

National Occupational Health and Safety Commission

**OCCUPATIONAL
DISEASES OF THE SKIN**

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Foreword

The National Occupational Health and Safety Commission, Worksafe Australia, is a tripartite body established by the Commonwealth Government to develop, facilitate and implement a national approach to occupational health and safety.

The National Commission comprises representatives of the peak employee and employer bodies - the Australian Council of Trade Unions (ACTU) and Confederation of Australian Industry (CAI) - as well as the Commonwealth, State and Territory governments.

Since its establishment, the National Commission has produced occupational health guides. Before the National Commission was established, a series of similar guides was published by the National Health and Medical Research Council.

This Guide has been reviewed and endorsed by a working group of the National Commission as part of the co-ordinated effort by the Commonwealth, State and Territory governments and employee and employer organisations to make Australian workplaces safe and healthy.

Although this Guide has been endorsed by the National Commission, it is an advisory document only. It is produced and distributed in the interests of providing useful information on occupational health and safety for employers, employees and others. This document does not replace statutory requirements under relevant State and Territory legislation.

This Guide is aimed primarily at workers and managers but should also be useful to occupational health and safety personnel and others. It may be used in conjunction with appropriate training and consultation, in line with good management practice.

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Introduction

Diseases of the skin represent a major proportion of occupational diseases.

A wide variety of agents encountered in the workplace may cause injury, irritation, sensitisation, infection, discoloration or other changes in the skin of the exposed worker. Some agents induce cancerous changes in the skin. The term occupational dermatoses includes all of these abnormalities of the skin resulting directly from, or aggravated by, the work environment.

Other Worksafe Australia Guides that should be used in conjunction with this publication include:

- *Atmospheric Contaminants;*
- *Solvent Vapour Degreasing;*
- *Electroplating;* and
- *Diseases Acquired from Animals.*

The structure and function of the skin

The skin is the protective covering of the body. It prevents loss of body constituents and restricts entry of noxious or unwanted chemical, physical or biological agents. However, because of the large surface area of the skin, it can be an important route of entry of toxic substances to the body.

The skin consists of two distinct layers, the *epidermis* and the *dermis*. The outer layer of the epidermis is a flexible, thin, semi-transparent layer of dead cells firmly dovetailed together. It has the thickness of a sheet of paper and is recognisable as the tissue covering a blister caused by heat or friction. It is constantly being worn away and being replaced by the growth and differentiation of the deeper layer of living cells. The cells of the epidermis contain the same tough, fibrous protein (keratin) which forms the major component of hair and nails. It imparts the following attributes to the skin:

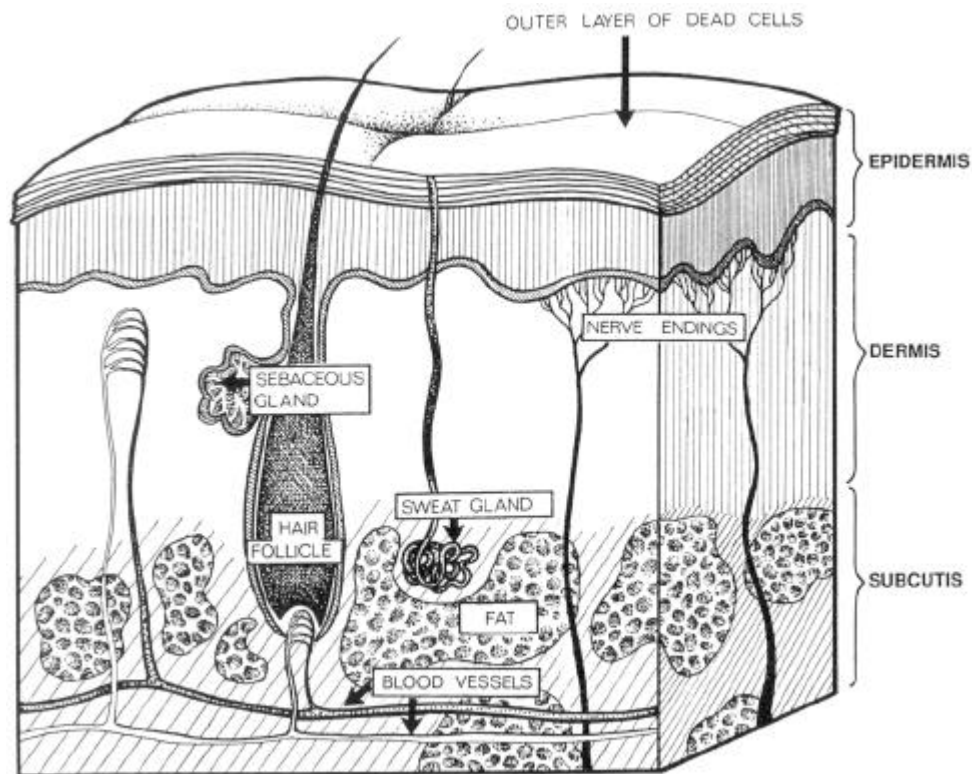
- physical toughness;
- restricted permeability to water and electrolytes; and
- resistance to corrosive chemicals.

