake: This summary from a 1998 workshop to discuss technical issues associated with dermal exposure and risk assessment.
- Exposure Factors Handbook, Chapter 6, Dermal. This 1997 document on general dermal exposure considerations is directed at environmental exposures, but may apply to some occupational settings as well.

Article ID: 540

Citation: National Library of Medicine. "TOXNET (Toxicology Data Network) - Databases on toxicology, hazardous chemicals, environmental health, and toxic releases [Home page]." 2005. <http://toxnet.nlm.nih.gov/>
<http://hazmap.nlm.nih.gov/hazmapadv.html>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Forestry/Fisheries, Manufacturing - Chemical, Manufacturing - Other, Medical Services, Mining, Service - Food, Service - Medical, Service - Other, Transportation/Communications/Utility

Specific Process: Haz-Map is searchable by job name and job task

Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Solvents

Specific Chemicals: Thousands of specific chemicals are addressed across the databases.

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.3 Investigation, intervention, and control of occupational skin exposures
 - A.6 Dermal regulations and skin notations
- B Surveillance and Clinical Aspects
 - B.4 Clinical protocols for recognition of skin exposure health effects
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.C Systemic toxicity
 - D.1.D Other health effects
 - D.1.E Contribution to overall exposure
 - D.2 Summaries of health effects, dose-response relationships
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations

Summary: TOXNET (TOXicology Data NETwork) is a cluster of databases covering toxicology, hazardous chemicals, environmental health and related areas. It is managed by the Toxicology and Environmental Health Information Program (TEHIP) in the Division of Specialized Information Services (SIS) of the National Library of Medicine (NLM). TOXNET provides free access to a variety of different toxicology databases, including those

described below:

- Haz-Map: an occupational toxicology database designed primarily for health and safety professionals, but also for consumers seeking information about the health effects of exposure to approximately 1,000 chemicals and biological agents at work. Haz-Map links jobs and hazardous tasks with occupational diseases and their symptoms (see ID 542 for more information).
- Hazardous Substances Data Bank (HSDB): a comprehensive, peer-reviewed toxicology information for over 4,900 potentially hazardous chemicals. HSDB also provides information on emergency handling procedures, industrial hygiene, environmental fate, human exposure, detection methods, and regulatory requirements.
- TOXLINE: a bibliographic database providing comprehensive coverage of the biochemical, pharmacological, physiological, and toxicological effects of drugs and other chemicals from 1965 to the present.
- Integrated Risk Information System (IRIS): a database from the U.S. Environmental Protection Agency (EPA) that contains health risk information on over 500 chemicals. IRIS risk assessment data has been scientifically reviewed by EPA scientists and represents EPA consensus.
- ChemIDplus: a database providing access to a variety of databases used for the identification of chemical substances cited in NLM databases. ChemIDplus is searchable by chemical name, synonym, CAS Registry Number, molecular formula, classification code, locator code, and structure. Links to a variety of different available databases are provided. ChemIDplus contains over 379,000 chemical records, of which over 257,000 include chemical structures.
- Wireless Information System for Emergency Responders (WISER): a system designed to assist first responders in hazardous material incidents. It is available as a web-based, windows-based or PDA application. It provides a wide range of

information on hazardous substances, including substance identification support, physical characteristics, human health information, and containment and suppression advice.

DRAFT-Do not cite, reference or distribute

Article ID: 542
Citation: National Library of Medicine. "HSDB - Hazardous Substances Data Bank." 2005. <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Forestry/Fisheries, Manufacturing - Chemical, Manufacturing - Other, Medical Services, Mining, Service - Food, Service - Medical, Service - Other, Transportation/Communications/Utility, Other

Specific Process:
Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Solvents

Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.6 Dermal regulations and skin notations
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.1.B Skin exposure minor focus
C Exposure Characterization
C.1 Workplace factors associated with harmful skin exposures
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity
D.1.D Other health effects
F Risk Management
F.1 Strategies for exposure control
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations

Summary: The Hazardous Substances Databank (HSDB) is a toxicology data file on the National Library of Medicine's (NLM) Toxicology Data Network (TOXNET). It focuses on the toxicology of potentially hazardous chemicals. It includes information on human exposure, industrial hygiene, emergency handling procedures, environmental fate, regulatory requirements, and related areas. All data are referenced and derived from a core set of books, government documents, technical reports and selected primary journal literature. HSDB is peer-reviewed by the Scientific Review Panel (SRP), a committee of experts in the major subject areas within HSDB's topic areas. HSDB is organized into individual chemical records, and contains over 4,900 records. The following broad groupings of information are provided, if available, for each

chemical:

- Human Health Effects
- Emergency Medical Treatment
- Animal Toxicity Studies
- Metabolism/Pharmacokinetics
- Pharmacology
- Environmental Fate/Exposure
- Chemical/Physical Properties
- Chemical Safety & Handling
- Occupational Exposure Standards
- Manufacturing/Use Information
- Laboratory Methods
- Special References
- Synonyms and Identifiers
- Administrative Information

DRAFT-Do not cite, reference or distribute

Article ID: 543

Citation: Agency for Toxic Substances and Disease Registry (ATSDR). "Agency for Toxic Substances and Disease Registry (ATSDR) [Home page]." 2005. <http://www.atsdr.cdc.gov/>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, PAHs, PCBs, Rubber Additives, Solvents

Specific Chemicals: Information on hundreds of chemicals.

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in workplace
- B Surveillance and Clinical Aspects
- B.4 Clinical protocols for recognition of skin exposure health effects
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- D.1.D Other health effects
- D.1.E Contribution to overall exposure
- D.2 Summaries of health effects, dose-response relationships
- F Risk Management
- F.1 Strategies for exposure control
- F.1.C Work practice/Administrative controls
- F.1.D PPE and PPE regulations

Summary: The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency of the U.S. Department of Health and Human Services. ATSDR is directed by Congressional mandate to perform specific functions concerning the effect on public health of hazardous substances in the environment. These functions include response to emergency releases of hazardous substances, information development and dissemination, and education and training concerning hazardous substances. The website contains a number of resources applicable to occupational dermal exposure to chemicals, including:

- The Medical Management Guidelines (MMGs): Guidelines for acute chemical exposures were developed by ATSDR to aid emergency department physicians and other emergency healthcare professionals who manage acute exposures resulting from chemical incidents. Information provided in the guidelines includes potential routes of exposure, applicable exposure standards and guidelines, health effects, and protective measure to be taken by rescue workers, decontamination procedures and printable

follow-up documents for patients who have been exposed to specified chemicals. Guidelines are available for approximately 50 chemicals.

- Toxicological Profile Information Sheets: Toxicological profiles for hazardous substances found at National Priorities List (NPL) sites. Profiles are available on over 250 chemicals (see ID544 for more detail).

- ToxFAQs: A series of summaries taken from toxicological profiles and public health statements. Each fact sheet serves as a quick and easy to understand guide. Answers are provided to the most frequently asked questions (FAQs) about exposure to hazardous substances found around hazardous waste sites and the effects of exposure on human health.

- Interaction Profiles for Toxic Substances: A series of documents being developed for certain priority mixtures that are of special concern to ATSDR. The purpose of the Interaction Profile is to evaluate data on the toxicology of the mixture and on the joint toxic action of the chemicals in the mixture in order to recommend approaches for the exposure-based assessment of the potential hazard to public health.

Article ID: 544

Citation: Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile Information Sheet. <http://www.atsdr.cdc.gov/toxpro2.html> . 2005.

Resource Type: Web Page

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Hand Cleansers, Heavy Metals/Inorganic Compounds, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Solvents

Specific Chemicals: 250 chemicals listed

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.2 Health hazards resulting from skin exposure to chemicals
- A.3 Investigation, intervention, and control of occupational skin exposures
- C Exposure Characterization
- C.4 Direct methods to measure exposure
- C.4.C Biomonitoring
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- D.1.D Other health effects
- D.1.E Contribution to overall exposure
- D.2 Summaries of health effects, dose-response relationships

Summary: The Agency for Toxic Substances and Disease Registry (ATSDR) produces Toxicological Profile Information Sheets for hazardous substances found at National Priorities List (NPL) hazardous waste sites. Although geared toward environmental rather than occupational exposures, the sheets contain useful information for occupational settings as well. So far, 282 toxicological profiles have been published or are under development and cover more than 250 substances. Each chemical profile contains available information on health effects, chemical and physical information, potential for human exposure, analytical methods and regulations and advisories. Each profile also contains a public health statement that includes information written in non-technical terms for a general audience on what the chemical is, how one might be exposed to it, how the chemical enters and leaves the body, the effects of exposure and medical tests to determine if you have been exposed.

Article ID: 545

Citation: International Labor Organization (ILO). "International Labor Organization (ILO) [Home page]." 2005. <http://www.ilo.org/> Website

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations: General - overview, Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Forestry/Fisheries, Manufacturing - Chemical, Manufacturing - Other, Medical Services, Mining, Service - Food, Service - Medical, Transportation/Communications/Utility

Specific Process:

Chemical: General - overview, Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Food Products, Hand Cleansers, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Soaps and Detergents, Solvents

Specific Chemicals:

Mixtures: Yes

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.3 Investigation, intervention, and control of occupational skin exposures
 - A.4 Skin physiology and functions as a barrier to chemical insults
 - A.6 Dermal regulations and skin notations
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.1.B Skin exposure minor focus
 - B.2 Loss of workdays and impact on productivity
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
 - C.2 Description of factors influencing exposure conditions
 - C.2.A Exposure intensity/frequency/duration
 - C.2.B Exposure concentration
 - C.2.C Skin area affected
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.C Systemic toxicity
 - D.1.E Contribution to overall exposure
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

