



# ENVIS-NIOH



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NEWS LETTER

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## Occupational Skin Diseases

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An occupational skin disease is one in which workplace exposure to some physical, chemical or biologic hazard has been a causal or a major and necessary contributing factor in the development of the disease. A person's existing skin disorder may also be made much worse by work activities, and such cases are also considered as Occupational Skin Diseases (OSDs). Diagnosis requires a high index of suspicion and knowledge of the worker's environment. Contact dermatitis accounts for at least 60% of occupational dermatoses, which, in turn, account for 40-70% of occupationally acquired illness.

<http://www.osh.dol.govt.nz/order/catalogue/pdf/occskin.pdf>

The commonest cause of OSD is irritation of the skin from contact with substances at work. Strong irritants (such as acids, alkalis or solvents) cause skin inflammation after a short period of skin contact. Weak irritants (such as water, detergents, coolants) cause inflammation after repeated exposures over a longer time.

Another important cause of OSD is allergy to substances handled at work. Examples of substances which can cause skin allergies are cement, metals and resins. Rubber gloves and boots worn for protection may sometimes paradoxically cause allergy.

<http://www.nsc.gov.sg/showpage.asp?id=138>

Occupational dermatoses vary both in their appearance (morphology) and severity. The effect of an occupational exposure may range from the slightest erythema (reddening) or discoloration of the skin to a far more complex change, as a malignancy. Despite the wide range of substances that are known to cause skin effects, in practice it is difficult to associate a specific lesion with exposure to a specific material. However, certain chemical groups are associated with characteristic reaction patterns. The nature of the lesions and their location may provide a strong clue as to causality.

A number of chemicals with or without direct toxic effect on the skin can also cause systemic intoxication following absorption through the skin. In order to act as a systemic toxin, the agent must pass through the keratin and the epidermal cell layers, then through the epidermal-dermal junction. At this point it has ready access to the bloodstream and the lymphatic system and can reach to vulnerable target organs.

## TYPES OF OSD

### Acute contact dermatitis (irritant or allergic)

Acute contact eczematous dermatitis can be caused by hundreds of irritant and sensitizing chemicals, plants and photoreactive agents. Clinical signs are heat, redness, swelling, vesiculation and oozing. Symptoms include itch, burning and general discomfort. The back of the hands, the inner wrists and the forearms are the usual sites of attack, but acute contact dermatitis can occur anywhere on the skin. If the dermatosis occurs on the forehead, the eyelids, the ears, the face or the neck, it is logical to suspect that a dust or a vapour may be involved in the reaction. When there is a generalized contact dermatitis, not restricted to one or a few specific sites, it is usually caused by a more extensive exposure, such as the wearing of contaminated clothing, or by autosensitization from a pre-existing dermatitis. The exposure history may reveal the suspected causative agent.

### Sub-acute contact dermatitis

Through a cumulative effect repeated contact with both weak and moderate irritants can cause a sub-acute form of contact dermatitis characterized by dry, red plaques. If the exposure continues, the dermatitis will become chronic.

### Chronic eczematous contact dermatitis

When a dermatitis recurs over an extended period of time it is called chronic eczematous contact dermatitis. The hands, fingers, wrists and forearms are the sites most often affected by chronic eczematous lesions, characterized by dry, thickened and scaly skin. Cracking and fissuring of the fingers and the palms may be present. Chronic nail dystrophy is also commonly found.

### Photosensitivity dermatitis (phototoxic or photoallergic)

Most photoreactions on the skin are phototoxic. Either natural and artificial light sources alone or in combination with various chemicals, plants or drugs can induce a phototoxic or photosensitive response. Phototoxic reaction is generally limited to light-exposed areas while photosensitive reaction can develop frequently on non-exposed body surfaces. Some examples of photoreactive chemicals are coal tar distillation products, such as creosote, pitch and anthracene. Members of the plant family Umbelliferae are well known photoreactors.