The deeper portion of the skin, the dermis, is a feltwork of fibrous and elastic tissue in a gel-like substance. Within the dermis are embedded hair follicles, sebaceous glands and sweat glands. Where the dermis and epidermis meet, the dermis forms a series of cone-shaped elevations which jut up into the overlying epidermis. Their shape promotes the distribution and function of the blood vessels and nerve endings beneath the epidermis. The blood flow through the skin varies in response to the need to conserve or lose body heat and the nerve endings perceive sensations of touch, pain, temperature and pressure.

The hair follicles and their emergent hairs provide a passage to the skin surface for sebum, an oily secretion of the sebaceous glands. The sweat glands and the sweat produced by them provide the means to dissipate body heat, as required, by evaporative cooling on the skin surface.

The skin is covered with an oily film derived mostly from the secretions of the sebaceous glands and the epidermis itself. It keeps the skin supple and helps to protect the skin from water and water soluble chemicals.

The natural pH of the skin is between 4 and 6.5, which is slightly acidic.



Cross section of the skin

Identification

Chemical agents often act as primary irritants, that is, they directly affect the exposed skin. Strong irritants (which may also be corrosives), such as nitric acid and sodium hydroxide (caustic soda), cause changes in the skin quickly, while mild irritants, such as alcohol and soap, may take several days to produce effects.

Various agents can sensitise the skin by altering the skin's reactivity through stimulating allergic responses so that even a slight subsequent exposure to the agent may cause allergic manifestations in the skin.

'Dermatitis' is a general term used to describe any inflammation of the skin. The term 'contact dermatitis' describes those conditions which result from direct contact of the skin with external agents. 'Irritant contact dermatitis' defines conditions where only that part of the skin contacted by the external agent becomes inflamed. 'Allergic contact dermatitis' results from skin contact with a sensitising agent which stimulates an allergic response. 'Photocontact dermatitis' describes any response to an agent which occurs only in the presence of certain wavelengths of light.

Dermatitis may also occur independently of the direct influence of an external agent. In this event the inflammation is termed *endogenous*. Although endogenous skin diseases are rarely caused initially by occupational factors, they may be aggravated by exposure to various agents in the workplace. For example, eczema may be aggravated at work by contact irritants.

In irritant contact dermatitis, the earliest change produced is limited to the area of contact with the irritant. There may be redness, swelling and blistering of the skin surface, then formation of scales and crusts. After continued irritation, the skin becomes thickened, has a firm leathery feel and later becomes roughened with spotty areas of pigmentation.

The appearance of allergic contact dermatitis is generally similar to that of irritant contact dermatitis.

Desensitisation to contact allergens (sensitising agents) is rarely, if ever, possible. However, if contact with the offending agent is completely avoided, successful resolution of allergic contact dermatitis may be achieved.

Health Hazards

When considering the hazards associated with any workplace, it is essential to understand the relationship between 'hazard', 'exposure', and 'risk'.

'Hazard' is the potential for an agent or process to do harm. 'Risk' is the likelihood that an agent will produce injury or disease under specified conditions.

Health effects can only occur if a worker is actually exposed to the hazard. The risk of injury or disease usually increases with the duration and frequency of exposure to the agent, and the intensity/concentration and toxicity of the agent.

Toxicity refers to the capacity of an agent to produce disease or injury. The evaluation of toxicity takes into account the route of exposure and the actual concentration of an agent in the body.

Predisposition to skin diseases

Although there is currently no effective way of determining which individuals will develop skin diseases, in general, those people with:

- fair skin are more readily affected by sunlight and some chemical irritants;
- dry skin have decreased resistance to friction and pressure and less tolerance to fat-solvent chemicals (which remove protective oils from the skin);
- greasy skin are more apt to develop infected hair follicles, blackheads, acne and chloracne, but have a greater tolerance to solvents such as naphtha, turpentine and trichloroethylene; and
- a tendency to sweat excessively are susceptible to heat rash.

