



Medical aspects of occupational skin disease

Guidance Note **MS 24** (Second edition)

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

INTRODUCTION

1 This Guidance Note is addressed to health professionals to advise them on the surveillance of those at risk from irritants, sensitisers and other non-infective skin damaging agents, excluding ionising and non-ionising radiation. It aims to advise on:

- (a) the incidence and nature of occupational skin disease;
- (b) the role of employers in preventing occupational skin disease, including statutory duties under the Control of Substances Hazardous to Health Regulations 2002 (COSHH),¹ and the Management of Health and Safety at Work Regulations 1999 (MHSW);²
- (c) suitable and necessary health surveillance; and
- (d) the management of individual cases.

2 For the broader context this guidance should be read in conjunction with the COSHH and MHSW Regulations, Approved Codes of Practice (ACOPs) and guidance publications.¹⁻⁵

This Guidance Note does not cover infective agents.

OCCUPATIONAL DERMATOSES

3 Occupational skin diseases, also known as occupational dermatoses, are skin diseases primarily caused by occupation.

Guidance Notes are published under five subject headings:

Medical

Environmental Hygiene
Chemical Safety
Plant and Machinery
General

4 Occupational dermatoses are not uncommon. The best estimate of the prevalence of work-related skin disease comes from the Self-reported Work-related Illness survey for 2001/02. This provides an estimated prevalence of self-reported work-related skin disease of 39 000 workers for Great Britain (with a 95% confidence interval of 30 000 to 48 000). An estimated average of 3900 new cases of work-related skin disease were diagnosed each year between 2000 and 2002 by dermatologists and occupational physicians through the EPIDERM and OPRA voluntary surveillance schemes.⁶ Approximately 80% of these new cases were contact dermatitis.

5 Skin diseases in general, as distinct from the sub-group due to occupation, are very common.⁷ A general population survey in the United States found that nearly one-third of people had 'some skin pathology that should be evaluated by a physician at least once'. Skin conditions prompted 22.5% of attendances at general practitioners' surgeries in an inner-city borough in the UK, and contact dermatitis (see paragraph 10) accounts for about 5% of dermatological consultations in hospital out-patient departments in industrialised countries.

6 The real cost of occupational dermatoses to the community can be expressed in human terms as well as financial. Disablement from an occupational dermatosis can be as great as that from the loss of a limb, though financial compensation is likely to be much less.

7 The aim should be to prevent the occurrence of occupational dermatoses. COSHH, or the more general requirements of the Health and Safety at Work Act and

MHSW Regulations, will apply wherever substances which have skin-damaging properties may be present. They require a regime based on accurate assessment of the risks; provision, use and maintenance of appropriate control measures; information, instruction and training; and, in appropriate cases, health surveillance.

Mechanisms of damage

8 To cause an occupational dermatosis, a substance must first penetrate the surface layer of the skin and then provoke a reaction from the vulnerable skin beneath. This surface layer, though only the thickness of tissue paper, is remarkably resistant to penetration. It is called the barrier layer. The barrier layer retains water and there must be at least 10% of water in the barrier layer for it to function properly. Partial gaps in the barrier layer are made by sweat gland and hair root openings and such gaps are more vulnerable to penetration.

Susceptibility

9 Susceptibility to skin damage varies widely, but largely unpredictably, among the general population. The nature of the substance and the degree, duration and frequency of exposure are the other major determinants of how much skin damage will result from any particular substance. Other factors, such as under-hydration or over-hydration of the barrier layer due to low or high humidity working environments, will increase the susceptibility of the individual to skin penetration and hence to skin damage.

CONTACT DERMATITIS

Definition

10 The commonest reaction of the skin to penetration through the barrier layer by a substance on its surface is an inflammation referred to as **eczema**. The main signs of eczema are redness, swelling, blistering, flaking and cracking. Its main symptom is itching. The type of eczema caused by contact with substances is called contact dermatitis.

