

Preventing Occupational Dermatitis

General Information

Safety & Health Assessment & Research for Prevention
Washington State Department of Labor and Industries

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INTRODUCTION

Nationally, dermatitis is the second most commonly reported occupational disease. For workers covered by the Washington State Department of Labor and Industries' state fund workers' compensation insurance, the costs amounted to over 3 million dollars in claims over the 5-year period from January 1993 through December 1997.

There are two types of dermatitis most associated with occupational exposures, allergic contact dermatitis and irritant contact dermatitis. These forms of dermatitis are difficult to distinguish from one another, often requiring specific medical tests to differentiate between the two. As the names suggest, these forms of dermatitis are caused by skin contact with a causal agent. As with all occupational disease, prevention is the key, and with most cases of occupational dermatitis, preventing skin contact with chemicals or other skin damaging agents will prevent the disease.

SKIN CARE PROGRAM

This pamphlet provides general guidance on developing a Skin Care Program in your facility. This program should become part of your existing written Accident Prevention Program and be tailored to your specific situation. As you read this pamphlet, be thinking of specific problem areas or processes in your facility. However, because the causes of dermatitis are quite varied, we can only provide general information here. If you need help with a specific problem, we recommend that you contact your regional Labor and Industries industrial hygiene Consultant, the University of Washington's Field Research and

Consulting Group, a private industrial hygiene consulting firm, or your occupational health care provider. The telephone numbers of the public consultants are provided at end of this pamphlet.

Ideally, a skin care program should communicate the following information to employees at risk of developing dermatitis.

- The structure of skin and its susceptibility to various compounds.
- Specific compounds, processes, or areas in your facility that can cause dermatitis.
- Controls in place to prevent dermatitis.
- What to do if a worker develops dermatitis.

"Zero Contact"

The best way to prevent dermatitis while working with a skin damaging material is to avoid any direct skin contact with it. You can prevent direct skin contact in a number of ways:

- Product Substitution - substituting one product capable of causing dermatitis with one that does not cause dermatitis.
- Engineering Controls - such as local exhaust ventilation, or process isolation.
- Tools - that eliminate the need for workers to touch dermatitis causing materials.
- Personal Protective Equipment - such as gloves and shop coats.

SKIN PHYSIOLOGY

Structures

The skin is composed of three main layers, the epidermis, the dermis and the subcutaneous layer.

DERMATITIS

Causes of Dermatitis

Intact skin is more able to fend off attacks by compounds capable of causing dermatitis. Broken skin (either from cuts, scrapes, or burns) allows these compounds to reach deeper into the skin layers.

Chemical

Chemical exposure is the main cause of work related skin problems. These agents are divided into two groups: primary irritants and sensitizers.

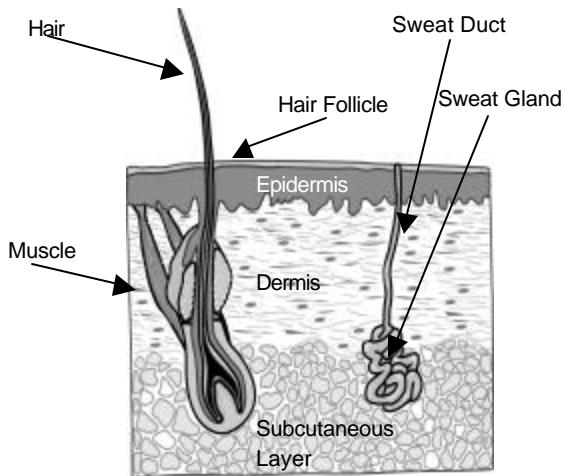
Primary irritants act directly on the skin, through chemical reactions. Depending on the specific chemical, its concentration and the length of time the skin is exposed, the reaction can range from inflammation to tissue destruction (e.g. severe chemical burns).

Sensitizers may not cause skin reactions on initial contact; however, repeated exposures can cause an allergic reaction in some people. These reactions can occur within days or years of the initial exposure. Once a person becomes sensitized (allergic), small amounts of the sensitizer can cause reactions.