The following predisposing factors may influence the development of skin diseases:

- poor personal hygiene;
- the presence of other skin diseases; and
- any injury which breaks the skin surface.

Hazards

The hazards which may cause or contribute to the incidence of occupational dermatoses include:

- chemical agents - a large number of organic and inorganic substances, as solids, liquids or gases, a few of which may be carcinogenic for the skin;
- physical agents - mechanical effects, heat, cold, water, relative humidity, and sunlight and other forms of radiation which may be carcinogenic for the skin; and
- biological agents - bacterial, viral and fungal infections, parasite infestations, plants and plant products.

Chemical agents

Strong irritants and corrosives

Chemical corrosives are irritants that are so strong that they produce immediate destruction of the skin. They include hydrofluoric and chromic acid, strong solutions of hydrochloric, nitric and sulphuric acid, strong ammonia and sodium hydroxide (caustic soda) solutions, chloride of lime and phenol. Other strong irritants include corrosive organic acids, corrosive salts, reducing agents, petroleum oils, solvents, tar and pitch.

Irritants

Chemical irritants which may not have an apparent and immediate destructive effect, but which may damage the skin after continued exposure, include kerosene, turpentine, inorganic mercury, photographic developers, dilute formalin solutions, soaps, detergents and cutting oils.

Organic solvents

Organic solvents are widely used and commonly cause skin irritation. They remove the oily barrier from the skin, causing it to become dry and cracked.

Among workers exposed to organic solvents are painters who use turpentine, toluene, or xylene as thinners; those engaged in degreasing operations; dry cleaners; those employed in paint, plastics, rubber or textile manufacturing; electricians; photographers and printing workers; and plumbers using glues.

Oils and related liquids

Oil dermatitis is a significant occupational skin disease. The typical result in machinists and allied tradespeople exposed to oils is the formation of blackheads (caused by blockage of the hair follicles), particularly on the forearms and the back of the hands. These may become infected and inflamed. Soluble cutting oils and synthetic coolants are alkaline and have a soap-like action which causes defatting and irritation of the skin.

Other damaging substances

Cement is a very common cause of occupational dermatitis, through the combined effects of abrasive materials, alkali, water, and cobalt and chromium salts.

Chlorinated hydrocarbons such as chloronaphthalenes, chlorodiphenyls and chlorotriphenyls may produce chloracne, a severe form of acne.

Chemical sensitisers

The following sensitising agents are common causes of allergic contact dermatitis:

- chromium, nickel and cobalt salts;
- azo-dyes, aniline and other dyes;
- dye intermediates;
- epoxy and other synthetic resins;
- formaldehyde;
- additives in soaps, detergents and oils;
- natural resins;
- some pesticide substances;
- photographic developers;
- rubber compounds (including those in some rubber gloves);
- various substances in plant and animal products; and
- chemicals in some medications and anaesthetics.

Skin sensitivity to nickel is commonly acquired from earrings, costume jewellery, watch bands, bracelets, buttons and buckles on clothing.

Nickel dermatitis may be induced in industry from contact with unexpected sources such as metal trays, counters and tools.

Hairdressers have been found to have a high incidence of nickel allergy, and are also exposed to many other irritating substances.

Chemicals that both irritate and sensitise the skin

Chromium and its salts

The salts of chromium irritate and sensitise the skin. Small amounts of chromium or cobalt contained in cement cause irritation and sensitisation, and the alkali in cement is an irritant. Due to these combined effects, bricklayers, building workers and cement workers have the highest incidence of occupational contact dermatitis.

Chrome ulcers on the skin of the hands, forearms and feet may occur in workers in the electroplating industry.

Perforation of the nasal septum may occur with severe exposures to chrome contained in dusts or mists.

Sensitivity to chromium may develop in chromium platers, tanners, ink makers, dye makers, lithographers, photoengravers, photographers, paper hangers, aircraft workers and welders.

Other chemicals

Many resins and adhesives are skin irritants and sensitisers. Contact dermatitis commonly follows exposure to glues, rubber adhesives and adhesives formulated with acrylic and epoxy resins.

Epoxy resins, particularly those containing Bisphenol A, are powerful skin sensitisers likely to affect a high proportion of people working with them unless the greatest care is taken. The amine hardeners used to cure epoxy resins are also powerful skin sensitisers.