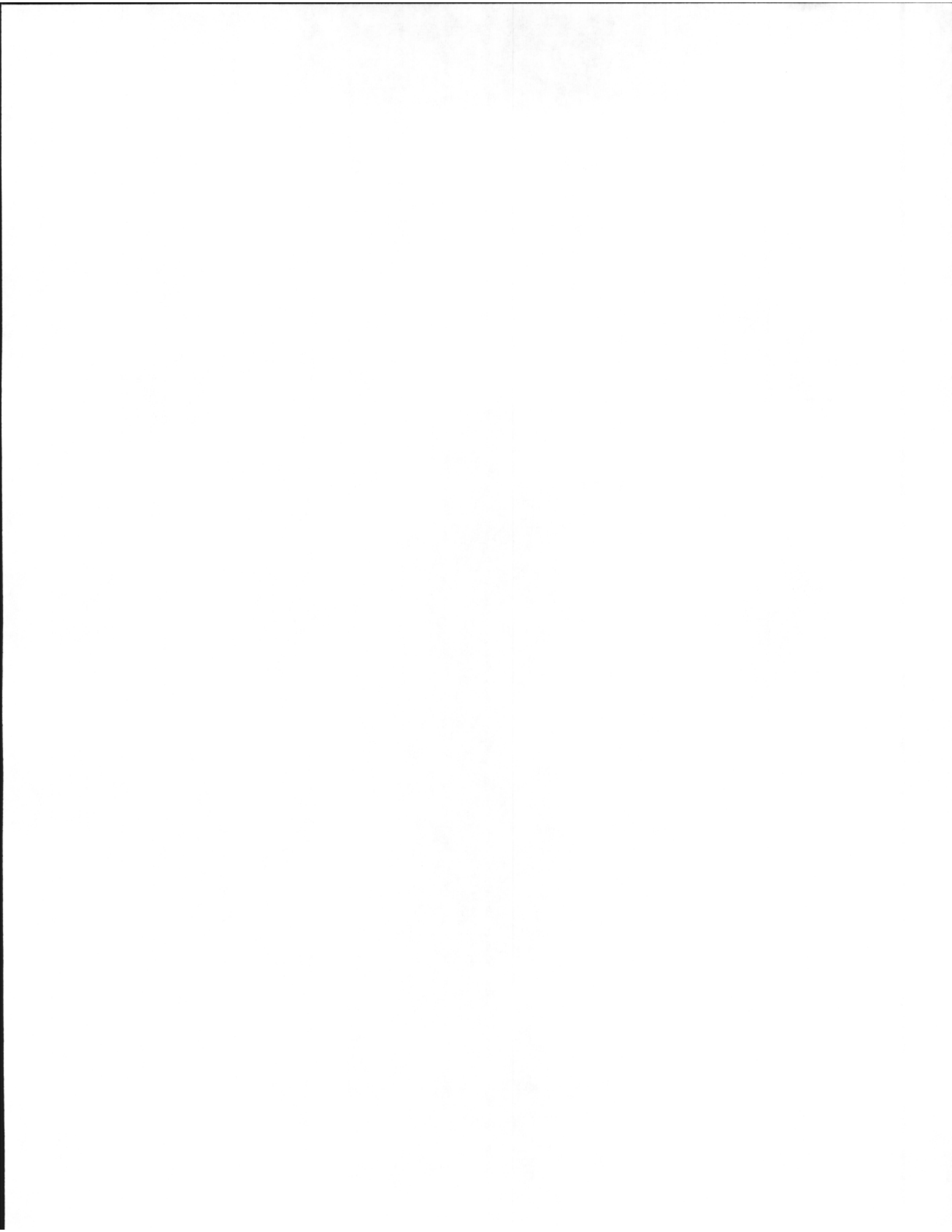
Summary:

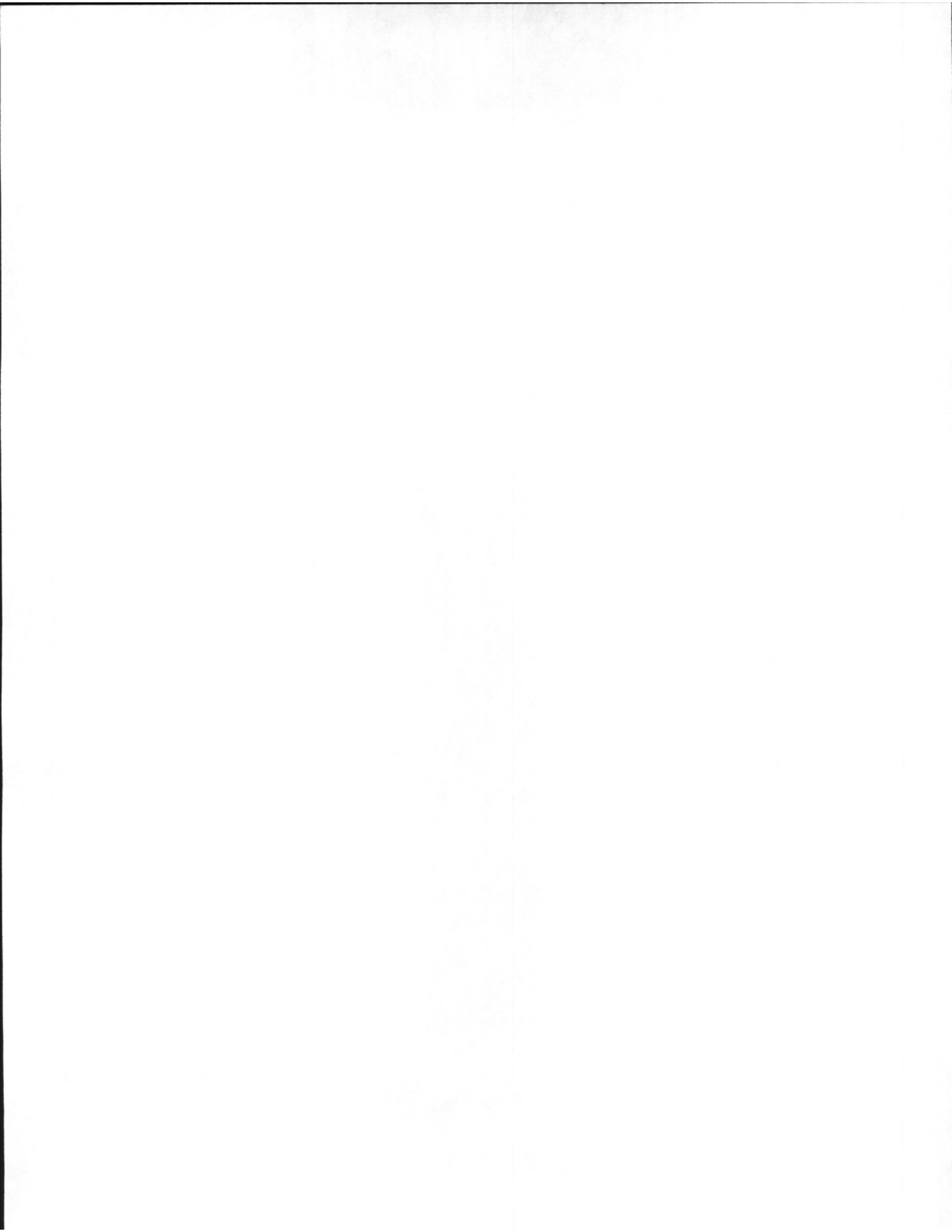
The International Labor Organization is the UN specialized agency which promotes internationally recognized human and labor rights. Among other things, it provides technical assistance in the field of occupational safety and health. A variety of different occupational safety and health resources containing information on dermal exposure are available through this website. Key resources available through ILO include:

- International Occupational Safety and Health Information Centre: CIS was established in 1959 with the aim of facilitating the exchange of information about occupational safety and health being published around the world, whatever the format or the language- Variety of different databases and services that contain dermal exposure information can be accessed through this centre. (<http://www.ilo.org/public/english/protection/safework/cis/products/dbs.htm>), including some of those listed below:
- ILO Encyclopedia of Occupational Health and Safety: This searchable web version of the encyclopedia includes sections on occupational skin diseases, occupational contact dermatitis, and the prevention of occupational dermatoses. The Encyclopedia can also be searched by chemical, industry and occupation and then look for potential dermal hazards within each.
- International Chemical Safety Cards (ICSC): The ICSC's summarize essential health and safety information on chemicals for their use by workers and employers in factories, agriculture, construction and other work places. These include information on skin exposure potential. They are available in a wide variety of different languages.
- International Risk Phrases Definitions: Risk phrases used by countries in the European Union, including those used to dermal exposure risks.
- International Hazard Datasheets on Occupation: the International Hazard Datasheets on Occupations are a multipurpose information resource containing information on the hazards, risks and guidelines for prevention related to specific occupations. Dermal hazards associated with listed occupations, when present, are given.

Article ID:	546
Citation:	Enviroderm Services. "Dermatological Engineering." 2005. http://www.enviroderm.co.uk/
Resource Type:	Website
Educational Materials:	Yes
Number of References:	
Industries/Occupations:	General - overview
Specific Process:	
Chemical:	General - overview, Coolants, Latex
Specific Chemicals:	metalworking fluids
Mixtures:	No
Audience:	Professional
Topics Addressed:	<ul style="list-style-type: none"> A Overview A.1 Occurrence of skin exposures in workplace A.2 Health hazards resulting from skin exposure to chemicals A.4 Skin physiology and functions as a barrier to chemical insults B Surveillance and Clinical Aspects B.3 Surveillance study protocols/procedures for gathering data B.4 Clinical protocols for recognition of skin exposure health effects C Exposure Characterization C.1 Workplace factors associated with harmful skin exposures C.2 Description of factors influencing exposure conditions C.2.A Exposure intensity/frequency/duration C.2.B Exposure concentration C.2.C Skin area affected C.2.E Uptake C.4 Direct methods to measure exposure C.4.B Skin D Hazard Identification D.1 Potential health effects resulting from specific chemicals D.1.A Irritant contact dermatitis D.1.B Allergic contact dermatitis/sensitization D.1.C Systemic toxicity E Risk Assessment E.1 Guidelines for risk assessment or analysis E.1.A Localized health effects E.1.B Systemic health effects E.2 Example risk assessments F Risk Management F.1 Strategies for exposure control F.1.A Substitution F.1.B Engineering controls F.1.C Work practice/Administrative controls F.1.D PPE and PPE regulations F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs F.2 Protocols for risk management F.2.B Development of approach to achieve exposure reduction goal

Summary: Enviroderm Services is a UK-based consulting firm founded by Mr. Chris Packham, a recognized expert in the field of dermal exposure, that specializes in the workplace dermal exposures prevention and control. Although consulting services are limited to





the UK, they have available through their website a variety of different dermal exposure-related materials, including literature, educational and training materials, workplace posters, skin monitoring equipment, dermal risk assessment forms and skin health surveillance tools including forms and questionnaires. The website also contains a brief description of all the materials and literature available for purchase.