Diagnosis

11 Accurate clinical diagnosis of suspected occupational dermatoses is essential for two main reasons. Firstly, a wide range of common non-occupational dermatoses can look very like contact dermatitis: these include various forms of constitutional (endogenous) eczema; or they can look like entirely non-eczematous conditions such as psoriasis and ringworm. Secondly, these non-occupational dermatoses occur as commonly in the general population as occupational contact dermatitis is likely to occur in a workforce.

IRRITANTS AND SENSITISERS

12 Substances capable of causing contact dermatitis can be divided into two groups, **irritants** and **sensitisers** (or allergens).

Irritants

Definition

13 A skin irritant is any non-infective agent, physical or chemical, capable of causing cell damage if applied to the skin for sufficient time and in sufficient concentration.

Acute and chronic irritation

14 Irritants can be divided, in practice, into those with strong and those with weak irritancy, though there is, in reality, a continuous gradation in strength. Thus, by sufficient dilution, a strong irritant can be converted to a weak one. Strong irritants can provoke visible skin damage, termed **acute irritant contact dermatitis**, or even chemical burns, after just a single exposure; whereas weak irritants require frequent multiple exposures, often over periods as long as months or even years, the result being termed **chronic (or cumulative) irritant contact dermatitis**.

15 Chronic irritant contact dermatitis is commonly caused by several weak irritants acting together, either simultaneously or sequentially. The effects of weak irritants are difficult to recognise by health surveillance because their effect on the skin cannot be seen for a long time. The human population also varies very widely in its resistance to weak irritants. Because some people's skin is susceptible to even very weak irritants, practically all substances that come into contact with their skin may act at times as chronic irritants if exposure to them is repeated frequently and for long enough. Chronic irritants therefore include a wide range of substances. Common occupational examples are weak acids and alkalis, soaps, detergents, organic solvents, water-based metalworking fluids (soluble oils), reducing agents and oxidising agents. Mechanical friction can also act as a chronic irritant. Chemical irritancy may be encouraged by cuts, abrasions or frictional damage.

16 Identifying a substance as an irritant is not necessarily the same as condemning it for general use. Almost everyone comes into contact with skin irritants every day and most suffer little or no visible skin damage as a result. The barrier layer and repair mechanisms within the skin counteract the irritant effect. Knowledge of the irritant **hazard** of a substance needs to be combined with knowledge of its concentration and the duration and frequency of skin contact, in the particular work station, before a realistic assessment of the **risk** of it producing dermatitis can be made.⁴ In making such an assessment it is necessary to consider any general information about the disease in the particular type of occupation, process or industry. The risk assessment may also need to take into account the protection required for the least resistant members of the exposed group to prevent skin irritation.

Sensitisers

Definition

17 A skin sensitiser, or allergen, is a substance capable of causing **allergic contact dermatitis**, the underlying mechanism of which is quite distinct from that of the irritant type. Skin sensitisers firstly induce a process

known as contact sensitisation by penetrating the barrier layer of the skin and provoking a chain of immunological events termed delayed or cell-mediated allergy. Once this mechanism has been initiated, it takes about seven days to complete the induction of sensitisation. After that time, further skin contact with that particular sensitiser causes allergic contact dermatitis.