Detergents and hand cleansers may also cause dermatitis or provoke existing conditions. Use only those products intended for skin cleaning for personal hygiene. Eliminate or limit exposures to stronger detergents intended for industrial cleaning.

Physical and Biological

Physical agents capable of causing skin conditions include temperature extremes and radiation (including sunlight). Mechanical causes of skin conditions include friction, abrasions, lacerations, and contusions (scrapes, cuts and bruises). One common source of mechanical dermatitis is glass fiber.



Skin structures

Epidermis

The epidermis is the outer layer of the skin. The outer most part of the epidermis consists of flat cells that form a thin protective layer. The epidermis offers some protection but is not effective at protecting against lipid soluble chemicals (organic solvents). These flat cells continually slough off, being replaced by new cells that are pushed up by cells constantly forming deeper in the epidermis.

Dermis

The dermis is the layer of skin just under the epidermis. The dermis contains blood vessels, nerves, muscles, connective tissue, hair and hair follicles, sweat glands, and sebaceous (oil) glands. Its main function is to protect against trauma to internal structures and acts as a support to the epidermis layer.

Subcutaneous Layer

The subcutaneous layer is located at the base of the skin. This layer contains fat cells and acts as a cushion for the layers above it.

Protective Functions of the Skin

The skin serves several protective functions: protecting the body from invasion by microorganisms and some types of chemicals, protecting internal organs, protecting against rays of the sun, and serving as temperature regulator.

Some biological causes of dermatitis are fungi, bacteria, viruses, parasites, and plant and animal materials.

Types of dermatitis

Contact Dermatitis

This is the most common cause of occupational skin disorders. There are two types of contact dermatitis, irritant and allergic. Irritant contact dermatitis is the most prevalent form of contact dermatitis.

Irritant Contact Dermatitis

A compound acting directly on the skin at the contact site causes irritant contact dermatitis. The compound may act immediately (such as strong acids or bases) or may act over a longer time (such as detergents).

Allergic Contact Dermatitis

Sensitizing agents cause allergic contact dermatitis. In this form of dermatitis, the skin's reaction is allergic, in that an antigen elicits an antibody immune reaction (a foreign substance that causes the body to create an antibody).

Other occupationally related skin conditions include *occupational acne* usually caused by petroleum-based products; *contact urticaria* or hives; and *photosensitivity* where the skin becomes more sensitive to sunlight.

Systemic Intoxication

It is possible that absorption through the skin can be a significant exposure route for some chemicals. These chemicals get into the blood stream (or other system) and cause health problems away from the site of entry. While these chemicals may or may not cause dermatitis, this exposure route should be considered while evaluating your processes.

Burns

Burns, as with any condition that compromises the skin, may permanently damage the skin.

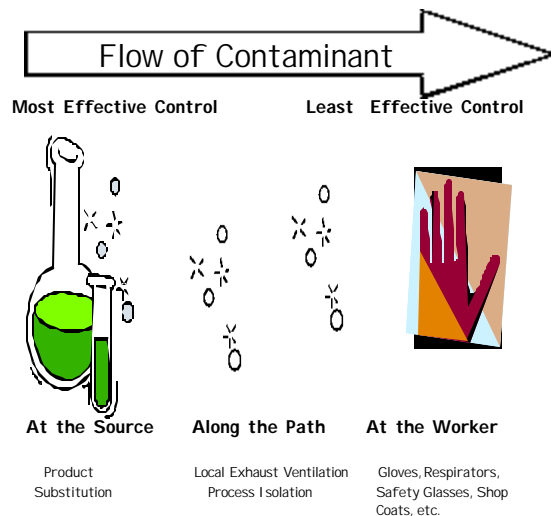
In the fourth edition of "Fundamentals of Industrial Hygiene" (1996) the National Safety Council produced a table of chemicals listing whether they are irritants, sensitizers, the types of skin conditions the chemicals can cause, and types of industries where these chemicals are commonly found. This table is reproduced at the end of this pamphlet.