Literature available through the website includes:

- Essentials of Occupational Skin Management. A 15 chapter textbook featured as a separate resource in this guide (see ID 478)
- Risk Assessment (for dermal exposure) Forms
- Technical Bulletin No.1 Skin Management
- Technical Bulletin No.2 Occupational Skin Diseases
- Technical Bulletin No.3 Chemical protection using gloves
- Technical Bulletin No.4 Health Surveillance and the skin
- Technical Bulletin No.5 Irritant Contact Dermatitis
- Technical Bulletin No.6 Thoughts on Latex Allergy
- Technical Bulletin No.7 Personal Hygiene
- Technical Bulletin No.8 Is it occupational?
- Technical Bulletin No.9 Emollients
- Technical Bulletin No.10 Barrier Creams
- Technical Bulletin No.11 Risk Assessment for Dermal Exposure
- Technical Bulletin No.12 Risk Management
- Technical Bulletin No.13 Allergic Skin Disorders
- Technical Bulletin No.14 Metalworking fluids
- Technical Bulletin No.15 Infection control and the skin
- Technical Bulletin No.16 Investigating a skin problem
- Technical Bulletin No.17 How hazardous is that chemical?
- Technical Bulletin No.18 Skin Exposure Measurement

Article ID: 551

Citation: Health and Safety Executive (HSE). "Health and Safety Executive (HSE) [Home page]." 2005. <http://www.hse.gov.uk/>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview, Beauty/Cosmetology, Manufacturing - Chemical, Manufacturing - Other, Service - Food

Specific Process: hairdressers, catering, printing

Chemical: General - overview, Food Products, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Pesticides, Plastics and Resins, PCBs, Soaps and Detergents, Solvents

Specific Chemicals: isocyanates, epoxy resins

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.3 Investigation, intervention, and control of occupational skin exposures
 - A.4 Skin physiology and functions as a barrier to chemical insults
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.2 Loss of workdays and impact on productivity
 - B.4 Clinical protocols for recognition of skin exposure health effects
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
 - C.2 Description of factors influencing exposure conditions
 - C.2.C Skin area affected
 - C.4 Direct methods to measure exposure
 - C.4.A Surfaces
 - C.4.B Skin
 - C.4.C Biomonitoring
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.2 Summaries of health effects, dose-response relationships
 - D.3 Characterization protocols
 - D.3.A Corrosivity
 - D.3.C Sensitization potential
 - D.3.E Measurement of skin permeation rates and reservoir effects
- E Risk Assessment
 - E.1 Guidelines for risk assessment or analysis
 - E.1.A Localized health effects
 - E.1.B Systemic health effects
 - E.2 Example risk assessments
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary:

Britain's Health and Safety Commission (HSC) and the Health and Safety Executive (HSE) are responsible for the regulation of occupational health and safety arising risks in the U.K. Any regulatory information provided here is specific to the U.K. This website provides comprehensive health and safety information, with most dermal exposure-related information found on the topic page Skin at Work.

The HSE's Skin at Work webpage includes a variety of free leaflets, including: Preventing Dermatitis at Work, Advice for Employers and Employees; MS24 - Medical Aspects of Occupational Skin Disease; Managing Health and Safety topics, Personal Protective Equipment (PPE), Risk Assessment, and a number of chemical-specific leaflets. It also contains links to chemical-specific Alert Notices. The Skin at Work web page provides specific dermal exposure information for the following industries: hairdressing, catering and printing industries.

HSE web site also has information on a variety of different dermal exposure research topics, including:

- Contact dermatitis
- Occupational dermatitis
- Skin disease surveillance data
- Development of a method to assess biologically relevant dermal exposure
- Dermal exposure resulting from liquid contamination
- In vitro dermal absorption of liquids
- Health effects of particles produced for nanotechnologies
- Pesticides in air and/or on surfaces
- Draft guidelines on route-to-route extrapolation of toxicity data when assessing health risks of chemicals
- Development of a field method for the assessment of the effectiveness of barrier creams in preventing skin irritation reactions
- An assessment of skin sensitization by the use of epoxy resin in the construction industry

Article ID: 554
Citation: American Academy of Family Physicians. "American Academy of Family Physicians [Home page]." 2005. <http://www.aafp.org/>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- C Hazard Identification
- C.2 Tables/charts/lists of hazards for specific chemicals
- E Risk Management
- E.1 Overview of skin exposure control options
- E.3 "Best practices"/guidelines/recommendations
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The American Academy of Family Physicians is one of the largest national medical organizations, representing more than 94,000 family physicians, family medicine residents, and medical students nationwide. They have material on their web site as well as links to other information related to dermal exposure and occupational skin disease. Key available information includes:

- Skin problems on the job - patient information handsheet - This handsheet, written for a more general audience, provides a brief overview of skin hazards and what a worker can do to protect themselves.
- Occupational Skin Disease - This article, written for medical professionals, provides an overview of cause, diagnosis and control of occupational skin disease, including a more detailed description of irritant contact dermatitis and allergic contact dermatitis, including occupational groups at risk.

Article ID: 555
Citation: Ansell Chemsafe. "Ansell Chemsafe [Home page]." 2005.
<http://www.ansellchemsafe.com/Content.aspx?topicID=248>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
E Risk Management
E.1 Overview of skin exposure control options
E.3 "Best practices"/guidelines/recommendations
E.3.D PPE and PPE regulations

Summary: Ansell is an Australian chemical glove manufacturer. Their website includes general information on dermal exposure to chemicals and protecting your skin as well as a software program, Specware, that can be used to assist in the glove selection process. SpecWare provides the user with glove use recommendations for a variety of commonly used chemicals. You can access the program on their website or with their hardcopy SpecWare guide, which is available on request.

Article ID: 556
Citation: Bureau of Labor Statistics. "Bureau of Labor Statistics Industry Illness and Injury Data." 2005. <http://www.bls.gov/iif/oshsum.htm>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Forestry/Fisheries, Manufacturing - Chemical, Manufacturing - Other, Medical Services, Mining, Service - Food, Service - Medical, Service - Other, Transportation/Communications/Utility, Other

Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.1.B Skin exposure minor focus
B.2 Loss of workdays and impact on productivity
B.3 Surveillance study protocols/procedures for gathering data

Summary: The BLS is an independent national statistical agency that collects, processes, analyzes, and disseminates essential statistical data to the American public, the U.S. Congress, other Federal agencies, State and local governments, business, and labor. The BLS also serves as a statistical resource to the Department of Labor. The Injuries, Illnesses, and Fatalities program provides data on illnesses and injuries on the job and data on worker fatalities, summarized by year. The data are presented in a variety of different way, including illness rates for different industries by type of illness. Skin diseases and skin disorders is one of the types of illness reported.

Article ID: 557

Citation: Centers for Disease Control, National Institute for Occupational Safety and Health, and Center to Protect Workers' Rights. "Electronic Library of Construction Occupational Safety and Health." 2005. <http://www.cdc.gov/elcosh/>

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations: Construction

Specific Process:

Chemical: Corrosives, Hand Cleansers, Heavy Metals/Inorganic Compounds, Soaps and Detergents

Specific Chemicals: Portland Cement, Hexavalent Chromium

Mixtures: Yes

Audience: General

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in the workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
 - B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
 - B.2 Factors that influence exposure conditions
 - B.2.B Exposure controls
 - B.3 Protocols/checklists to characterize exposure to skin hazards
- C Hazard Identification
 - C.3 Protocols/checklists to identify skin hazards in the workplace
- D Risk Assessment
 - D.1 Protocols/checklists to identify risk from exposure
- E Risk Management
 - E.3 "Best practices"/guidelines/recommendations
 - E.3.B Engineering controls
 - E.3.C Work practice/administration controls
 - E.3.D PPE and PPE regulations
 - E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
 - E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The Electronic Library of Construction Occupational Health and Safety (eLCOSH) is intended to provide accurate, user-friendly information about safety and health for construction workers from a variety of different source. The eLCOSH was developed by the Center to Protect Workers' Rights (CPWR) through funding from NIOSH, and is maintained by CPWR. Information on the website can be located by hazard, trade, job sites and other categories. Downloadable resources on this site related to dermal exposure to chemicals include the following:

- Save your Skin: Tips on Preventing Skin Problems - a general information brochure for workers.
- Chemical Glove Selection - A document produced by the University of Delaware Cooperative Extension on glove selection in agricultural settings.
- Physician's Alert: Skin Conditions - A brochure produced by the CPWR for workers to bring to their physicians office.
- An Employer's Guide To Skin Protection – A comprehensive

document for employers covering a variety of issues associated with dermal exposure evaluation, control and prevention to cement products, hexavalent chromium, and worksite cleansers.

- A Safety & Health Practitioner's Guide to Skin Protection – A comprehensive document on dermal exposure developed for the person responsible for protecting the safety and health of workers using Portland cement products. Similar to the document produced for employers, this document goes into more depth and includes a worker safety pamphlet, a best practices checklist, and a symptoms questionnaire.

DRAFT-Do not cite, reference or distribute

Article ID: 558

Citation: Canadian Centre for Occupational Health and Safety. "Canadian Centre for Occupational Health and Safety [Home page]." 2005. <http://www.ccohs.ca/>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process: Variety of different occupations

Chemical: General - overview, Corrosives, Heavy Metals/Inorganic Compounds, Latex, Particulates, Petroleum Products & Lubricants, Solvents

Specific Chemicals: Variety of different chemicals

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- B.2 Factors that influence exposure conditions
- B.2.B Exposure controls
- C Hazard Identification
- C.3 Protocols/checklists to identify skin hazards in the workplace
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
- E.3.B Engineering controls
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The Canadian Centre for Occupational Health and Safety (CCOHS) is a Canadian federal government agency that promotes workplace health and safety by providing resources and programs on a variety of different health and safety topics. The website contains general information, articles, news releases, products & services related to occupational safety and health. Dermal exposure-related information can be found throughout the site. Good sources include:

- OSH Answers - This searchable page contains information on a variety of different topics in occupational health and safety. Information can be searched based on hazards present; occupations and workplaces; and diseases, disorders and injuries, to name a few. OSH Answers contains hazard and prevention-related information for a variety of chemicals and chemicals classes that are known skin hazards, including an allergic contact dermatitis.
- Dermatitis, Allergic Contact Web page - This web page covers occupations at risk, recognition treatment and preventive measures associated with allergic contact dermatitis.
- Dermatitis, Irritant Contact Web Page - This web page covers

occupations at risk, recognition, treatment and preventive measures associated with irritant contact dermatitis.

- WHMIS (Workplace Hazardous Materials Information System) label contains health hazard information. These labels are required by law. They use classifications to group chemicals with similar properties or hazards. Class E – corrosive material, is for compounds that can cause burns to eyes, skin or respiratory system.

DRAFT-Do not cite, reference or distribute

Article ID: 559
Citation: American Academy of Family Physicians. "Skin Problems: How to Protect Yourself From Job-related Skin Problems." 2004. <http://familydoctor.org/750.xml>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals
E Risk Management
E.1 Overview of skin exposure control options

Summary: This very general review of job-related skin problems includes a discussion on how workers can protect themselves against workplace skin hazards.