### Folliculitis and acneform dermatoses, including chloracne

Workers with dirty jobs often develop lesions involving the follicular openings. Comedones (blackheads) may be the only obvious effect of the exposure, but often a secondary infection of the follicle may ensue. Poor personal hygiene and ineffective

cleansing habits can add to the problem. Lesions generally occur on the forearms and less often on the thighs and buttocks, but they can occur anywhere except on the palms and soles. Follicular and acneform lesions are caused by overexposure to insoluble cutting fluids, to various tar products, paraffin, and certain aromatic chlorinated hydrocarbons.

Chloracne is the most serious form, because it can lead to disfigurement (hyperpigmentation and scarring) as well as potential liver damage, including porphyria cutanea tarda and other systemic effects that the chemicals can cause. Chloronaphthalenes, chlorodi-phenyls, chlorotriphenyls, hexachlorodibenzo-p-dioxin, tetrachloroazoxybenzene and tetrachlorodibenzodioxin (TCDD), are among the chloracne-causing chemicals. The blackheads and cystic lesions of chloracne often appear first on the sides of the forehead and the eyelids

### Sweat-induced reactions

Many types of work involve exposure to heat and where there is too much heat and sweating, followed by too little evaporation of the sweat from the skin, prickly heat can develop. When there is chafing of the affected area by skin rubbing against skin, a secondary bacterial or fungal infection may frequently occur. This happens particularly in the underarm area, under the breast, in the groin and between the buttocks.

### Pigment change

Occupationally induced changes in skin colour can be caused by dyes, heavy metals, explosives, certain chlorinated hydrocarbons, tars and sunlight. The change in skin colour may be the result of a chemical reaction within the keratin. Increased pigmentation induced by chlorinated hydrocarbons, tar compounds, heavy metals and petroleum oils generally results from melanin stimulation and overproduction. Hypopigmentation or depigmentation at selected sites can be caused by a previous burn, contact dermatitis, contact with certain hydroquinone compounds or other antioxidant agents used in selected adhesives and sanitizing products.

### Neoplastic lesions

Neoplastic lesions of occupational origin may be malignant or benign (cancerous or non-cancerous). Traumatic cysts, fibromata, asbestos, petroleum and tar warts and keratoacanthoma, are typical benign new growths. Keratoacanthomas can be associated with excessive exposure to sunlight and also have been ascribed to contact with petroleum, pitch and tar.

### Ulcerative changes

Chromic acid, concentrated potassium dichromate, arsenic trioxide, calcium oxide, calcium nitrate and calcium carbide are documented ulcerogenic chemicals. The fingers, hands, folds and

palmar creases are the favorite attack sites. Several of these agents also cause perforation of the nasal septum.

### Granulomas

Granulomas can be caused by occupational exposures to bacteria, fungi, viruses or parasites. Inanimate substances, such as bone fragments, wood splinters, cinders, coral and gravel, and minerals such as beryllium, silica and zirconium, can also cause granulomas after skin embedment.

### Other conditions

Hair loss caused by burns, or mechanical trauma or certain chemical exposures, is one example. A facial flush that follows the combination of drinking alcohol and inhaling certain chemicals, such as trichlorethylene and disulfuram, is another. Acroosteolysis, a type of bony disturbance of the digits, plus vascular changes of the hands and forearm (with or without Raynaud's syndrome) has been reported among polyvinyl chloride polymerization tank cleaners.

[http://www.ilo.org/safework\\_bookshelf/english?content&nd=857170127](http://www.ilo.org/safework_bookshelf/english?content&nd=857170127)

## CAUSES OF OSD

They are currently divided into mechanical, physical, biological and chemical categories, which continue to grow in number each year.

### Mechanical

Friction, pressure or other forms of more forceful trauma may induce changes ranging from callus and blisters to myositis, tenosynovitis, osseous injury, nerve damage, laceration, shearing of tissue or abrasion. Lacerations, abrasions, tissue disruption and blisters additionally pave the way for secondary infection by bacteria or, less often, fungi to set in. Those who use pneumatic riveters, chippers, drills and hammers are at greater risk of suffering neurovascular, soft tissue, fibrous or bone injury to the hands and forearms. because of the repetitive trauma from the tool.