PREVENTING DERMATITIS

Hierarchy of Controls

The hierarchy of controls often referred to by occupational health and safety professionals is simply a ranking of exposure controls from the most effective to the least effective. The way to think about exposures is to visualize a source and the pathway along which the compound travels to reach the worker. We think of controlling exposures by eliminating the source (product substitution), capturing the contaminant along the pathway (engineering controls), and finally controlling exposures at the worker (personal protective equipment (PPE), administrative controls, personal hygiene). This ranking of controls applies to all occupational exposures from airborne chemicals to noise exposures and can be applied to other hazards in your workplace.

Hierarchy of Controls



Control at the Source: Product Substitution

The most effective method of control is to eliminate the exposure to the compound or product causing the skin condition. This can be accomplished by substituting with another compound of lower skin reactivity. The substitution of one key compound may require a full evaluation of the process with modifications in work practices down the line.

Control along the Path: Engineering Controls

Engineering controls such as ventilation, isolation booths, etc. can prevent dermatitis causing compounds from contacting workers' skin. Local exhaust ventilation is most commonly associated with reducing respiratory exposures, but can be effective at preventing agents such as metal working fluid mists and glass fibers from reaching the workers' skin.

Control at the Worker: Personal Protective Equipment (PPE), Administrative Controls, and Personal Hygiene

This final layer of control stops the exposure at the worker. Because these controls rely on workers to implement, they require greater oversight to be effective. Personal protective equipment (PPE) includes gloves, safety glasses or goggles, shop coats or overalls, boots, etc. Administrative controls are those policies established to educate workers, define work practices, and establish the consequences of not following the policies. Personal hygiene may seem exclusively the worker's responsibility. However, without the proper facilities and cleansing agents, workers may rely on solvents or other harsh cleansers to clean up, which may damage the skin.

Quite often PPE is the first choice to control exposures. This practice may be appropriate for the time it takes to implement other forms of exposure control or to supplement existing controls; however, this is not recommended as the sole form of exposure control.

The example of glove selection and use can demonstrate the problems encountered when choosing to control exposures at the worker's level as the primary form of exposure control. The facility must understand the nature of the exposure and select gloves that provide adequate protection. This may require the stocking of several types of gloves. Workers must understand the types of skin hazards in the facility and the proper glove for each hazard. Workers need to know how to inspect gloves before each use and when to dispose of them. Each worker must wear the correct gloves whenever exposed to the hazard.

Managers must obtain and stock the proper gloves for the types of hazards encountered; ensure employees get training; and wear the proper gloves. Managers should also be aware that the gloves themselves might cause dermatitis (natural rubber latex is an example of this). There should be a clear policy on glove use and the consequences of not wearing gloves under the specified conditions. Finally, management must be committed to enforcing these policies. As can be seen the apparently simple solution of using gloves to control an exposure quickly becomes complicated.

What to do when an employee develops dermatitis.

If a worker develops dermatitis, he or she should seek the advice of a medical professional. Occupational physicians are specifically trained on diseases caused by work. Dermatologists specialize in disorders of the skin.

Workers may be inclined to treat the condition with over-the-counter medications. However, these medications may not help the symptoms, and the underlying condition may worsen. It is important to ensure that workers get proper medical attention and that the exposure causing the skin condition is controlled or eliminated.

Where to get help with your skin care program.

Labor and Industries

Call the service location nearest you and ask to speak to an industrial hygiene consultant.

Everett	(425) 290-1300
Seattle	(206) 281-5400
Spokane	(509) 324-2600
Tacoma	(253) 596-3800
Tumwater	(360) 902-5799
Vancouver	(360) 896-2300
Wenatchee	(509) 886-6570

SHARP Program

Work-related dermatitis web site:

www.lni.wa.gov/sharp/derm

University of Washington

Field Research and Consulting Group.