Article ID: 560

Citation: World Health Organization. "International Programme on Chemical Safety [Home page]." 2005. <http://www.who.int/ipcs/en/> Website

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview, Cleaning Agents, Coolants, Corrosives, Heavy Metals/Inorganic Compounds, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Solvents

Specific Chemicals: Variety of chemicals included in chemical-specific hazard assessments

Mixtures: No

Audience: Professional

Topics Addressed:

- B Surveillance and Clinical Aspects
- B.4 Clinical protocols for recognition of skin exposure health effects
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.1.C Systemic toxicity
- D.1.D Other health effects
- D.1.E Contribution to overall exposure
- D.2 Summaries of health effects, dose-response relationships
- D.3 Characterization protocols
- D.3.E Measurement of skin permeation rates and reservoir effects

Summary: The International Programme on Chemical Safety (IPCS) is a cooperative venture between WHO, UNEP, and ILO. The two main roles of the IPCS are to establish the scientific basis for the safe use of chemicals and to strengthen national capabilities and capacities for chemical safety. A variety of different resources containing information on dermal exposures and exposures to chemicals in general can be found at this web site. Information of interest includes:

- Concise International Chemical Assessment Documents (CICADs): reviews on the effects of over 60 chemicals on human health and the environment. Over a hundred chemicals are included. The CICADs characterize the hazard and dose-response of exposure to chemicals and provide examples of exposure estimation and risk characterizations. Skin exposure information can be found under the occupational exposure section.
- IPCS INCHEM: a way to access peer reviewed information on chemicals commonly used throughout the world and that occur as contaminants in the environment and food. It consolidates information from a number of different intergovernmental organizations..
- IPCS INTOX: a tool for poison centers and related units that provide information on preventing, evaluating, diagnosing, treating

and reporting on chemical emergencies.
The Glossary of Exposure Assessment-Related Terms: contains definitions for terms used in exposure assessment literature.

DRAFT-Do not cite, reference or distribute

Article ID: 561
Citation: World Health Organization International Programme on Chemical Safety. "Environmental Health Criteria Document on Dermal Absorption [Draft]." 2005.
http://www.who.int/ipcs/methods/dermal_absorption/en/
Resource Type: Technical publication/report
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.4 Skin physiology and functions as a barrier to chemical insults
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
D Hazard Identification
D.3 Characterization protocols
D.3.E Measurement of skin permeation rates and reservoir effects
D.3.F [Q]SARs – development, validation, and application

Summary: This document provides an overview of percutaneous/dermal absorption of chemicals and its measurement, in particular as part of the process of chemical risk assessment. It is not meant to be comprehensive, but rather to cover current topics of interest in the field. A draft version is available on their website, and the final version reportedly will be available in early 2006.

Article ID: 562
Citation: Unison. "Health and Safety Zone." 2005.
<http://www.unison.org.uk/safety/index.asp>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals
B Exposure Characterization
B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
E Risk Management
E.1 Overview of skin exposure control options

Summary: UNISON is Great Britain's biggest trade union, with members working in the public services, for private contractors providing public services and in the essential utilities. Their website includes a health and safety zone, which contains information on variety of different health and safety topics. Included is an information sheet on dermatitis, which provides background information on causes of dermatitis in the workplace and steps that can be taken to prevent dermatitis. The information provided on legal requirements is specific to Great Britain.

Article ID: 563
Citation: US Department of Transportation. "Emergency Response Guidebook." 2004. <http://hazmat.dot.gov/pubs/erg/gydebook.htm>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview, Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Solvents
Specific Chemicals: Covers hundreds of different chemicals
Mixtures: No
Audience: Professional
Topics Addressed:
F Risk Management
F.1 Strategies for exposure control
F.1.A Substitution
F.1.B Engineering controls
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations

Summary: The Emergency Response Guidebook (ERG2004) was developed jointly by the US Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (SCT) for use by firefighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving a hazardous material. It is was designed as a guide to aid first responders in (1) quickly identifying the specific or generic classification of the material(s) involved in the incident, and (2) protecting themselves and the general public during this initial response phase of the incident. The ERG is updated every three to four years.

Each chemical or material listed in the guide book is assigned a corresponding response guide number. The guides are then used to direct first responders on how to safely respond to hazardous material incidents. Information provided on the guides includes general health hazards, including any associated dermal hazards, recommended personal protective equipment and proper emergency response procedures. The guide can be searched by material name or identification number. The guidebook is available on-line as a searchable database as well as in hard copy form.

Article ID: 564

Citation: European Agency for Safety and Health and Work. "European Agency for Safety and Health and Work [Home page]." 2005. <http://europe.osha.eu.int/OSHA>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview

Specific Chemicals:

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- A.4 Dermal regulations and skin notations
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- C Hazard Identification
- C.2 Tables/charts/lists of hazards for specific chemicals
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
 - E.3.A Substitution
 - E.3.B Engineering controls
 - E.3.C Work practice/administration controls
 - E.3.D PPE and PPE regulations
 - E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The European Agency for Safety and Health at Work collects, analyzes and promotes occupational safety and health-related information in Europe. The Agency is a tripartite European Union organization that brings together representatives from governments, employers' and workers' organizations as well as from the European Commission. The Agency's web portal provides links to over 30 national web sites, usually the lead OSH organization in the EU Member States, candidate countries and other international partners. Information on dermal exposure can be found here based on chemical, risks, industry or sector and topics of interest. Information also is available in multiple languages.

Useful information on dermal exposures available through the Agency's website includes the following fact sheets:

- Issue 34 - Eliminating and Substituting Dangerous Substances
- Issue 35 - Communicating Information about Dangerous Substance
- Issue 40 - Skin Sensitizers

Article ID: 565

Citation: Washington State Department of Labor and Industries. "Skin disorders (Dermatitis) Safety & Health Assessment & Research for Prevention (SHARP)." 2005.
<http://www.lni.wa.gov/Safety/Research/Dermatitis/default.asp>
 Web Page

Resource Type: Web Page

Educational Materials: Yes

Number of References:

Industries/Occupations: General - overview, Agricultural, Manufacturing - Other, Service - Medical

Specific Process:

Chemical: General - overview, Fiberglass and other fibers, Latex, Petroleum Products & Lubricants, Plastics and Resins, Solvents

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.3 Investigation, intervention, and control of occupational skin exposures
 - A.4 Skin physiology and functions as a barrier to chemical insults
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.1.B Skin exposure minor focus
 - B.2 Loss of workdays and impact on productivity
 - B.3 Surveillance study protocols/procedures for gathering data
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The Safety and Health Assessment and Research for Prevention (SHARP) Program at the Washington State Department of Labor and Industries conducts work-related dermatitis research and surveillance. Under the Washington Sentinel Event Notification System for Occupational Risks (SENSOR) Dermatitis Program, SHARP has conducted surveillance on and prevention of work-related dermatitis. This web site on skin disorders describes the research projects, educational materials and surveys produced by this project, as well as summaries of data collected. Examples of documents available on this website include:

- A guide to preventing dermatitis while working with advanced composite materials
- Metal Working Fluids: Prevention of skin problems when working with metal working fluids
- Clothing dermatitis and clothing-related skin conditions
- Skin health in agriculture

- Hand dermatitis in health care workers
- Prevention of hand dermatitis in the health care setting
- Latex sensitivity in Washington State acute care hospitals: A needs assessment and survey of awareness of the issues
- Latex sensitivity in Washington State acute care hospitals

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Article ID: 566
Citation: Oregon Department of Human Services. "Oregon Worker Illness and Injury Prevention Program (OWIIPP)." 2005.
<http://oregon.gov/DHS/ph/owiipp/dermatitis/dermatitis.shtml>
Website
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview, Latex, Rubber Additives
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.2 Loss of workdays and impact on productivity
B.3 Surveillance study protocols/procedures for gathering data
F Risk Management
F.1 Strategies for exposure control
F.1.A Substitution
F.1.C Work practice/Administrative controls

Summary: The Oregon Worker Illness and Injury Prevention Program (OWIIPP) is working to identify and prevent targeted occupational illnesses and injuries in Oregonians. Workplace dermatitis and latex allergies are two of their targeted occupational illnesses.

Article ID: 567

Citation: [No Author] . "Montana Department. of Labor and Industries - Employment Relations [Home page]." 2005. <http://erd.dli.state.mt.us/>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview, Latex

Specific Chemicals:

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- E Risk Management
- E.1 Overview of skin exposure control options
- E.3 "Best practices"/guidelines/recommendations
- E.3.A Substitution
- E.3.B Engineering controls
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
- E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The Montana State Department of Labor and Industries' (DLI) Safety and Health Bureau is responsible for workplace safety and health through inspection, consultation, technical assistance and training. Over 100 different occupational safety and health documents and brochures are available either electronically through their website or hard copies can be ordered through their website. Documents are accessed through the Program Samples topic on the Health and Safety Bureau's drop down box. Dermal-exposure related documents and brochures found at this site include:

- Dermatitis Prevention: Occupational Skin Disorders
- Latex Allergy
- Job Safety Analysis Packet (though generic, can be used to evaluate dermal hazards)

Article ID: 568
Citation: [No Author] . "The American Skin Association [Home page]."
2005. <http://www.americanskin.org/frameset.htm>
Resource Type: Website
Educational Materials: Yes
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview, Latex
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals

Summary: The American Skin Association (ASA) is a volunteer-led health organization that works on issues associated with skin disorders. One of the primary missions of the American Skin Association is to raise public awareness of the wide range of skin disorders through ongoing public education. They produce a consumer-oriented quarterly newsletter called Skin Facts. Past issues can be accessed through the website's archives. Past articles have included skin disease in the workplace and latex sensitivity.

Article ID: 569
Citation: US Environmental Protection Agency - Office of Pollution Prevention and Toxics (OPPT). "US Environmental Protection Agency - Office of Pollution Prevention and Toxics (OPPT) : Exposure Assessment Tools and Models." 2005. <http://www.epa.gov/opptintr/exposure/index.htm>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling
E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects
E.2 Example risk assessments

Summary: The US EPA's Office of Pollution Prevention and Toxics (OPPT) has developed several exposure assessment methods, databases, and predictive models to help in evaluating, among other things, how workers may be exposed to chemicals. This web page provides a table of EPA's exposure assessment tools and models, whether they include a dermal component, whether they address workplace exposures and links to where they can be downloaded. Methods listed include exposure assessment screening tools.

Article ID: 570

Citation: Human Exposure Research Organisations Exchange. "HEROX - Human Exposure Research Organisations Exchange [Home page]." 2005. <http://www.herox.org/>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- E Risk Assessment
- E.1 Guidelines for risk assessment or analysis
- E.1.A Localized health effects
- E.1.B Systemic health effects

Summary: HEROX is a forum for people interested in research on human exposure to hazardous substances. It provides European information related to exposure to carcinogens, dermal exposure assessment, development of analytical methods and exposure modeling research as well as access to databases on workplace exposure measurements. Material on this site is edited by people from the Department of Environmental and Occupational Medicine at the University of Aberdeen, UK.