### Physical agents

Heat, cold, electricity, sunlight, artificial ultraviolet, laser radiation and high energy sources such as X-rays, radium and other radioactive substances are potentially injurious to skin and to the entire body. High temperature and humidity at work or in a tropical work environment can impair the sweat mechanism and cause systemic effects known as sweat retention syndrome. Milder exposure to heat may induce prickly heat, intertrigo (chafing), skin maceration and supervening bacterial or fungal infection, particularly in overweight and diabetic individuals.

Thermal burns are frequently experienced by electric furnace operators, lead burners, welders, laboratory chemists, pipe-line

workers, road repairmen, roofers and tar plant workers contacting liquid tar. Prolonged exposure to cold water or lowered temperatures causes mild to severe injury ranging from erythema to blistering, ulceration and gangrene. Frostbite affecting the nose, ears, fingers and toes of construction workers, firemen, postal workers, military personnel and other outdoor workers is a common form of cold injury.

### Biological

Occupational exposures to bacteria, fungi, viruses or parasites may cause primary or secondary infections of the skin. While bacterial infections can occur in any kind of work setting, certain jobs, such as animal breeders and handlers, farmers, fishermen, food processors and hide handlers have greater exposure potential. Similarly, fungal (yeast) infections are common among bakers, bartenders, cannery workers, cooks, dishwashers, child-care workers and food processors. Dermatoses due to parasitic infections are seen most often among agricultural and livestock workers, grain handlers and harvesters, longshoremen and silo workers.

### Chemicals

Organic and inorganic chemicals are the major source of hazards to the skin. Hundreds of new agents enter the work environment each year and many of these will cause cutaneous injury by acting as primary skin irritants or allergic sensitizers. It has been estimated that 75% of the occupational dermatitis cases are caused by primary irritant chemicals. A primary irritant is a chemical substance, which will injure every person's skin if sufficient exposure takes place. Irritants can be rapidly destructive (strong or absolute) as would occur with concentrated acids, alkalis, metallic salts, certain solvents and some gases.

### Plants and woods

Many plants cause mechanical and chemical irritation and allergic sensitization, while others have gained attention because of their photoreactive capacity. The family *Anacardiaceae*, which includes poison ivy, poison oak, poison sumac, cashew-nut shell oil and the Indian marking nut, is a well-known cause of occupational dermatitis due to its active ingredients (polyhydric phenols). Poison ivy, oak and sumac are common causes of allergic contact dermatitis. Other plants associated with occupational and non-occupational contact dermatitis include castor bean, chrysanthemum, hops, jute, oleander, pineapple, primrose, ragweed, hyacinth and tulip bulbs.

Several varieties of wood have been named as causes of occupational dermatoses among plumberers, sawyers, carpenters and other wood craftspeople.

## Non-Occupational Factors in Occupational Skin Disease

Indirect or predisposing factors may also merit attention. A predisposition can be inherited and related to skin colour and type or it may represent a skin defect acquired from other exposures. Some workers have lower tolerance to materials or conditions in the work environment.

[http://www.ilo.org/safework\\_bookshelf/english?content&nd=857170127](http://www.ilo.org/safework_bookshelf/english?content&nd=857170127)

## DIAGNOSIS OF OSD

### Occupational History

Cause and effect of occupational skin disease can be best ascertained through a detailed history, which should cover the past and present health and work status of the employee. Family history, particularly of allergies, personal illness in childhood and the past, is important. The title of the job, the nature of the work, the materials handled, how long the job has been done, should be noted. It is important to know when and where on the skin the rash appeared, the behaviour of the rash away from work, whether other employees were affected, what was used to cleanse and protect the skin, and what has been used for treatment (both self-medication and prescribed medication); as well as whether the employee has had dry skin or chronic hand eczema or psoriasis or other skin problems; what drugs, if any, have been used for any particular disease; and finally, which materials have been used in home hobbies such as the garden or woodworking or painting.

### Clinical examination

**Appearance of the lesions :** Acute or chronic eczematous contact dermatoses are most common. Follicular, acneform, pigmentary, neoplastic, ulcerative granulomatous lesions and conditions such as Raynaud's syndrome and contact urticaria can occur.