(206) 543-9711

Yellow Page Headings for Private Consultants

Industrial Hygiene Consultants

Physicians

Dermatology

Occupational Medicine

Acknowledgements

SHARP staff would like to thank the National Safety Council for their kind permission to reproduce the table of chemical compounds and likely types of skin disorders they may cause.

What is SHARP?

SHARP stands for Safety & Health Assessment & Research for Prevention. SHARP is a multidisciplinary research program within the Washington State Department of Labor and Industries, whose mission is to conduct research, monitoring, and demonstration projects that promote healthy work environments and the prevention of workplace injuries and illnesses. SHARP was created by the Washington State Legislature in 1990.

Since 1990, SHARP has addressed a diverse range of occupational health concerns in response to requests from employers, labor, health care professionals, and agency staff. SHARP's research specialists offer expertise in computer systems, epidemiology, ergonomics, industrial hygiene, occupational medicine, occupational safety, and toxicology.

To obtain additional information about the program, please contact us at:

SHARP
Washington State Department of
Labor and Industries
PO Box 44330
Olympia WA 98504-4330
Tel. (888)-66-SHARP (toll-free)

**Check out SHARP on the
World Wide Web!**

www.lni.wa.gov/sharp

SHARP's web site provides more information on the SHARP program, describes SHARP's research interests, lists our publications (some are available on-line), introduces the SHARP team, and provides links to other sites of occupational and environmental interest.

National Safety Council, Itasca, Illinois

Chemical	Primary Irritants	Sensitizers	Selected Skin Manifestations (Some also have important systemic effects on other organs.)	Selected Occupations, Trades, or Processes Where Exposure Can Occur
ACIDS				
Acetic	X	?	Dermatitis and ulceration	Manufacturing acetate rayon, textile printing and dyeing, vinyl plastic makers
Carbolic (phenol)	X		Corrosive action on skin, local anesthetic effect	Carbolic acid makers, disinfectant manufacturing, dye makers, pharmaceutical workers, plastic manufacturing
Chromic	X	X	Ulcers ("chrome holes") on skin, inflammation and perforation of nasal septum	Platers, manufacturing organic chemicals and dyestuffs
Cresylic	X		Corrosive to skin, local anesthetic effect	Manufacturing disinfectants, coal tar pitch workers, foundry workers
Formic	X		Severe irritation with blisters and ulcerations	Rubber and laundry workers, mordanters, cellulose formate workers, airplane dope makers
Hydrochloric	X		Irritation and ulceration of skin	Bleachers, picklers (metals), refiners (metals), tanners, chemical manufacturing, masons (clean cement)
Hydrofluoric	X		Severe chemical burn with blisters, erosion, or ulceration	Enamel manufacturing, etchers, hydrofluoric acid makers, fluorochemical workers
Lactic	X		Ulceration (if strong solutions are used)	Adhesives, plastics, textiles
Nitric	X		Severe skin burns and ulcers	Nitric acid workers, electroplaters metal cleaners, acid dippers, nitrators, dye makers
Oxalic	X		Severe corrosive action on skin, cyanosis (bluish discoloration), and brittleness of nails	Tannery workers, blueprint paper makers, oxalic acid makers
Picric	X	X	Erythema, dermatitis, scaling, yellow discoloration of skin and hair	Explosives workers, picric acid makers, dyers and dye makers, tannery workers
Sulfuric	X		Corrosive action on skin, severe inflammation of mucous membranes	Nitrators, picklers (metals), dippers, chemical manufacturing
ALKALIS				
Ammonia	X		Irritation including airborne dermatitis of face from vapors	Ammonia production, fertilizers, photocopying (blueprint, diazo); gas and liquid forms
Calcium Cyanamide	X		Irritation and ulceration	Fertilizer makers, agricultural workers, nitrogen compound makers
Calcium Oxide	X		Dermatitis, burns, or ulceration	Lime workers, manufacturing of calcium, salts, glass, and fertilizer
Potassium Hydroxide	X		Severe corrosion of skin, deep-seated persistent ulcers, loss of fingernails	Potassium hydroxide makers, electroplaters, paper, soap, and printing ink makers
Sodium Hydroxide	X		Severe Corrosion of skin, deep-Seated persistent ulcers, loss of fingernails	Sodium hydroxide makers, bleachers, soap and dye makers, petroleum refiners, mercerizers, Plastic manufacturing
Sodium or potassium cyanide	X		Blisters, ulcers	Electroplaters, case hardening, extraction of gold
Trisodium phosphate	X		Blisters, ulcers	Photographic developers, leather tanning, industrial cleaning detergents