Allergic contact dermatitis

18 There is no absolute visual distinction between irritant and allergic contact dermatitis; they can look the same in spite of the essential differences in their underlying mechanisms. Because of this fundamental difference in mechanism, a skin sensitiser is not necessarily also a skin irritant, though some substances, such as chrome salts, can act as both irritants and sensitisers. Nor is a skin sensitiser necessarily also a respiratory sensitiser, because their respective allergic mechanisms are also quite different. However, a few substances, such as rosin, are capable of this double allergenic role. For sensitisers, as for irritants, the concentration, duration and frequency of skin contact are crucial factors in determining their risk of inducing sensitisation, given a substance of known inherent sensitisation hazard (or sensitisation potential). The sensitisation hazard of chemicals varies from none, through weak and moderate, to strong. The concentration of sensitiser on the skin required to induce sensitisation in the first place (induction concentration) is higher than the concentration subsequently required to elicit allergic contact dermatitis (elicitation concentration), which may be extremely low. Sensitisation may be induced following the very first contact, or after many such contacts, or not induced at all. In industry it is often induced after a few months of repeated contact, but sometimes it occurs after many years of tolerated contact. There is a very wide individual variation in susceptibility to sensitisation among the human population, which reflects differences in allergic response within the skin rather than differences in skin permeability.

19 Several thousand contact sensitisers are already well known and described in standard reference sources.⁸⁻¹³ Chromates, epoxy resins and their hardening agents, acrylic resins, formaldehyde, formaldehyde releasers and formaldehyde resins, biocides, hardwoods, and plants such as the *Compositae* family (chrysanthemums, for example) are common occupational examples. Many of these sensitisers remain essential to certain industries and some may continue to cause allergic contact dermatitis, even when everything has been done to ensure adequate control of exposure. Also, instances of allergic contact dermatitis in industry sometimes occur from new products or intermediates. Nickel, while causing some occupational sensitisation, is more frequently a non-occupational sensitiser due to its presence in personal jewellery. Health surveillance of those at risk may be needed to identify allergic contact dermatitis rather than occupational sensitisers.

OTHER NON-INFECTIVE HAZARDOUS AGENTS

20 There are certain occupational dermatoses, other than contact dermatitis, which can be caused by particular substances. Together they constitute a substantial minority of the total number of cases. Some of these are

inflammatory (but not in the form of dermatitis) eg **contact urticaria (hives)**, **oil acne**, and **chloracne**. Contact urticaria gives a shorter-lasting rash than contact dermatitis and may be caused, for example, by rubber latex in protective gloves. Oil acne and chloracne are inflammations of hair roots - oil acne from mineral oil, usually in cutting oils, and chloracne from certain polyhalogenated aromatic hydrocarbons, including dibenzodioxins. Others are ulcerative: **chrome ulcers** (or chrome holes) from chromic acid or its hexavalent salts; and **cement burns** from wet cement, often when trapped against the skin. Still others are degenerative, such as the skin disorder associated with **vinyl chloride monomer**. Certain chemicals are capable of causing **loss of normal skin pigmentation**, which can be visually indistinguishable from a common non-occupational skin disorder; these substances include alkyl phenols, alkyl catechols and hydroquinones. Repeated exposure over periods of many years to coal tar products and to polycyclic aromatic hydrocarbons in mineral oils which have not been solvent refined or severely hydrotreated can cause **skin cancer**.

21 Therefore, although the dermal risk assessment mainly needs to consider the hazard of a substance from the point of view of its causing contact dermatitis (either as an irritant or allergen), it may also be necessary to consider whether it has the potential to cause contact urticaria, oil acne, chloracne, ulceration, depigmentation, degeneration or cancer.

RISK ASSESSMENT AND PRECAUTIONS IN THE WORKPLACE

Identifying skin damaging agents

22 Under COSHH and the MHSW Regulations the employer must make an assessment of the risks to any employees liable to be exposed to a substance hazardous to health (see guidance on COSHH assessments⁴). In order to do this, the presence of any agents (used in or given off by processes or activities) with known risks of skin damage needs to be established. There are various ways by which these can be identified:

- (a) the Appendix to this guidance lists some of the commoner causes of skin damage - but this list is a selection only and not exhaustive;
- (b) suppliers' labels and literature may provide an indication of whether a substance is hazardous to skin (eg corrosive, harmful). Standard labels required to be used under the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002,¹⁴ are based on defined tests of irritant and sensitising potential. Data sheets provided by manufacturers and suppliers should also indicate the presence of skin-damaging potential and the necessary precautions to avoid it;
- (c) experience within the company or industry sector may suggest a risk of skin damage from a particular substance or process;
- (d) many occupations are known generally to carry a risk of skin damage. Examples are jobs where there

is regular immersion of hands in liquids, skin contact with substances such as solvents, mechanical trauma from sharp particles, or where plants and animals are handled;