**Sites involved :** The hands, the digits, the wrists and the forearms are the most commonly affected sites. Exposure to dusts and fumes usually cause the dermatosis to appear on the forehead, face, and V of the neck. Widespread dermatitis can result from autosensitization (spread) of an occupational or non-occupational dermatosis.

**Diagnostic tests :** Laboratory tests should be employed when necessary for the detection of bacteria, fungi and parasites. When allergic reactions are suspected, diagnostic patch tests can be used to detect occupational as well as non-occupational allergies, including photosensitization. At times, useful information can be obtained through the use of analytical chemical examination of blood, urine, or tissue (skin, hair, nails).

**Course:** An occupationally induced acute contact eczematous dermatitis tends to improve upon cessation of contact. Chronic eczematous dermatoses, acneform lesions and pigmentary

changes are less responsive to treatment even when contact is eliminated. Ulcerations usually improve with elimination of the source. With granulomatous and tumour lesions, eliminating contact with the offending agent may prevent future lesions but will not dramatically change already existing disease. Dermatoses caused by metals such as nickel or chrome have a notoriously prolonged course partly because of their ubiquitous nature.

[http://www.ilo.org/safework\\_bookshelf/english?content&nd=857170127](http://www.ilo.org/safework_bookshelf/english?content&nd=857170127)

## CONTROL OF OSD

Employers should follow the following step to protect workers from OSD:

- **Elimination :** In most cases, preventing skin contact with chemicals or other skin damaging agents will prevent disease. Eliminating exposure to the compound or product that causes the skin condition is the most effective method of control.
- **Substitution :** If possible, employers should attempt to substitute the hazardous agent with a less hazardous compound.
- **Engineering controls :** If elimination or substitution is not possible, engineering controls such as local exhaust ventilation systems and isolation booths can prevent hazardous agents from contacting workers' skin.
- **Administrative controls:** Employers should provide training programs that educate workers about hazards that they may be exposed to and ways to protect themselves from the hazards.
- **Personal protective equipment:** Personal protective equipment such as gloves, safety glasses or goggles, shop coats or coveralls, and boots should be provided by employers and worn by workers involved in the following activities (not an exhaustive list):
  - ❖ Wet or dry cleaning of work tools, equipment and work areas
  - ❖ Disinfection of work tools, equipment, and work areas
  - ❖ Contact with solvents
  - ❖ Contact with monomers of epoxy resins and tacky surfaces or hardening agents (such as glue or epoxy resins)
  - ❖ Use of preparations containing soaps, detergents, and disinfectants

Occupational dermal risks can also be assessed using control banding, an approach in which a single control technology (such as general ventilation) is applied to a range or band of chemical exposures (such as 1–10 mg/m<sup>3</sup>) that falls within a given hazard group.

<http://www.cdc.gov/niosh/topics/engcontrols/>

## Types of contact dermatitis

Features	Irritant contact dermatitis	Allergic contact dermatitis
Mechanism of production	Direct cytotoxic effect	Delayed-type cellular immunity (Gell and Coombs type IV)
Potential victims	Everyone	A minority of individuals
Onset	Progressive, after repeated or prolonged exposure	Rapid, within 12-48 hours in sensitized individuals
Signs	Subacute to chronic eczema with erythema, desquamation and fissures	Acute to subacute eczema with erythema, oedema, bullae and vesicles
Symptoms	Pain and burning sensation	prurifus
Concentration of contactant	High	Low
Investigation	History and examination	History and examination - patch tests

[http://www.ilo.org/safework\\_bookshelf/english?content&nd=857170130](http://www.ilo.org/safework_bookshelf/english?content&nd=857170130)