National Safety Council, Itasca, Illinois

Chemical	Primary Irritants	Sensitizers	Selected Skin Manifestations (Some also have important systemic effects on other organs.)	Selected Occupations, Trades, or Processes Where Exposure Can Occur
SALTS or Elements				
Antimony and its compounds	X	X	Irritation and lichenoid eruptions of skin	Antimony extractors, glass and rubber mixers, manufacturing of various alloys, fireworks, and aniline colors
Arsenic and its compounds	X	X	Spotty pigmentation of skin, perforation of nasal septum, skin Cancer, keratoses Especially on palms and soles, Dermatitis, pustules	Leather workers, manufacturing insecticides, Glass Industry, agriculture, pesticides, tanning, taxidermy, alloy, lubricating oils
Barium and its compounds	X		Irritation of skin	Barium carbonate, fireworks, textile dyes and paint makers
Bromine and its compounds	X		Irritation, vesicles, and ulceration; acne	Bromine extractors, bromine salts makers, dye and drug makers, photographic trades
Chromium and its compounds	X	X	Pitlike ulcers (chrome holes) on skin, perforation of nasal septum, dermatitis	Chromium platers, dye industry workers, chrome manufacturing, leather tanners
Mercury and its compounds	X	X	Corrosion and irritation of skin, Dermatitis	Explosives manufacturing, silver and gold extractors, manufacturing electrical appliances and scientific equipment
Nickel salts	X	X	Folliculitis, dermatitis	Nickel platers, alloy makers
Sodium and certain of its compounds	X		Burns and ulceration	Bleaching: detergent, paper, glass, tetraethyl lead manufacturing
Zinc Chloride	X	?	Ulcers of skin and nasal septum	Manufacturing chemicals, dyestuffs, paper, disinfectants
SOLVENTS				
Acetone	X		Dry (defatted) skin	Spray painters, celluloid industry, artificial silk and leather workers, acetylene workers, lacquer and varnish makers, garage mechanics
Benzene and its homologues (toluene and xylene)	X		Dry (defatted) skin	Chemical and rubber manufacturing
Carbon disulfide	X	X	Dry (defatted) irritated skin	Extraction of oils, fats, and a wide range of other materials, manufacture of rayon, rubber, rubber cements, germicides, and other chemicals
Trichloroethylene	X	?	Dermatitis	Degreasers, chemical intermediates
Turpentine	X	X	Dermatitis	Painters, furniture polishers, lacquerers, artists
Alcohols (such as ethanol)	X	X	Dermatitis	Chemical manufacture; painters
SOME DYE INTERMEDIATES				
Dinitrobenzene	X		Yellow discoloration of skin, hair, and eyes	Dye manufacturing
Nitro and nitroso compounds	X	X	Dermatitis	Dye manufacturing
Phenyl Hydrazine	X	X	Severe chemical burns, dermatitis	Dye and pharmaceutical manufacturing
PETROLEUM AND COAL-TAR DERIVATIVES				
Petroleum oils	X		Dermatitis, folliculitis	Petroleum workers, machinists, mechanics
Pitch and asphalt	X		Dermatitis, folliculitis, keratoses, skin cancer	Manufacturing pitch and asphalt, roofers
Tar (coal)	X	X	Dermatitis, folliculitis, skin cancer, eye inflammation	Tar manufacturing: manufacturing roofing paper and pitch; road building