Isocyanates used in the manufacture of flexible and rigid foams (polyurethane) also irritate and sensitise the skin.

Arsenic trioxide may be present in significant amounts in the flue dusts associated with gold and copper ore smelting. This substance is both a sensitiser and an irritant. In the presence of sweat, abrasions or wounds, it will readily promote ulceration of the skin.

Acrylic materials, for example, methyl methacrylate and urethane monomers, have been responsible for cases of allergic contact dermatitis in the printing industry.

Fibreglass products

Polyester resins, widely used in the building of fibreglass boats, may cause dermatitis from contact with the resin itself or from catalysts, plasticisers or accelerators.

Fibrous glass spicules from sanding may become embedded in the worker's skin, causing irritation. However, most of the occupational dermatoses in fibreglass boat building are the result of the irritant effects of the solvents, particularly styrene and ketones, which are important components of the polyester resin system.

Carcinogenic substances

Occupational skin cancer can result from exposure to a range of chemicals.

The chemical agents most commonly responsible for occupational skin cancer are the polycyclic hydrocarbons found in tar, pitch, shale and mineral oils or in their distillation products, or in derivatives such as creosote. Coal tar hydrocarbons cause skin cancer much more frequently than petroleum hydrocarbons. Certain occupational exposures to arsenic or arsenic-based compounds may cause skin cancer, as may overexposure to ionizing radiation or X-rays.

In all cases, a long latent period precedes the appearance of skin tumours.

Physical agents

Mechanical effects

Mechanical effects result from friction, accidental injury and pressure. They vary from a simple corn to a severe laceration or contusion. Calluses occurring at the points of greatest pressure are common in workers who habitually use hand-held tools. Mechanical injuries may contribute, in some occupations, to the development of skin infections and chemically-induced dermatitis. Mechanical effects can greatly increase the damage caused by chemical irritants.



Contact dermatitis

courtesy Dr S. Kosard



Contact dermatitis

courtesy Dr S. Freeman



courtesy Dr S. Freeman

Contact dermatitis is common in the construction industry



courtesy Dr S. Freeman

Dermatitis caused by photographic chemicals



courtesy Dr S. Kosard

Nickel dermatitis is common in workers who handle nickle-plated objects



courtesy Dr S. Freeman

Dermatitis caused by inappropriate rubber gloves



courtesy of Animal Health, University of Sydney

The disease orf is a viral infection which can be acquired from sheep and goats



courtesy of Animal Health, University of Sydney

The erysipeloid bacterium can cause skin eruptions on the hands and fingers of kitchen workers, poultry workers, fishermen, fish dealers and others

Heat, cold and humidity

Heat can cause burns and scalds, prickly heat and increased sensitivity to chemicals. Sweat retained beneath protective clothing, nylon, or drip-dry or glazed cotton garments can soften the skin and favour the occurrence of dermatoses. Cold injuries to the skin include chilblains and, if associated with damp or wet conditions, may produce trench foot in extreme cases.

Conditions of low humidity, which may occur in air conditioned workplaces, are an important cause of dermatitis, through drying out of the skin.

Water

Prolonged contact with water and other solutions softens and weakens the skin. Intermittent exposure to water, with intervening periods of dryness, often produces a dry skin. Soaps and detergents remove the outer oily film of the skin, leading to dryness and cracking as water is lost from the skin surface. The use of moisturisers helps counteract these effects.

Sunlight and other radiation

Ultraviolet radiation with wavelengths between approximately 200 and 380 nm causes various effects ranging from sunburn to skin cancer. The shorter the wavelength the more severe the effect.

Note: The range of wavelengths visible to the human eye is from about 380 nm (violet) to 780 nm (red). One nanometre (nm) is equal to one thousand-millionth of a metre (10^{-9} m).

Outdoor workers, such as farmers, sailors, construction workers and fishermen, are exposed to wavelengths of from 290 to 320 nm from the sun (solar radiation).

As they get older, these workers are prone to develop dry adherent scales on the skin, solar keratoses or various types of skin cancer.

Statistically, Australia displays the highest incidence of skin cancer in the world. The incidence is increasing, and the following factors can influence the risk of developing ultraviolet radiation-related skin conditions:

- outdoor workers, particularly in northern Australia, are at risk of developing skin cancer;
- exposure to sunlight during the middle of the day can be particularly hazardous;

- sand and snow can reflect ultraviolet radiation quite efficiently;
- those with a fair complexion and freckles who tan poorly or who easily develop painful sunburn are at the greatest risk;
- wet, loosely-knit clothes are readily penetrated by ultraviolet radiation (water transmits most of the ultraviolet radiation which reaches it); and
- increases in altitude are associated with greater intensities of ultraviolet radiation.