Article ID: 571
Citation: Organisation for Economic Co-operation and Development (OECD. "Chemicals Testing - Guidelines." 2005. http://www.oecd.org/findDocument/0,2350,en_2649_34377_1_1_1_1_1,00.html
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations:
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- D Hazard Identification
- D.3 Characterization protocols
- D.3.A Corrosivity
- D.3.B Irritation potential
- D.3.C Sensitization potential
- D.3.D Potential to cause systemic effects
- D.3.E Measurement of skin permeation rates and reservoir effects

Summary: The Organization for Economic Co-operation and Development (OECD) Guidelines for the testing of chemicals are a basic set of tools that are designed for use in regulatory safety testing and subsequent chemical product notification and chemical registration. These are only guidelines. The existing guidelines are periodically updated and new guidelines are also added regularly. The dermal related guidelines listed below can be downloaded from the OECD site.

- OECD Guidelines for the Testing of Chemicals - Sections 1-5, Section 4, Health Effects
- 402 Acute Dermal Toxicity (Updated Guideline, adopted 24th February 1987)
- 404 Acute Dermal Irritation/Corrosion (Updated Guideline, adopted 24th April 2002)
- 406 Skin Sensitisation (Updated Guideline, adopted 17th July 1992)
- 410 Repeated Dose Dermal Toxicity: 21/28-day Study (Original Guideline, adopted 12th May 1981)
- 411 Subchronic Dermal Toxicity: 90-day Study (Original Guideline, adopted 12th May 1981)
- 427 Skin Absorption: In Vivo Method (Original Guideline, adopted 13th April 2004)
- 428 Skin Absorption: In Vitro Method (Original Guideline, adopted 13th April 2004)
- 429 Skin Sensitisation: Local Lymph Node Assay (Updated Guideline, adopted 24th April 2002)
- 430 In Vitro Skin Corrosion: Transcutaneous Electrical Resistance Test (TER) (Original Guideline, adopted 13th April 2004)
- 431 In Vitro Skin Corrosion: Human Skin Model Test (Original

Guideline, adopted 13th April 2004)

- 434 Acute Dermal Toxicity-Fixed Dose Procedure Draft New Guideline (May 2004) (Deadline for public comments passed: 16 July 2004)

Chemical Testing Guidelines

- No. 9: Guidance Document for the Conduct of Studies of Occupational Exposure to Pesticides During Agricultural Application

- No. 13: Detailed Review Document on Classification Systems for Sensitising Substances in OECD Member Countries

- No. 16: Detailed Review Document on Classification Systems for Skin Irritation/Corrosion in OECD Member Countries

DRAFT-Do not cite, reference or distribute

Article ID: 572
Citation: Centers for Disease Control and Prevention. "NASD: National Ag Safety Database." 2006. Centers for Disease Control and Prevention <http://www.cdc.gov/nasd/>
Resource Type: Website
Educational Materials: Yes
Number of References:
Industries/Occupations: Agricultural
Specific Process:
Chemical: Hand Cleansers, Pesticides
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
E Risk Management
E.1 Overview of skin exposure control options
E.3 "Best practices"/guidelines/recommendations
E.3.B Engineering controls
E.3.C Work practice/administration controls
E.3.D PPE and PPE regulations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The National Ag Safety Database (NASD), developed through funding from NIOSH, is designed to provide a national information resource on agricultural safety and health issues, with the purpose of reducing agricultural work-related illnesses and injuries. It contains a variety of agricultural technical bulletins by topic, as well as posters, videos for training. They also have Spanish language material. The materials on this website are produced by other sources, mostly State and University Agriculture Extension Offices. Dermal exposure bulletins include: Skin Irritants, Pesticide-contaminated clothing laundering and pesticide exposure in general. Under Mixing, loading, and application, there are a number of bulletins on the selection, proper use, cleaning and handling of PPE. Bulletins on of other control measures and videotapes on pesticide safety for training purposes are also available.

Article ID: 573
Citation: International Brotherhood of Teamsters. "International Brotherhood of Teamsters [Home page]." 2006. International Brotherhood of Teamsters <http://www.teamster.org/>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview, Plastics and Resins, Solvents
Specific Chemicals: diisocyanates
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
A.2 Health hazards resulting from skin exposure to chemicals
B Exposure Characterization
B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
E Risk Management
E.1 Overview of skin exposure control options

Summary: The International Brotherhood of Teamsters' safety and health department has a web page on the Teamsters' website that contains information on health and safety issues associated with Teamster work activities. A variety of fact sheets in the Health and Safety section of their web site address dermal exposure related issues, including:

- Dermatitis
- Diisocyanates
- Solvents
- General requirements for sanitation

Article ID: 574
Citation: California Division of Labor Statistics and Research. "California Division of Labor Statistics and Research [Home page]." 2003. California Division of Labor Statistics and Research <http://www.dir.ca.gov/DLSR/Injuries/2003/Menu.htm>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
B.1.B Skin exposure minor focus
B.2 Loss of workdays and impact on productivity

Summary: The California Division of Labor Statistics and Research collects, compiles, and presents statistics and research relating to the condition of labor in the state. Data presented on their site include incidence rates and numbers of nonfatal occupational illnesses by industry sector and category of illness disorders and the numbers of nonfatal occupational illnesses by selected industries and category of illness. "Skin disorders" is included as a category of illnesses.

Article ID: 575

Citation: [No Author] . "Alliance for the Polyurethanes industry." 2006.
Alliance for the Polyurethanes industry
<http://www.polyurethane.org/>

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations: Manufacturing - Chemical

Specific Process:

Chemical: Plastics and Resins

Specific Chemicals: Diisocyanates

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- B.2 Factors that influence exposure conditions
- B.2.A Exposure intensity/frequency
- B.2.B Exposure controls
- E Risk Management
- E.1 Overview of skin exposure control options
- E.3 "Best practices"/guidelines/recommendations
- E.3.A Substitution
- E.3.B Engineering controls
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The Alliance for the Polyurethanes Industry (API) is a business unit of the American Plastics Council. API's 61 members include U.S. producers or distributors of chemicals and equipment used to make polyurethane, and polyurethane product manufacturers. Their website contains information on polyurethane health and safety. Resources of interest associated with dermal exposure issues include:

- Hyperreactivity and Other Health Effects of Diisocyanates: Guidelines for Medical Personnel
- Working with TDI: What you should know
- Polyol Resin Blends Safety and Handling Guidelines
- Working with MDI: What you should know

Article ID: 578

Citation: [No Author] . "Occupational Skin Exposure-Absorption of Chemical Agents and Assessment of Exposures." Patty's Industrial Hygiene, 5th Edition: Volume I: Recognition and Evaluation of Chemical Agents. Ed. Robert Harris. Cincinnati: American Conference of Governmental Industrial Hygienists, 2000.

Resource Type: Book/monograph, chapter

Educational Materials: No

Number of References: 142

Industries/Occupations:

Specific Process:

Chemical:

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- F Risk Management
- F.1 Strategies for exposure control
- F.1.A Substitution
- F.1.B Engineering controls
- F.1.C Work practice/Administrative controls
- F.1.D PPE and PPE regulations
- F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: This chapter from Patty's Industrial Hygiene Volume 1 includes a discussion of factors that cause and contribute to occupational dermatoses, covering chemicals, primary irritants, allergic contact dermatitis, plants and wood, photosensitivity, mechanical, physical, and biological factors. The chapters also discusses the physiology of the skin, patch tests, prevention, and control.

Article ID: 579

Citation: Wang, Rhoda G. M. Knaak James B. and Howard I. Maibach. Health Risk Assessment: Dermal and Inhalation Exposure and Absorption of Toxicants (Dermatology). St. Louis: Mosby, 1993
Book/monograph, whole

Resource Type: Book/monograph, whole

Educational Materials: No

Number of References: 1718

Industries/Occupations: General - overview

Specific Process:

Chemical: General - overview, Solvents

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
- A.4 Skin physiology and functions as a barrier to chemical insults
- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.5 Exposure modeling
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.D Other health effects
- D.2 Summaries of health effects, dose-response relationships

Summary: This book, published by the California Environmental Protection Agency, includes contributions from over 40 contributors. The book has a clinical focus. There are no chapters specifically on dermal occupational exposures. It does, however, discuss skin and inhalation exposure to toxicants, skin metabolism, absorption, pharmacokinetic modeling, dermal absorption, cholinesterase inhibition, adverse reproductive effects, carcinogenicity, PBPK modeling, cytochrome P-450 metabolism in skin, health effects, and the role of epidemiology in assessing the hazards of toxicology. The following is a list of the book's chapters:

- Ch. 1 Physiologically Based Pharmacokinetic Modeling to Predict Tissue Dose and Cholinesterase Inhibition in Workers Exposed to Organophosphorus and Carbamate Pesticides
- Ch. 2 The Application of Pharmacokinetic Models to Predict Target Dose
- Ch. 3 Cytochrome P450-Dependent Metabolism of Drugs and Carcinogens in Skin
- Ch. 4 Percutaneous Absorption
- Ch. 5 In Vitro Skin Metabolism
- Ch. 6 Animal Models for Percutaneous Absorption
- Ch. 7 A Comparative Study of the Kinetics and Bioavailability of Pure and Soil-Absorbed Benzene, Toluene, and m-Xylene after Dermal Exposure
- Ch. 8 Prediction of Human Percutaneous Absorption with Physicochemical Data
- Ch. 9 Dermal Absorption of TCDD: Effect of Age
- Ch. 10 Percutaneous Absorption of Chemicals from Water during

Swimming and Bathing
Ch. 11 Percutaneous Absorption of Contaminants from Soil
Ch. 12 General Overview of Toxicological Responses and Routes of Chemical Exposure
Ch. 13 Acute Toxicity Testing by the Dermal Route
Ch. 14 Subchronic Dermal Exposure Studies with Industrial Chemicals
Ch. 15 The Dose Response of Percutaneous Absorption
Ch. 16 Reproductive and Developmental Toxicity Studies by Cutaneous Administration
Ch. 17 Dermal Carcinogenicity Studies of Petroleum-Derived Materials
Ch. 18 Comparison of Results from Carcinogenicity Tests of Two Halogenated Compounds by Oral, Dermal and Inhalation Routes
Ch. 19 The Objectives and Goals of Dermal Carcinogenicity Testing of Petroleum Liquids
Ch. 20 Chemical Carcinogenesis in Skin: Causation, Mechanism, and Role of Oncogenes
Ch. 21 Incorporating Biological Information into the Assessment of Cancer Risk to Humans Under Various Exposure Conditions and Issues Related to High Background Tumor Incidence Rates
Ch. 22 Phototoxicity of Topical and Systemic Agents
Ch. 23 Techniques for Assessing the Health Risks of Dermal Contact with Chemicals in the Environment
Ch. 24 Interspecies Extrapolation of Toxicological Data
Ch. 25: Human Skin Xenografts to Athymic Rodents as a System to Study Toxins Delivered to or Through the Skin
Ch. 26 The Isolated Perfused Porcine Skin Flap
Ch. 27 Perspectives on Assessment of Risk from Dermal Exposure to Polycyclic Aromatic Hydrocarbons
Ch. 28 The Paradox of Herbicide 2,4,-D Epidemiology
Ch. 29 A Review of Epidemiologic Studies with Regard to Routes of Exposure to Toxicant

Article ID: 580

Citation: Marks, James G., Peter Elsner, and Vincent A. Deleo. Contact & Occupational Dermatology. 3rd ed. St. Louis: Mosby, 2002

Resource Type: Book/monograph, whole

Educational Materials: No

Number of References:

Industries/Occupations: General - overview, Agricultural, Beauty/Cosmetology, Cleaning/Janitorial/Maid, Construction, Manufacturing - Other, Medical Services

Specific Process: Electronics workers, Dental workers, Florists, Food workers, Machinists, Office workers, Photographers, Printers, Textile workers

Chemical: Food Products

Specific Chemicals: Preservatives

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.4 Direct methods to measure exposure
- C.4.B Skin
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.3 Characterization protocols
- D.3.C Sensitization potential

Summary: This book covers the diagnosis and management of suspected contact and occupational dermatitis. The early chapters of this book focus non-occupational aspects of dermatology, but include discussions of dermatitis recognition, monitoring, and treatment, as well as health effects from preservatives, vehicles, cosmetics, fragrances, hair and nail care. The focus is on treatment rather than prevention.