- (e) where newly introduced materials are handled and there is reason to suspect they may cause skin damage, or existing materials are used in new ways which may increase skin contact, the COSHH assessment should be revised, and this may indicate a need for health surveillance. Otherwise, a cautious approach is advisable to detect any adverse effects as soon as possible.

23 The prime purpose of the risk assessment is to determine the measures required to prevent ill health. First, consideration should be given to preventing the possibility of contact with the substance by eliminating it or replacing it by a safer alternative. Otherwise, control measures should be applied which minimise contact of the skin, either directly or indirectly, with contaminated surfaces in the working environment. Measures should be in place to ensure the controls are properly used and maintained. Personal protective equipment such as gloves should not be the first or only means of control considered. Adequate washing facilities and attention to personal hygiene are always important control measures. Safe methods of working with known toxic agents should be applied to analogous new chemicals in order to limit the dermatitis that might otherwise be caused by an unconfirmed or unsuspected contact sensitiser.

HEALTH SURVEILLANCE

24 As part of the assessment employers should also determine whether health surveillance is required. Health surveillance is for the protection of individuals, to identify as early as possible any indications of disease or adverse changes related to exposure, so that steps can be taken to treat their condition and to advise them about the future. It may also provide early warning of lapses in control and indicate the need for a reassessment of the risk. Because predictive tests are never likely to be totally reliable, and because certain known toxic agents still need to be used, dermatological health surveillance must never be regarded as reducing the need for control of exposure and effective decontamination after exposure.

25 Workers involved in any process involving vinyl chloride and in the manufacture of patent fuels from pitch will need to be subject to medical surveillance under the supervision of a medical inspector or appointed doctor, unless that exposure is not significant. Otherwise, employers are required to arrange for employees to receive suitable health surveillance where there is exposure to a substance known to be associated with skin disease or adverse effects on the skin and where, under particular working conditions, there is a reasonable likelihood that the disease or effect may occur. Guidance is given in paragraphs 26 to 35 and in other publications^{1,2,5} on the kinds of situations which are covered by these criteria. However, there are other circumstances, outside the confines of the law, where employers may be best advised to operate or extend surveillance schemes. Prudent employers will wish to do this.

26 For employees who may be exposed to any agent known to cause skin damage (see paragraph 22 and Appendix), there should be arrangements to identify cases of occupational dermatoses. COSHH regulation 12 requires employers to provide employees with information, instruction and training on the nature of the risks to health and the precautions to be taken. This should include characteristic signs and symptoms of the particular dermatosis. Employees should be encouraged to examine their skin for any such signs and report them. Where the requirement for health surveillance has been identified (COSHH regulation 11), these reports should be made to the responsible person appointed to undertake the surveillance or to the company's occupational health adviser. Otherwise, employees should be advised to report to their family doctor. Confidentiality must be safeguarded if such reporting is to be effective.

27 A responsible person is a person, appointed by the employer, who, following instruction from a medical practitioner (or occupational health nurse), is competent to recognise the particular signs and symptoms of the skin conditions associated with the substances concerned. The responsible person is charged with reporting his or her findings to the employer, but he or she should also have access to a suitably qualified person (eg an occupational health nurse or medical practitioner), to whom all suspected cases of dermatoses should be referred.

28 Where health surveillance is legally required, employers should make arrangements for cases of occupational skin disease to be identified in the workplace. Also, for every employee required to be subject to health surveillance, a health record containing the particulars set out in the COSHH General ACOP¹ must be kept.