National Safety Council, Itasca, Illinois

Chemical	Primary Irritants	Sensitizers	Selected Skin Manifestations (Some also have important systemic effects on other organs.)	Selected Occupations, Trades, or Processes Where Exposure Can Occur
			(keratitis)	and repairing
DYES (such as paraphenylenediamine)	X		Contact dermatitis (erythema, blisters, edema)	Dye workers, cosmetologists
RUBBER AND ANTIOXIDANTS Mercaptobenzothiazole, tetramethylthiuram disulfide, diethylthiourea, and paraphenylenediamine	X		Contact dermatitis (erythema, blisters, edema)	Rubber workers, such as compound mixers and calendar and mill operators; fabricators of rubber products
SOAPS AND SOAP POWDERS	X	X	Dermatitis, dry skin, paronychia (inflammation around finger-nails); allergy from fragrance, germicides, or dyes	Soap manufacturing, dishwashers, soda fountain clerks, maintenance workers - all associated with wet work
INSECTICIDES			See above under salts or elements	Manufacturing and applying insecticides
Arsenic	X		Dermatitis, chloracne	Pesticide and wood preservative
Pentachlorophenols	X	?	Dermatitis, folliculitis, keratoses, hyperpigmentation, skin cancer	Manufacturing wood preservatives, railroad ties, coal tar lamp black and pitch workers
Creosote	X	X	Severe burns, dermatitis	Manufacturing insecticides, enamel manufacturing
Fluorides	X		Dermatitis	Manufacturing and applying fungicides and disinfectants
Phenylmercury compounds	X	X	Dermatitis	Manufacturing and applying insecticides
Pyrethrum		X	Dermatitis	Manufacturing and applying insecticides
Rotenone	X		Dermatitis	Manufacturing and applying insecticides
RESINS (Natural)*				
Cashew nut oils		X	Severe poison-ivy like dermatitis	Handlers of unprocessed cashew nuts, varnish
Rosin		X	Dermatitis	Adhesive and paper mill workers, dentists, rubber industry
Shellac		X	Dermatitis	Coating, cosmetics
Synthetic resins such as phenolformaldehyde, epoxy, vinyl, polyurethane, polyester, acrylate, cellulose esters	X	X	Dermatitis	Plastic workers, varnish makers, adhesives, coatings, rubber, cosmetology

*The skin reactions from this group of chemicals in some instances are due to the essential composition of the synthetic resin, but in other cases are due to the presence of added compounds such as plasticizers and other modifying agents.

National Safety Council, Itasca, Illinois

Chemical	Primary Irritants	Sensitizers	Selected Skin Manifestations (Some also have important systemic effects on other organs.)	Selected Occupations, Trades, or Processes Where Exposure Can Occur
EXPLOSIVES				
Nitrates, mercury fulminate, tetryl, lead azide, TNT, nitroglycerin	X	X	Severe irritation, dermatitis, skin discoloration	Explosives manufacturing, shell loading
METAL WORKING FLUIDS				
Cutting oils	X		Oil acne (folliculitis), rare dermatitis	Machinists
Coolants – synthetic and semisynthetic	X	X	Dermatitis	Machinists
OXIDIZING AGENTS				
Hydrogen peroxide	X	X	Dermatitis	Chemical industry; medical disinfectant; cosmetology
Enzoyl peroxide	X	X	Dermatitis	Chemical industry; polyester manufacture
OTHER				
Isocyanates such as TDI, MDI, HDI	X	X	Dermatitis	Polyurethane makers, adhesive workers, organic chemical synthesizers
Vinyl chloride	X		Dermatitis, acro-osteolysis	Polyvinyl resin, rubber and organic chemical makers
Formaldehyde	X	X	Dermatitis	Undertakers, biologists, textile workers
Plants, weeds (such as poison oak, ivy, sumac)	X	X	Dermatitis	Outdoor workers (such as fire fighters, utility workers)