Chapters 12 through 17 cover occupational dermatology: These chapters are:

- Ch. 12 Etiology of Occupational Skin Disease
- Ch. 13 Evaluation of the Worker in the Office and at the Work Site
- Ch. 14 Management of Occupational Dermatitis
- Ch. 15 Occupations Commonly Associated With Contact
- Ch. 16 Contact Urticaria
- Ch. 17 Contact Dermatitis in Children

Article ID: 581
Citation: American Industrial Hygiene Association. "American Industrial Hygiene Association [Home page]." 2006. American Industrial Hygiene Association <http://www.aiha.org>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations:
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: A Overview
A.6 Dermal regulations and skin notations

Summary: The American Industrial Hygiene Association (AIHA) is a non-profit, international association of occupational and environmental health professionals. Among other things, the AIHA website is a source of information on occupational and environmental health and safety topics and publications, including dermal exposure. AIHA members can serve on a number of committees that support AIHA's mission to promote healthy and safe environments by advancing the science, principles, practice and value of industrial hygiene and occupational and environmental health and safety. The Dermal project Team of the Exposure Assessment Strategies Committee focuses on issues associated with dermal exposure assessment. On the Dermal project team web page are resources related to dermal exposure, including a list of general sources of dermal information. The AIHA Workplace Environmental Exposure Levels (WEEL's) Committee works on establishing and updating AIHA's WEEL's. These include a skin designation for chemicals in which significant amounts may be absorbed through the skin, and therefore contribute to overall exposures.

Article ID: 582

Citation: The Center for the Protection of Worker's Rights. "The Center for the Protection of Worker's Rights [Home page]." 2006. The Center for the Protection of Worker's Rights <http://www.cpwr.com/indexstart.html>

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations: Construction

Specific Process:

Chemical: General - overview, Corrosives, Solvents

Specific Chemicals:

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- C Hazard Identification
- C.2 Tables/charts/lists of hazards for specific chemicals
- E Risk Management
- E.1 Overview of skin exposure control options
- E.3 "Best practices"/guidelines/recommendations
 - E.3.C Work practice/administration controls
 - E.3.D PPE and PPE regulations
 - E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
- E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The Center to Protect Workers' Rights (CPWR) is a non-profit organization created by the Building and Construction Trades Department of the AFL-CIO. They provide applied research, training, and service to the construction industry. CPWR developed and maintains The Electronic Library of Construction Occupational Safety and Health (for more information see eLCOSH, ID557), which provides on line construction-related health and safety information in English, Spanish, and other languages. The CPWR web site also contains updates on conferences, publications, and news events associated with construction health and safety. Dermal exposure-related resources available on this website include:

- Hazard Alerts: Skin Problems in Construction; Beryllium; Solvents, Lead
- The Construction Chart Book, which contains a chapter on Nonfatal Skin Diseases and Disorders in Construction
- Save Your Skin: Tips on Preventing Skin Problems (brochure)
- The Construction Solutions database – Currently under development, this will organize hazards by tasks and present ways to control those hazards.

Article ID: 583
Citation: American Conference of Governmental Industrial Hygienists (ACGIH). Documentation of the Threshold Limit Values for Chemical Substances. 7th ed. Cincinnati: American Conference of Governmental Industrial Hygienists, 2001
Resource Type: Guideline
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Latex, Nanoparticles, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Rubber Additives, Solvents
Specific Chemicals: Includes over 500 chemicals
Mixtures: No
Audience: Professional
Topics Addressed:
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity
D.1.D Other health effects
D.1.E Contribution to overall exposure
D.2 Summaries of health effects, dose-response relationships

Summary: The American Conference of Governmental Industrial Hygienists (ACGIH) is a scientific association with a number of technical committees that develop professional practice guidelines, such as Threshold Limit Values (TLVs) for chemical substances and physical agents, and the Biological Exposure Indices (BEIs) for selected chemicals. The TLVs and BEIs are developed as guidelines to assist in the control of health hazards. The Documentation of the TLVs and BEIs provides the basic rationale for the development of TLVs and of BEIs. The publication consists of documentation for over 750 chemical and physical agents. These recommendations or guidelines are intended for use in the practice of industrial hygiene, to be interpreted and applied only by a person trained in this discipline. They are not developed for use as legal standards and ACGIH does not advocate their use as such. The documentation is available in hard copy, on CD or downloadable from the ACGIH website.

Article ID: 584
Citation: U.S. Environmental Protection Agency (EPA). "Harmonized Test Guidelines [OPPTS]." 1998.
<http://www.epa.gov/opptsfrs/home/guidelin.htm>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview, Agricultural
Specific Process:
Chemical: General - overview, Pesticides
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:

- C Exposure Characterization
 - C.4 Direct methods to measure exposure
 - C.4.A Surfaces
 - C.4.B Skin
 - D Hazard Identification
 - D.3 Characterization protocols
 - D.3.B Irritation potential
 - D.3.C Sensitization potential
 - D.3.D Potential to cause systemic effects
 - D.3.E Measurement of skin permeation rates and reservoir effects

Summary: The U.S. EPA's Office of Prevention, Pesticides and Toxic Substances (OPPTS) harmonized test guidelines were developed to minimize variations in testing procedures under the Toxic Substances Control Act and the Federal Insecticide, Fungicide and Rodenticide Act. These were developed primarily for occupational pesticides and other toxic substances.

-In Series 870 , the Health Effects Test Guidelines, guidelines can be found for use in the testing of pesticides and toxic substances, and the development of test data that must be submitted to the Agency for review under Federal regulations. The following dermal-related test guidelines can be found in this series:

- 870.1200 Acute dermal toxicity
- 870.2500 Acute dermal irritation
- 870.2600 Skin sensitization
- 870.3200 21/28-Day dermal toxicity
- 870.3250 90-Day dermal toxicity

In Series 875, The Occupational and Residential Exposure Test Guidelines Post Application Exposure Guidelines, the following dermal exposure test guidelines can be found:

- 875.1100 Dermal exposure-outdoor
- 875.1200 Dermal exposure-indoor
- 875.2400 Dermal exposure

Article ID: 585

Citation: The Center to Protect Workers' Rights. "A Safety & Health Practitioner's Guide to Skin Protection." 2000. The Center to Protect Workers' Rights
<http://www.cdc.gov/elcosh/docs/d0400/d000458/d000458.html>

Resource Type: Brochure, Pamphlet

Educational Materials: Yes

Number of References:

Industries/Occupations: Construction

Specific Process: Bricklayer, carpenter, masons, hod carrier, plasterer, terrazzo worker, tile setter

Chemical: Corrosives, Hand Cleansers, Heavy Metals/Inorganic Compounds, Plastics and Resins

Specific Chemicals: Portland Cement, Hexavalent Chromium

Mixtures: No

Audience: Professional

Topics Addressed:

- A Overview
 - A.1 Occurrence of skin exposures in workplace
 - A.2 Health hazards resulting from skin exposure to chemicals
 - A.4 Skin physiology and functions as a barrier to chemical insults
- B Surveillance and Clinical Aspects
 - B.1 Surveillance study reporting incidences of occupational skin exposures
 - B.1.A Skin exposure major focus
 - B.2 Loss of workdays and impact on productivity
 - B.3 Surveillance study protocols/procedures for gathering data
 - B.4 Clinical protocols for recognition of skin exposure health effects
- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
 - C.2 Description of factors influencing exposure conditions
 - C.2.A Exposure intensity/frequency/duration
 - C.2.B Exposure concentration
 - C.2.E Uptake
 - C.3 Checklists/questionnaires to quantify skin exposure incidences
 - C.4 Direct methods to measure exposure
 - C.4.A Surfaces
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.A Irritant contact dermatitis
 - D.1.B Allergic contact dermatitis/sensitization
 - D.1.D Other health effects
- E Risk Assessment
 - E.1 Guidelines for risk assessment or analysis
 - E.1.A Localized health effects
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations
 - F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs
 - F.2 Protocols for risk management
 - F.2.C Evaluation to demonstrate program/intervention effectiveness

Summary:

This comprehensive guide was developed by a CPWR Consortium on Preventing Contact Dermatitis. Developed for safety and health practitioners, it covers dermal hazards associated with Portland cement work. It provides a detailed description of how to recognize, evaluate and control dermal hazards. In addition to covering Portland cement, it also provides a thorough description of skin physiology and presents a model of skin disease within the context of occupational exposures to caustic chemicals and sensitizing agents. At the end, it provides a list of recommended resources, a best practices check list, a skin symptoms questionnaire for workers and a worker safety pamphlet.. This brochure is available for download on the eLCOSH website (see ID 557) .

This guide contains the following chapters:

- Ch. 1 Recognizing Skin Problems
- Ch. 2 A New Model of Skin Disease
- Ch. 3 Worksite Exposures
- Ch. 4 The Role of pH
- Ch. 5 Product Modification
- Ch. 6 Best Protective Practices
- Ch. 7 Resources
- Ch. 8 Evaluating Your Success

Article ID: 586
Citation: University of California-Davis, Oregon State University, Michigan State University, Cornell University, and University of Idaho. "EXTOXNET - The EXTension TOXicology NETwork." 2006. <http://extoxnet.orst.edu/ghindex.html>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: Agricultural
Specific Process:
Chemical: Pesticides
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
A.6 Dermal regulations and skin notations
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.A Irritant contact dermatitis
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity
D.2 Summaries of health effects, dose-response relationships

Summary: The Extension Toxicology Network (EXTOXNET) is a cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University, and the University of Idaho. Their website contains a variety of different resources about exposure to toxicants in our environment. The Pesticide Information Profiles contain basic toxicology information about a variety of different pesticides, including, where relevant, information on skin exposure and toxicological effects.