Individuals working with electric discharges such as welding arcs or sterilising lamps are exposed to ultraviolet radiation below 280 nm. This radiation can cause skin inflammation after quite short periods of exposure.

Acute overexposure to ionising radiation and radioactive isotopes may cause inflammation of the skin (radio-dermatitis). When exposure is repeated over many years the cumulative effects may cause premature ageing, ulceration or skin cancer.



The exposure of outdoor workers, such as farmers, building workers and recreation workers, to sunlight should be minimised by wearing wide-brimmed hats, protective clothing and applying sunscreens

Photosensitivity

Photosensitivity describes skin conditions where the skin is abnormally sensitive to sunlight. In very severe photosensitivity, even artificial lights used indoors can produce dermatitis. Such conditions can be caused as follows:

- Workers exposed to sunlight and handling certain chemicals, notably coal tar products, including anthracene, acridine, creosote, pitch and some roof paints, may display dermatitis-type skin reactions in the sun-exposed areas. Agricultural or timber workers exposed to various oils in plants, including those in parsnips, celery and certain types of wood, may also display photosensitivity.
- Exposure to light of workers who have received certain medications, either orally or by skin application. Some tranquilisers, antibiotics and soap products can interact with light to cause skin reactions.

Biological agents

Bacterial and viral infections

Bacterial and viral infections of the skin are more common in certain occupations. The following are some examples:

- infections round the nail fold (paronychia) occur in workers whose hands are exposed to repeated or prolonged immersion in water;
- superficial abrasions and cuts predispose the skin to bacterial infections, for example, among abattoir workers and meat handlers; and
- veterinarians, farmers and shearers contract the viral infection orf (typically on the hands) by direct contact of broken skin with infected sheep or goats.

Fungal infections

Fungal infections of the feet and groin (tinea or ringworm) may rarely be transmitted from one worker to another when using a common shower, bathroom or change room.

Fungal infections are also seen in farmers and others coming into contact with animals which themselves have fungal infections on their skin.

Infestations and bites

Outbreaks of dermatoses caused by insects occasionally occur in a variety of occupations. Some examples include:

- scabies, caused by a parasitic mite, and usually associated with communal living areas such as exist in the mining and construction industries, the armed forces and prisons;
- skin eruptions, caused by various mites associated with animal and vegetable products, and which usually affect rural workers, poultry workers, dockers and bakers; and
- bites from mosquitoes and midges (sandflies) which breed in wet or moist areas in many parts of Australia, and which can cause severe reactions in some workers.

Plants and plant products

Many plants contain latex, gum or resin, or bristles which have a corrosive or irritant action on the skin. Some examples include:

- A significant number of contact dermatitis cases occur in workers carrying out picking, packing and canning operations in the fruit and vegetable industry.
- Gardeners, landscapers and nursery workers are typically exposed to plants which may initiate allergic skin responses. Several grevillea species are notable examples. Euphorbia species of succulents (cacti) are extremely irritant and may even have a tumour-promoting effect on the skin.
- Sawyers, carpenters, joiners, polishers and finishers are all exposed to saps and fine dusts from woods. Timbers known to irritate and occasionally sensitise the skin are western red cedar, acacia, ash, birch, maple, mahogany, pine and spruce.

Protective clothing and rubber compounds

Allergic contact dermatitis can result from chemicals in rubber compounds and also other materials such as chrome or adhesives present in some types of protective clothing. In these cases, other protective clothing can generally be found which does not contain the substance to which the particular individual is allergic.

Sweating caused by the wearing of protective clothing can result in skin irritation and enhance or predispose an individual to the development of dermatitis.

Prevention and Control Measures

To ensure appropriate prevention of significant health effects, an evaluation of work practices and conditions may be undertaken by qualified health and safety personnel. These practices should be considered an integral part of management's responsibilities. Good occupational hygiene promotes elimination of hazards, where workable. Engineering controls to minimise the hazard at the source and administrative controls should be adopted, where workable.