## Examples of skin irritants and sensitizers with occupations where contact can occur

Occupation	Irritants	Sensitizers
Construction workers	Turpentine, thinner, fibreglass, glues	Chromates, epoxy and phenolic resins, colophony, turpentine, woods
Dental technicians	Detergents, disinfectants	Rubber, epoxy and acrylic monomer, amine catalysts, local anaesthetics, mercury, gold, nickel, eugenol, formaldehyde, glutaraldehyde
Farmers, florists, gardenerst	Fertilizers, disinfectants, soaps and detergents	Plants, woods, fungicides, insecticides
Food handlers, cooks, bakers	Soaps and detergents, vinegar, fruits, vegetables	Vegetables, spices, garlic, rubber, benzoyl peroxide
Hairdressers, beauticians	Shampoos, bleach, peroxide, permanent wave, acetone	Paraphenylenediamine in hair dye, glycerylmonothioglycolate in permanents, ammonium persulphate in bleach, surfactants in shampoos, nickel, perfume, essential oils, preservatives in cosmetics
Medical personnel	Disinfectants, alcohol, soaps and detergents	Rubber, colophony, formaldehyde, glutaraldehyde, disinfectants, antibiotics, local anaesthetics, pheno-thiazines, benzodiazepines
Metal workers, machinists and mechanics	Soaps and detergents, cutting oils, petroleum distillates, abrasives	Nickel, cobalt, chrome, biocides in cutting oils, hydrazine and colophony in welding flux, epoxy resins and amine catalysts, rubber
Printers and photographers	Solvents, acetic acid, ink, acrylic monomer	Nickel, cobalt, chrome, rubber, colophony, formaldehyde, paraphenylene diamine and azo dyes, hydroquinone, epoxy and acrylic monomer, amine catalysts, B&W and colour developers
Textile workers	Solvents, bleaches, natural and synthetic fibres	Formaldehyde resins, azo- and anthraquinone dyes, rubber, biocides

[http://www.ilo.org/safework\\_bookshelf/english?content&nd=857170130](http://www.ilo.org/safework_bookshelf/english?content&nd=857170130)

## PATCH TESTING :

A patch test is a method used to determine if a specific substance causes allergic inflammation of the skin. Any individual with eczema suspected of having allergic contact dermatitis and/or atopic dermatitis needs patch testing.



[www.theucbinstituteofallergy.com/.../index.asp](http://www.theucbinstituteofallergy.com/.../index.asp)

Patch testing is intended to produce a local allergic reaction on a small area of skin where the diluted chemicals are planted. The chemicals included in the patch test kit are the offenders in approximately 85-90 percent of contact allergic eczema and include chemicals present in metals (e.g. nickel), rubber, leather, hair dyes, formaldehyde, lanolin, fragrance, preservative and other additives.

[http://en.wikipedia.org/wiki/Patch\\_test\\_\(medicine\)](http://en.wikipedia.org/wiki/Patch_test_(medicine))

The allergens are mixed with a non-allergic material (base) to a suitable concentration. They are then placed in direct contact with the skin, usually on the upper back, within small aluminium discs. Adhesive tape is used to fix them in place, and the test sites are marked. The patches are left in place for 48 hours, during which time it is important not to wash the area or play vigorous sport because if the adhesive tapes peel off the process will have to be repeated.

The patches should not be exposed to sunlight or other sources of ultraviolet (UV) light. After 48 hours the patches are removed and an initial reading is taken one hour later. The final reading is taken a further 48 hours later. Additional readings beyond 48 hours increase the chance of a positive test patch by 34 per cent. The patient should refrain from washing until the last reading is taken.

[http://www.netdoctor.co.uk/health\\_advice/examinations/patchtesting.htm](http://www.netdoctor.co.uk/health_advice/examinations/patchtesting.htm)

## SOME PECULIAR OSD :

### Housewife Dermatitis:

Housewives are more prone to develop this type of eczema due to primary irritation with soaps, detergents stains and polishers. It begins as dryness and flaking - then spreads to involve sides and back of fingers, hands and wrists. Later symptoms may be oozing. The condition usually worsens during winter months and under psychological stress.

<http://www.quickacneremedy.com/natural-acne-treatment/eczema.html>

### Cement burns :

Wet portland cement can cause caustic burns, sometimes referred to as cement burns. Cement burns may result in blisters, dead or hardened skin, or black or green skin. In severe cases, these burns may extend to the bone and cause disfiguring scars or disability.