Article ID: 587
Citation: International Safety Equipment Association and American National Standards Institute (ANSI). American National Standard for Hand Protection Selection Criteria ANSI/ISEA 105-2005. Report # ANSI/ISEA 105-2005. 2005.
Resource Type: Guideline
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
F Risk Management
F.1 Strategies for exposure control
F.1.D PPE and PPE regulations

Summary: This standard addresses the classification and testing of hand protection for specific performance properties related to chemical and industrial applications. Hand protection includes gloves, mittens, partial gloves, or other item covering the hand or a portion of the hand that is intended to provide protection against or resistance to a specific hazard. This standard can be downloaded from the International Safety Equipment Association's website (<http://www.safetysitequipment.org/glovestd.htm>).

Article ID: 588
Citation: ASTM International. "ASTM International [Home page]." 2006. <http://www.astm.org/>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: Coolants, Plastics and Resins
Specific Chemicals: isocyanates, metalworking fluids
Mixtures: No
Audience: Professional
Topics Addressed:

- C Exposure Characterization
 - C.1 Workplace factors associated with harmful skin exposures
 - C.4 Direct methods to measure exposure
 - C.4.B Skin
- D Hazard Identification
 - D.1 Potential health effects resulting from specific chemicals
 - D.1.B Allergic contact dermatitis/sensitization
- F Risk Management
 - F.1 Strategies for exposure control
 - F.1.A Substitution
 - F.1.B Engineering controls
 - F.1.C Work practice/Administrative controls
 - F.1.D PPE and PPE regulations

Summary: ASTM International is a voluntary standards development organization. Standards developed at ASTM are the work of ASTM members. These technical experts represent producers, users, consumers, government and academia from over 100 countries. Standards and guides are available for sale on their website.

Some of the ASTM standards and guides relevant to dermal exposure include:

E1497-05 Standard Practice for Safe Use of Water-Miscible Metal Removal Fluids - This practice provides guidelines for the selection and safe use of metal removal fluids, additives, and antimicrobials. This includes product selection, storage, dispensing, and maintenance.

Standard E 1302, Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids - This guide defines acute animal toxicity tests and presents references for procedures that assess the acute toxicity of water-miscible metalworking fluid concentrates as manufactured.

WK8210 Standard Guide to Test Methods for Personal Protective Equipment intended for Homeland Security Applications - This guide provides a listing of test methods for personal protective equipment (PPE) intended to protect first and second responders, casualty receivers and remediation personnel involved in homeland security incidents.

STP 1408 ISOCYANATES: Sampling, Analysis, and Health

Effects - 11 peer-reviewed papers, including: Isocyanate Determination in Atmospheres, Sampling Strategy and Control; and personal protective equipment.

F1296-03 Standard Guide for Evaluating Chemical Protective Clothing - This guide is intended to promote the proper selection, use, maintenance, and understanding of the limitations of chemical protective clothing by users, employers, employees, and other persons involved in programs requiring chemical protective clothing.

DRAFT-Do not cite, reference or distribute

Article ID: 589
Citation: Oregon OSHA. "Oregon OSHA [Home page]." 2006. Oregon OSHA <http://www.cbs.state.or.us/external/osha/index.html>
Resource Type: Website
Educational Materials: Yes
Number of References:
Industries/Occupations: General - overview, Agricultural
Specific Process:
Chemical: General - overview, Latex, Pesticides, PCBs
Specific Chemicals:
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
A.4 Dermal regulations and skin notations
B Exposure Characterization
B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
B.2 Factors that influence exposure conditions
B.2.A Exposure intensity/frequency
B.2.B Exposure controls
E Risk Management
E.1 Overview of skin exposure control options
E.3 "Best practices"/guidelines/recommendations
E.3.C Work practice/administration controls
E.3.D PPE and PPE regulations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: Oregon OSHA, (OR-OSHA), a division of the Oregon Department of Consumer and Business Services, enforces Oregon state workplace safety and health rules. Their website has a variety of resources, including pamphlets and brochures, on working safely with agricultural chemicals. Although these do not exclusively address skin exposure, they do address skin exposures in terms of overall routes of exposure to agricultural chemicals. Examples include:

- Safe Practices when working around hazardous agricultural chemicals (brochure)
- Clothes washing for pesticide handlers (magnet)
- IH for the Non-IH (workbook)
- Audio-visual Library with several videos on skin exposure
- Training materials for basic health and safety, including identifying and controlling hazards, and personal protective equipment

Article ID: 590

Citation: U.S. Army Center for Health Promotion and Preventive Medicine. "United States Army Center for Health Promotion & Preventive Medicine [Home page]." 2006. U.S. Army Center for Health Promotion and Preventive Medicine <http://chppm-www.apgea.army.mil/>

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations:

Specific Process: Military

Chemical: Pesticides, Petroleum Products & Lubricants, Solvents

Specific Chemicals: JP-8 jet fuel, paints

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- B.3 Protocols/checklists to characterize exposure to skin hazards
- E Risk Management
- E.3 "Best practices"/guidelines/recommendations
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs
- E.4 Guidelines/recommendations for post-exposure skin decontamination

Summary: The US Army Center for Health Promotion and Preventive Medicine's website has a variety of resources available in their website concerning identifying, assessing and controlling environmental, occupational, and disease threats in support of the National Military. Their website has a variety of different Post Deployment Exposure Fact Sheets that address exposure, including dermal, to a variety of different chemicals, such as paints, solvents, pesticides and jet fuel. The fact sheets include information on personal protective equipment and control measures; signs and symptoms of acute and chronic exposure; reversibility of acute and chronic health effects; and treatment options and long term surveillance requirements.

Article ID: 591

Citation: [No Author] . "Occupational Health and Safety [Magazine On-line version][Home page]." 2006. Stevens Publishing Corporation
<http://www.ohsonline.com>

Resource Type: Website

Educational Materials: No

Number of References:

Industries/Occupations: General - overview, Medical Services

Specific Process:

Chemical: General - overview, Heavy Metals/Inorganic Compounds, Latex, Plastics and Resins

Specific Chemicals: Hexavalent Chromium

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.4 Dermal regulations and skin notations
- B Exposure Characterization
- B.1 Job/tasks, industries/processes, or chemicals associated with skin exposures
- B.3 Protocols/checklists to characterize exposure to skin hazards
- C Hazard Identification
- C.1 Risk phrases, hazard symbols, skin designations
- C.3 Protocols/checklists to identify skin hazards in the workplace
- E Risk Management
- E.2 Protocols/checklists to monitor potential exposures
- E.3 "Best practices"/guidelines/recommendations
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The Occupational Health and Safety On-line magazine periodically featuring articles on dermal exposure and control. They have archived old issues that can be searched by subject. Dermal exposure articles that can be found on-line include:

- Effective Dermal Protection
- Butyl & Viton Hand Protection
- Latex Allergy & Dermatitis
- CrVI: New Regulations and Detection Methods

Article ID: 592
Citation: Organisation for Economic Co-operation and Development (OECD). "OECD's Database on Chemical Risk Assessment Models." 2006. Organisation for Economic Co-operation and Development (OECD)
<http://webdomino1.oecd.org/comnet/env/models.nsf>
Resource Type: Web Page
Educational Materials: No
Number of References:
Industries/Occupations: General - overview
Specific Process:
Chemical: General - overview
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.5 Exposure modeling
D Hazard Identification
D.3 Characterization protocols
D.3.F [Q]SARs – development, validation, and application

Summary: This searchable database includes information on models (computerized or capable of being computerized) that are used by OECD Member governments and industry to predict health or environmental effects, exposure potential and possible risks. The database can be searched by route of exposure and will list all dermal models. These are generic exposure models and not specific to occupational settings. The methods described here have not been evaluated or validated by OECD, and no endorsement of the methods by OECD should be inferred by the inclusion of certain methods in this web page.

Article ID: 593

Citation: Portland Cement Association. "Portland Cement Association [Home page]." 2006. Portland Cement Association <http://www.cement.org/>

Resource Type: Website

Educational Materials: Yes

Number of References:

Industries/Occupations: Construction

Specific Process:

Chemical: Corrosives

Specific Chemicals: Portland Cement

Mixtures: No

Audience: General

Topics Addressed:

- A Overview
- A.1 Occurrence of skin exposures in the workplace
- A.2 Health hazards resulting from skin exposure to chemicals
- B Exposure Characterization
- B.2 Factors that influence exposure conditions
- B.2.A Exposure intensity/frequency
- B.2.B Exposure controls
- E Risk Management
- E.1 Overview of skin exposure control options
- E.3 "Best practices"/guidelines/recommendations
- E.3.C Work practice/administration controls
- E.3.D PPE and PPE regulations
- E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The Portland Cement Association represents cement companies in the United States and Canada. It provides, among other things, research, education, and public affairs programs. Resources on dermal exposure that are available through their website include a webpage on working safely with concrete, as well as the publications:

- Skin Safety with Cement and Concrete (video and DVD)
- Working Safely with Concrete (brochure, downloadable from their website)

Article ID: 594
Citation: National Ready Mixed Concrete Association. "National Ready Mixed Concrete Association [Home page]." 2006. National Ready Mixed Concrete Association <http://www.nrmca.org>
Resource Type: Website
Educational Materials: Yes
Number of References:
Industries/Occupations: Construction
Specific Process:
Chemical: Corrosives
Specific Chemicals: Portland Cement
Mixtures: No
Audience: General
Topics Addressed:
A Overview
A.1 Occurrence of skin exposures in the workplace
E Risk Management
E.1 Overview of skin exposure control options
E.3 "Best practices"/guidelines/recommendations
E.3.C Work practice/administration controls
E.3.D PPE and PPE regulations
E.3.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: The National Ready Mix Concrete Association (NRMCA) is an industrial organization for the read mix concrete industry. Through their website's E-Store, there are several resources available on dermal exposure hazards and controls associated with ready mix concrete. These include:
- Cement Burn Awareness Kit: (training material)
- Cement Burn Warning (Mini Poster)
- Safe Drum Cleaning (video)

Article ID: 595
Citation: [No Author] . "Dermal Exposure Modeling." Mathematical Models for Estimating Occupational Exposure to Chemicals. Ed. Charles B. Keil. Fairfax, VA: American Industrial Hygiene Association, 2000. 65-76.