29 Table 1 lists specific cases (in addition to vinyl chloride processes and patent fuel manufacture) taken from the COSHH ACOP, where health surveillance should be carried out using the procedures listed in the table as a minimum. However, this is not an exclusive list and employers may decide to institute a higher level of surveillance (eg by a medical practitioner) instead. The more inherently dangerous the dermatosis to the individual, the more appropriate it is that a suitably qualified person or medical practitioner examines the employee.

30 Although not specifically mentioned in the ACOP, the criteria for statutory health surveillance would also apply to many cases of exposure to:

- (a) substances known to cause contact urticaria (eg rubber gloves);
- (b) substances known to cause depigmentation (eg alkyl phenols); and
- (c) substances known to cause oil acne (eg cutting oils) and chloracne (eg dibenzodioxins).

In such cases, enquiries about symptoms by a responsible person following self-inspection would be the minimum procedure.

Table 1 Health surveillance procedures for specific cases

<i>Type of substance</i>	<i>Typical procedure</i>
Substances known to cause severe dermatitis	Skin inspection by a responsible person
Chrome solutions in chrome plating, dyeing and tanning processes	Skin inspection by a responsible person
Substances which may cause skin cancer	Enquiries by a responsible person following self-inspection by employees or skin inspection by a suitably qualified person

31 Health surveillance is required for substances falling into the categories described above, unless skin contact with the substance is so infrequent or for such a brief period of time that skin damage would be most unlikely. Where there is any doubt, employers will need to obtain advice from an occupational physician, or a medical practitioner or occupational health nurse with appropriate expertise. A substance may be said to cause severe dermatitis where it is known to be liable to cause dermatitis in some individuals at exposure levels encountered in the particular work situation. This information should be available to a reasonably well-informed employer from the sources given in paragraph 22, other HSE Guidance Notes, trade literature etc.

32 The exact nature and frequency of the surveillance will often need to be determined in the first instance by a medical practitioner with sufficient expertise in occupational health (or an occupational health nurse), especially if there is no written guidance available on surveillance requirements for the particular agent as used in the workplace. The frequency of inspection or examination will depend on the nature of the risk, but a brief weekly or monthly routine is often appropriate.

33 Suitably qualified people, such as occupational health nurses, can carry out regular examinations of 'at risk' workers to identify early signs of skin damage for referral to a medical practitioner. They will also be able to advise on modification to the work. This is often best done when assessing work practices, and can provide an opportunity for education and advice on how to remove or avoid contact. Confidential clinical records, held separately from the health record, should be kept of all suspected cases and regularly scrutinised for evidence of patterns linked with particular types of activity or exposure. Directness of recording is recommended: descriptive terms such as 'red', 'swollen', 'blistered', 'flaky' and 'cracked' are better than loose terms such as 'rash' or interpretive terms such as 'dermatitis'. Photographs of dermatoses may be useful for training staff as well as for recording the nature and distribution of cases. Scrutiny of clinical records should be complemented by a review of medical centre attendance or sickness absence records as a further source of information.

34 Access to a medical practitioner with appropriate experience underpins all systems of health surveillance and he or she may, within the minimum constraints of the law, modify the surveillance system as indicated. The urgency of referrals or requests to the doctor depends on the severity of the dermatosis in each case. Yet it should not be forgotten that one case may sometimes be the first of many (an index case). It is recommended that no advice on permanent changes of job on account of

dermatoses should be made without a thorough dermatological assessment (see paragraph 42).

35 In most circumstances surveillance should continue as long as exposure is taking place. In the case of skin cancer those at risk should be advised to look for and report any suspicious skin changes for the rest of their lives.

CLINICAL INVESTIGATION AND DIAGNOSIS

36 The surveillance procedures in the workplace, particularly if they are performed by 'responsible persons' (see paragraph 27) rather than a health professional, should aim to identify suspect cases of dermatoses related to exposure to hazardous substances in the workplace. If the surveillance is being carried out conscientiously, then suspect cases would be expected in most workplaces. The responsible persons should be under instructions to refer the employees concerned to a medical practitioner for investigation and treatment. The diagnosis by the clinician should aim to determine whether the origin is occupational and, if so, the causative agent and process.