<http://www.osha.gov/dsg/guidance/cement-guidance.html>



'Pizza Knee' from a cement burn

<http://www.hse.gov.uk/skin/images/pizzaknee.jpg>

### Athlete's foot :

Athlete's foot is a fungal infection of the skin that causes scaling, flaking, and itch of affected areas. It is caused by fungi in the genus *Trichophyton* and is typically transmitted in moist areas where people walk barefoot, such as showers or bathhouses. Although the condition typically affects the feet, it can spread to other areas of the body, including the groin.

[http://en.wikipedia.org/wiki/Athlete's\\_foot](http://en.wikipedia.org/wiki/Athlete's_foot)



[http://www.healthhype.com/wp-content/uploads/tinea\\_pedis\\_athletes\\_foot.jpg](http://www.healthhype.com/wp-content/uploads/tinea_pedis_athletes_foot.jpg)

### 'White finger' or 'dead finger' :

White finger, sometimes also termed dead finger, is one of the dangers of vibration based haptic immersion over an extended period of time. It derives its name from the colour the body part initially turns on the onset of this condition. It is caused by a loss of blood flow by prolonged exposure to vibration, the same as experienced with heavy machinery, and despite the name, it can occur on any part of the body. If exposure continues past the

tissue bleaching, possible side effects include that body part turning numb, an increased sensitivity to cold, and finally, necrosis where the tissue literally starts to die off.

<http://www.virtualworldlets.net/Resources/Dictionary.php?Term=White%20Finger>

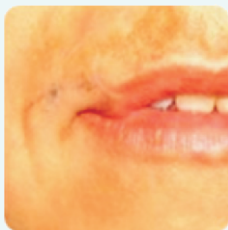


<http://www.whitefinger.co.uk/>

**Hypothenar hammer syndrome (HHS):** It is caused by repetitive use of the hand as a hammer so that there is thrombosis of the superficial palmar arch of the ulnar artery. There is trauma over the hook of hamate, where the superficial branch of the palmar artery lies. This leads to vascular insufficiency of the ulnar side of the hand. Typically, it occurs in men around age 40 years, in occupations and sports where the heel of the hand is used as a hammer or is subject to repeated force.

[http : www.ccohs.ca/oshanswers/diseases/hypothen.html](http://www.ccohs.ca/oshanswers/diseases/hypothen.html)

**Traumatic tattoos :** A traumatic tattoo occurs when a substance such as asphalt is rubbed into a wound. There are two types of



[http : www.quantasystem.com/root/en/division\\_medical\\_dermatology\\_traumatic\\_tattoo.aspx](http://www.quantasystem.com/root/en/division_medical_dermatology_traumatic_tattoo.aspx)

traumatic tattoos: explosive tattoos, which occur when gunpowder granules are impregnated into the skin, and abrasive tattoos, which most often occur from falls on blacktop surfaces in vehicle accidents.

[http://www.quantasystem.com/root/en/division\\_medical\\_dermatology\\_traumatic\\_tattoo.aspx](http://www.quantasystem.com/root/en/division_medical_dermatology_traumatic_tattoo.aspx)

**Cat scratch disease (CSD):** It is a bacterial disease caused by *Bartonella henselae*. Most people with CSD have been bitten or scratched by a cat and developed a mild infection at the point of injury. Lymph nodes, especially those around the head, neck, and upper limbs, become swollen.

<http://www.cdc.gov/healthypets/diseases/catscratch.htm>



<http://health-pictures.com/disease/images2/CatScratchFever.jpg>

## WEBLINKS

<http://www.osh.dol.govt.nz/order/catalogue/pdf/occskin.pdf>  
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<http://www.cdc.gov/niosh/topics/engcontrols/>  
[http://www.ilo.org/safework\\_bookshelf/english?content&nd=857170130](http://www.ilo.org/safework_bookshelf/english?content&nd=857170130)  
[http://en.wikipedia.org/wiki/Patch\\_test\\_\(medicine\)](http://en.wikipedia.org/wiki/Patch_test_(medicine))  
[http://www.netdoctor.co.uk/health\\_advice/examinations/patchtesting.htm](http://www.netdoctor.co.uk/health_advice/examinations/patchtesting.htm)  
<http://www.quickacneremedy.com/natural-acne-treatment/eczema.html>  
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