Resource Type: Book/monograph, chapter
Educational Materials: No
Number of References: 30
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.5 Exposure modeling

Summary: This chapter of the book focuses on estimating dermal exposures. There is a discussion of absorption mechanics, absorption factors, modeling, and data gaps and suggestions for additional research.

Article ID: 596
Citation: Roy, A., C. P. Weisel, P. J. Liroy, and P. G. Georgopoulos. "A distributed parameter physiologically-based pharmacokinetic model for dermal and inhalation exposure to volatile organic compounds." Risk Anal. 16.2 (1996): 147-60
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 30
Industries/Occupations:
Specific Process:
Chemical: Other: VOCs
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.A Exposure intensity/frequency/duration
C.2.B Exposure concentration
C.2.C Skin area affected
C.2.E Uptake
C.5 Exposure modeling

Summary: This paper compares the way three models, developed to estimate dermal dose from exposures to toxic chemicals, estimate chloroform dose. Two are physiologically-based pharmacokinetic model (PBPKs). The other is a more recently developed generalized "distributed parameter" physiologically-based pharmacokinetic model (DP-PBPK), which has been developed for short-term exposures. The three models were evaluated by comparing simulated post-exposure exhaled breath concentration profiles with measured concentrations following environmental chloroform exposures. All three models yielded estimates close to that of measured exhaled breath concentrations. Differences are described in detail.

Article ID: 597
Citation: van Hemmen, J. J. and D. H. Brouwer. "Assessment of dermal exposure to chemicals." Sci.Total Environ. 168.2 (1995): 131-41
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 51
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.E Uptake
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.4.C Biomonitoring

Summary: This paper compares qualitative, semi-qualitative, and quantitative methods for assessing dermal exposure to chemicals. These methods include job (activity) exposure profiles, surrogate skin techniques, removal techniques, tracer techniques, biological monitoring, surface sampling techniques. It compares the methods by validation tests, key input factors sampling area, and time of collection.

Article ID: 598
Citation: Kissel, J. C., K. Y. Richter, and R. A. Fenske. "Factors affecting soil adherence to skin in hand-press trials." Bull. Environ. Contam Toxicol. 56.5 (1996): 722-28
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 12
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.C Skin area affected

Summary: This paper compares three approaches for estimating soil adherence to the skin for use in dermal risk estimates (listed below). Each approach offers information of value. Laboratory studies provide an opportunity for systematic examination of the possible effects of soil characteristics on adherence.
1) laboratory studies using artificial loading scenarios (Que Hee, 1985; Driver, 1989; Sheppard and Evenden, 1992),
2) lead exposure studies reporting lead concentrations in soil and dust (Roels, 1980; Charney, 1980; Gallacher, 1984; Duggan, 1985)
3) direct field measurement using gravimetric methods (Lepow, 1975).

Article ID: 601
Citation: van Wendel de, Joode B., J. J. van Hemmen, T. Meijster, V. Major, L. London, and H. Kromhout. "Reliability of a semi-quantitative method for dermal exposure assessment (DREAM)." J.Expo.Anal.Environ.Epidemiol. 15.1 (2005): 111-20
Resource Type: Journal article - primary
Educational Materials: No
Number of References: 21
Industries/Occupations: Agricultural, Manufacturing - Chemical, Transportation/Communications/Utility
Specific Process: Provides dermal risk calculations for 35 industrial and agricultural tasks.
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.4 Direct methods to measure exposure
C.4.A Surfaces
C.4.B Skin
C.5 Exposure modeling

Summary: The reliability of DREAM, a semi-quantitative dermal exposure assessment method, was assessed by using 29 observers (mainly occupational hygienists) who were asked to fill in DREAM while performing side-by-side observations for different tasks, comprising dermal exposures to liquids, solids, and vapors. It is concluded that DREAM is useful for estimating dermal exposure both for epidemiological research and for occupational hygiene practice.

Article ID: 602
Citation: Kimber, I. "The role of the skin in the development of chemical respiratory hypersensitivity." *Toxicol.Lett.* 86.2-3 (1996): 89-92
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 29
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
A Overview
A.2 Health hazards resulting from skin exposure to chemicals
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity
D.1.D Other health effects

Summary: The paper examines the mechanisms relevant to the stimulation of respiratory sensitization following cutaneous exposure to chemical allergens and implications for the prevention of occupational asthma.

Article ID: 603
Citation: Lowney, Y. W., M. V. Ruby, R. C. Wester, R. A. Schoof, S. E. Holm, X. Y. Hui, S. Barbadillo, and H. I. Maibach. "Percutaneous absorption of arsenic from environmental media." *Toxicol.Ind.Health* 21.1-2 (2005): 1-14
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 30
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals: arsenic
Mixtures: No
Audience: Professional
Topics Addressed: C Exposure Characterization
C.2 Description of factors influencing exposure conditions
C.2.B Exposure concentration
C.2.E Uptake

Summary: This paper addresses what is known about percutaneous absorption of arsenic based on studies of rhesus monkeys and offers study design considerations including particle size, application rates, means of ensuring skin contact and appropriate statistical evaluation of the data. The authors conclude that there are likely to be many site- or sample-specific factors that control the absorption of arsenic, and matrix-specific analyses may be required to understand the degree of percutaneous absorption.

Article ID: 604
Citation: Day, G. A., A. B. Stefaniak, A. Weston, and S. S. Tinkle.
"Beryllium exposure: dermal and immunological considerations."
Int.Arch.Occup.Environ.Health 79.2 (2006): 161-64
Resource Type: Journal article - review, meta-analysis
Educational Materials: No
Number of References: 38
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals: beryllium
Mixtures: No
Audience: Professional
Topics Addressed: B Surveillance and Clinical Aspects
B.1 Surveillance study reporting incidences of occupational skin exposures
B.1.A Skin exposure major focus
D Hazard Identification
D.1 Potential health effects resulting from specific chemicals
D.1.B Allergic contact dermatitis/sensitization
D.1.C Systemic toxicity

Summary: The paper assesses the state of knowledge concerning skin exposure to beryllium. It concludes that the reduction in inhalation exposure to beryllium has not reduced beryllium sensitization or CBD, suggesting that unchecked skin exposure is causing continued prevalence.

Article ID: 605

Citation: Syracuse Research Corporation. "Syracuse Research Corporation - Business Areas : Environmental Science [Home page]." 2006. <http://www.syrres.com/esc/default1.htm>

Resource Type: Data file

Educational Materials: No

Number of References:

Industries/Occupations: General - overview

Specific Process:

Chemical: Abrasives, Cleaning Agents, Coolants, Corrosives, Fiberglass and other fibers, Heavy Metals/Inorganic Compounds, Organic Dyes, Particulates, Pesticides, Petroleum Products & Lubricants, Plastics and Resins, PAHs, PCBs, Solvents

Specific Chemicals:

Mixtures: No

Audience: Professional

Topics Addressed:

- C Exposure Characterization
- C.2 Description of factors influencing exposure conditions
- C.2.E Uptake
- C.4 Direct methods to measure exposure
- C.4.B Skin
- D Hazard Identification
- D.1 Potential health effects resulting from specific chemicals
- D.1.A Irritant contact dermatitis
- D.1.B Allergic contact dermatitis/sensitization
- D.3 Characterization protocols
- D.3.D Potential to cause systemic effects
- D.3.E Measurement of skin permeation rates and reservoir effects

Summary: SRC is a not-for-profit, independent, research and development organization. SRC's environmental science area has expertise in analyzing information on occupational and environmental hazards. They have developed a number of different estimation software, available for download on their website, which are useful for work on dermal exposures, including:

- DermWin, which estimates the dermal permeability coefficient (Kp), used to estimate the potential for a chemical to be absorbed through the skin.
- KowWin, which estimates the log octanol-water partition coefficient, log P, of chemicals using an atom/fragment contribution method developed at SRC.
- WsKow, which estimates an octanol/water partition coefficient using the algorithms in SRC's LogKow program and estimates a chemical's water solubility from this value.

They also developed the Toxic Substance Control Act Test Submission database (TSCATS), which is used for the collection, maintenance, and dissemination of information on unpublished technical reports submitted by industry to EPA under the TSCA.

Article ID: 606
Citation: ten Berge, Wil. "Home page of Wil ten Berge [Wil ten Berge model for dermal absorption]." 2004. <http://home.planet.nl/~wtberge/>
Resource Type: Website
Educational Materials: No
Number of References:
Industries/Occupations:
Specific Process:
Chemical:
Specific Chemicals:
Mixtures: No
Audience: Professional
Topics Addressed:
C Exposure Characterization
C.5 Exposure modeling
D Hazard Identification
D.3 Characterization protocols
D.3.F [Q]SARs – development, validation, and application

Summary: This Home page of Wil ten Berge contains a downloadable version of the SKINPERM Program, which can be used for the estimation of the skin permeation coefficients of aqueous and vapor chemicals using physico-chemical properties of the chemical and the octanol/water partition coefficient. This program is based on a QSAR database developed by A Wilschut, WF ten Berge, PJ Robinson and TE McKone in 1995. The program currently contains data for over 60 chemicals.

Article ID: 607
Citation: Colormetric Laboratories, Inc. "The pioneer in the reduction of dermal exposure [Colormetric Laboratories, Inc. Home page]." 2005. Colormetric Laboratories, Inc. <http://www.clilabs.com/>
Resource Type: Website
Educational Materials: No
Number of References: General - overview
Industries/Occupations: General - overview, Plastics and Resins
Specific Process: isocyanates
Chemical: No
Specific Chemicals: Professional
Mixtures: C Exposure Characterization
Audience: C.4 Direct methods to measure exposure
Topics Addressed: C.4.A Surfaces
C.4.B Skin
C.4.C Biomonitoring
E Risk Assessment
E.1 Guidelines for risk assessment or analysis
E.1.A Localized health effects
E.1.B Systemic health effects
F Risk Management
F.1 Strategies for exposure control
F.1.A Substitution
F.1.B Engineering controls
F.1.C Work practice/Administrative controls
F.1.D PPE and PPE regulations
F.1.E Skin management, barrier creams, moisturizers, cleansers, and rubs

Summary: Colormetric Laboratories, Inc. provides biological monitoring analytical services and direct reading detection systems for evaluating surface and skin contamination. They produce the following detection systems:

- SWYPES™ detectors to determine where and when the skin exposures occurred that contributed to biological exposures.
- Permea-Tec Sensors™, which are breakthrough indicators for chemical protective gloves and can be used to determine glove life expectancy.
- D-TAM Safe solvent for removing non-water soluble contaminants from skin.
- D-TAM™ Skin Cleansers, which are formulated to remove non-water soluble contaminants from the skin.