Patch testing

37 Patch testing is frequently required in order to make a reliable distinction between allergic contact dermatitis and either irritant contact dermatitis or endogenous eczema. It is generally recommended that patch testing is done only by those specifically trained in its technique and who regularly and frequently carry it out, because of the technical and interpretative difficulties and implications for following up the procedure. Maximum confidence can be placed in the diagnosis of an occupational contact dermatitis only when patch testing has been properly carried out with further enquiries to determine the relevance of the results. The reliability of patch test results and the assessment of their relevance to the current condition remain subject to the skills, knowledge and persistence of the patch tester. It should particularly be noted that:

- (a) patch testing, as routinely carried out, is a diagnostic test for allergy and not for irritancy. It is still a useful tool, however, in many cases of suspected irritant contact dermatitis, to confirm (or deny) the absence of allergy;
- (b) false positive and false negative patch test reactions commonly occur and may mislead. Under-dilution and over-dilution, respectively, of substances supplied for patch testing from the workplace are common causes of these two potentially misleading types of patch test result;¹⁵ and

- (c) true positive patch test reactions may have their relevance to the current dermatitis wrongly assessed in either direction: dismissed as not relevant when they are, due to ignorance of a source: or accepted as relevant when they are not, due to a presumption of contact that does not exist.

Other clinical investigations

38 As well as patch testing, other special investigations may be required to make an accurate diagnosis. Table 2 provides some examples.

Dermatological surveys

39 Sometimes the assessment of individual patients may be insufficient to identify or characterise clearly an occupational dermatosis, and an epidemiological survey of dermatoses within a work area may be needed. This may be the case, for example, when skin complaints arise which are widespread or without an identifiable cause. Occupational skin disease may be multifactorial in its causes and a proper evaluation of its prevalence or its importance in relation to specific exposures should always be planned with dermatological and epidemiological or statistical advice from the very beginning. It is also important to involve management and employee representatives from the outset. Communication with the group(s) being studied is vital before, during and after a survey. Ethical issues should be given full consideration. Particular care should be taken with regard to control groups: the risk of inducing sensitisation by patch testing control subjects, for example, should be evaluated. At the conclusion of any study, the results should be made available and explained in terms readily understandable to those taking part in the survey.

Table 2 Investigations required to make accurate diagnosis

<i>Test</i>	<i>Examples of suspected conditions</i>	<i>Examples of occupational groups</i>
Prick testing	Contact urticaria Protein contact dermatitis	Hospital staff Foodhandlers Veterinarians
Blood testing		
IgE	Atopic eczema	'Wet workers'
RAST	Contact urticaria Protein contact dermatitis	Food handlers Veterinarians
Skin biopsy	Chloracne Skin cancer Other non-eczematous dermatoses	Chemical workers Mineral oil workers

Note: Only skin biopsy requires that the patient sign a consent form, but all require appropriate standards of care and medical support services when carried out.

MANAGEMENT OF INDIVIDUAL CASES

40 Having identified a case of occupational dermatosis and the likely cause of it, the medical practitioner should advise the patient about continuing employment in the process concerned or about precautions or hygiene practices to prevent a recurrence. Wherever feasible, the workplace and work practices should be examined. Often the co-operation of the employer will be needed to review exposures and control measures, although the case may

well have highlighted a failure on the employer's part to meet legal requirements and control exposure. Only this can instil any confidence in preventing a recurrence or further cases. Where specific case details need to be disclosed, the individual's permission should be sought to bring the matter to the employer's attention. Cases of doubt or concern may be discussed with the medical inspector.