Measures required to prevent the occurrence of occupational skin diseases include:

- Elimination of the hazard or, if this is not feasible, substitution of a less hazardous chemical or process whenever feasible.
- Engineering controls to minimise exposure to dusts, gases, fumes, fogs, mists and vapours, and to maintain comfortable working conditions whenever possible. To prevent skin diseases, these controls should be directed towards avoiding direct contact of dusts or solutions with the skin, together with avoiding buildup of materials on surfaces which may come into contact with the skin.
- Maintaining a high standard of hygiene in the work environment, incorporating good housekeeping practices.
- Maintaining a high standard of personal hygiene. Employees should have ready access to clean work clothes, protective clothing, adequate washing and laundry facilities, and in some of the more hazardous situations, showers and change rooms. Splashes by irritant or sensitising substances must be washed off immediately with soap and water. Contaminated clothing must be removed.
- Ready access to first aid and medical treatment.
- Minimising exposure to sunlight, where workable.
- Advantage should be taken of appropriate measures such as shade, hats and sunscreens. Re-allocation of activities during the day may be necessary. Sunscreens typically require re-application every hour if sweating occurs, and must be regarded as adjuncts to, rather than substitutes for, protective clothing. Clear lipsticks may be needed to protect against lip cancer. Reflection of ultraviolet radiation from surfaces, such as sand or water, must be considered.

- Personal protective clothing, such as gloves, sleeves, aprons and protective suits, should be selected for its suitability and ease of use, taking fit, comfort and applicability to task into account. All personnel should be trained in the correct use and care of this equipment.
- MSDS should be consulted for details of skin hazards and protection needed for particular products.
- Relevant occupational health authorities should be contacted for information regarding the selection and suitability of personal protective equipment.
- The potential interaction between light and various chemicals or plant substances must be taken into account whenever such exposures are likely to occur.

Barrier creams

An appropriate occupational health professional should be consulted regarding the suitability, selection and use of barrier creams.

Barrier creams should be used as substitutes for protective clothing only when gloves, sleeves or face guards cannot be worn. Any creams used for these purposes must be able to provide adequate and safe protection for the skin against the particular agents involved.

Most creams are formulated to be either water-repellent or oil-repellent. The water-repellent types offer little protection against oils or solvents.



The incidence of skin disease can be reduced by maintaining a high standard of personal hygiene, covering cuts and using appropriate protective gloves and, in some cases, barrier creams

Skin cleansers

A large range of industrial skin cleansers are available. Many of them soften and remove the surface layer of the skin and remove natural oils. The safety requirements for petroleum solvent type cleansers are described in Australian Standard AS 1223. To avoid possible harm from their use, skin cleansers should:

- be free from materials known to be irritating or abrasive to the skin;
- be chemically stable;
- have a pH between 4.5 and 10.5;
- contain no more than 2 g/kg of free alkali (sodium hydroxide);
- contain minimal amounts of anti-bacterial or cosmetic materials; and
- preferably be solvent free.

Excessive use of some cleansers, for example, detergent types, can severely dry out the skin. The use of solvents, such as kerosene, to remove materials from the skin should be actively discouraged. This practice can cause or aggravate dermatitis.

Health assessment

In some occupations, health assessment may form part of a comprehensive occupational health and safety strategy. Where employees are to undergo health assessment, there should be adequate consultation prior to the introduction of any such program. Where medical records are kept, they must be confidential. In some cases, it is valuable to be able to relate employee health and illness data, including skin diseases, to workplace exposures.

Education and training

Education to promote knowledge about relevant hazards is essential for prevention and control measures to be effective. Where applicable, instruction in the causes, nature and prevention of industrial dermatoses should be included in apprentice training, job instruction and safety programs. Special attention should be given to ensuring that all personnel understand instructions, especially newly recruited employees and those with English-language difficulties, where they are known.

First Aid

Any worker suffering from a skin disease which persists for more than a few days, in spite of removal from contact with known skin irritants and/or sensitisers, should be referred for medical treatment.

On the advice of the doctor responsible, once the skin condition has been controlled, the worker may resume normal duties, using adequate precautions to prevent skin contact with the causative agent. In most cases he/she will be able to continue working. Occasionally contact dermatitis prevents the resumption of normal duties. Efforts should be made to achieve a suitable alternative job placement.

When an occupational skin disease occurs, work practices and opportunities for contact with the causal agent(s) should be reviewed and preventive measures instigated to ensure that other workers do not develop the same condition.

A range of hypoallergenic protective clothing, such as gloves and boots, is available. These products should be immediately substituted for protective clothing that is suspected of causing allergic skin responses in the wearer.

Medical advice should be sought on the preparations for, and the methods of treatment to be used in, the first aid room.

Further Reading

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