41 The detailed dermatological management of cases requires training and employs skills beyond the scope of this guidance, but there are broad principles which are relevant to all concerned. The management of individual cases of occupational dermatoses must always be based on a confidential nurse-patient or doctor-patient relationship. No two people react to a dermatosis in the same way. The prime aim in dermatological rehabilitation is to keep the patient in the same job by treating the dermatosis and by altering the working practice to avoid recurrence. Sometimes this prime aim may not be achievable and the patient and his or her medical adviser(s) may then be left with a difficult choice. Sometimes the best that can be achieved is to alter the work so that the patient's symptoms are reduced to a tolerable level. This can still be a worthwhile outcome because the prognosis of well-established occupational contact dermatitis is in some cases only marginally improved even by a complete change of job.⁸ On other occasions, such as when sensitisation is detected to allergens which are adequately controlled in the workplace (and cannot be dispensed with or avoided) or when people with previous histories of hand eczema find themselves in unsuitable jobs such as hairdressing, food handling or general nursing, their whole future career is jeopardised. A decision may then reluctantly have to be made to advise a change of job, but it is important to regard this as a last resort in unusually difficult cases, rather than as a quick and easy solution to be used frequently.

42 Before recommending that an employee should change jobs because of a skin condition, the doctor should be satisfied that the employer has done his or her best to ensure that the employee has been adequately medically investigated. This will often involve a consultation with a dermatologist, and sound medical grounds for the decision. Whenever possible, employees should be redeployed within companies rather than dismissed. Once again, sound medical advice about suitable alternative work should be sought. Employers should therefore remember that occupational dermatoses are almost invariably neither infectious or contagious. Employers should therefore remember that no harm will come to other people if an employee is kept at work with a persistent but manageable degree of skin disease - an advantage both for the employee and the employer.

APPENDIX: SOME OCCUPATIONAL CONTACT IRRITANTS AND SENSITISERS

These lists are not intended to be exhaustive, but to provide examples. Many items can be both irritants and sensitisers. In the case of collective terms such as 'dusts', it is not implied that all dusts can harm the skin, only that certain ones can.

Some specific chemicals or materials

Acrylates	Fibreglass	Organic solvents
Ammonium persulphate	Formaldehyde	Organotin compounds
Amylases	Formaldehyde releasers	Paraffin
Asphalt	Formaldehyde resins	Permanent wave solutions
Azo dyes	Glutaraldehyde	Phenols
Brine	Hydrazine	Quinones
Cement	Hydrofluoric acid	Rubber processing chemicals
Chromates	Hypochlorites	Shampoos
Cobalt	Isocyanates	Soluble oils
Colophony (rosin)	Kerosene	Styrene
Cresols	Lime	Synthetic coolants
Cyanoacrylates	Methacrylates	Talc
Dimethacrylates	Neat oils	Thinners
Epoxy resins and hardeners	Nickel	White spirit

Some broader groups of chemicals or materials

Acids	Fluxes
Adhesives	Fragrances, eg cinnamates
Alkalis	Local anaesthetics, eg amethocaine
Animal feed additives, eg ethoxyquin	Oils and greases
Biocides, eg methyl dibromo glutaronitrile	Oxidising agents, eg peroxides
Bleaches	Pesticides, eg difolatan
Degreasers	Polishes
Descalers	Preservatives
Detergents	Reducing agents, eg thioglycolates
Diesel fuels	Resins
Disinfectants	Sealants
Dusts, eg of angular or hygroscopic particles	Skin cleansers
Enzymes	Soaps
Fertilisers	UV absorbers, eg benzophenones
Flavourings, eg eugenol	

Some biological materials

Animal hair, saliva, tissues	Plants, eg Compositae
Aquatic organisms, eg bryozoans	Woods, eg mahogany
Foods, eg fish, garlic	

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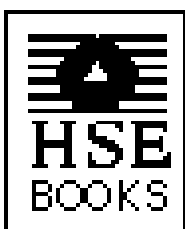
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