*HEALTH HAZARDS MANUAL*

**FOR**

# CUSTODIANS, JANITORS AND HOUSEKEEPERS

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Why custodians, janitors, and housekeepers?
Because studies indicate many cases of skin problems such as dermatitis and allergies or cases of asthma among workers who perform housekeeping tasks. Some phenolic disinfectants have caused loss of skin pigmentation in workers using them without gloves. Many cleaning products contain acids or caustic which can cause skin or eye burns or irritations. Both male and female workers may have an increased risk of bladder cancer due to exposure to solvents and cleaning agents. The use of highly abrasive pads to sand or buff asbestos floor tiles at high speeds could expose custodians to unacceptable levels of asbestos fibers in the air.

But, if you knew in advance what problems could develop, you could take the appropriate precautions. Much of the information in this manual is not necessarily intended for immediate use, but can serve as a future reference or resource:

- to help you understand how the products you use actually work and what is in them
- to help you select products to minimize hazards
- to ask intelligent questions when purchasing
- to provide information on how you are exposed to chemicals
- how your exposure is related to the use of appropriate ventilation, protective equipment such as gloves use
- to help you read labels and material safety data sheets (MSDSs)
- to help you troubleshoot health problems and trace possible work-related health problems

While you read of product health hazards and case histories, see if the experiences of these janitors, custodians, and housekeepers sound familiar. Have they happened to you or others you know or have heard of who are in this line of work?

The manual will look at the principal occupational health hazards and exposures themselves and some of the related issues. We will look closely at the chemical composition of cleaning products to see what components appear to be particularly hazardous, how you are exposed to them, and what you can do to minimize exposure. The health effects discussed for these products are based upon the exposure of the professional, not the consumer; for example, we will examine the health effects of toilet bowl cleaners for the housekeeper who cleans toilets many times a day, not for the consumer whose exposure is perhaps once a week.

People react differently to chemicals. Although comparing symptoms with co-workers can be valuable, one person could react to a product for which no one else at the workplace has a problem.

## SOME BASIC IDEAS ON PRODUCT SELECTION HAZARDS, AND SUBSTITUTION

Chemicals can hurt us only if they make contact with us or actually enter the body. When using cleaning products, we should consider how a product can enter the body. This will depend upon the ingredients and how volatile they are, the form of the product (powder, liquid, aerosol, spray), and how the product is actually used or applied in order to do its job. The ways in which chemicals can interact with the body are called ROUTES OF ENTRY. Routes of entry include

- inhalation: aerosols, vapors, or dusts can be inhaled into the nose, mouth, or into the lungs where damage can be done directly causing breathing problems or by absorption into the bloodstream which carries the chemical to other body organs where damage could be done
- skin contact: chemicals can directly damage the skin by de-fatting the skin causing drying and dermatitis, by actually burning tissue, or by being absorbed through the skin into the bloodstream which carries the chemical to other body organs where damage could be done, or
- ingestion: chemicals can be eaten accidentally or by hand-to-mouth contact (such as by eating or smoking without first washing the hands or face).

As we examine product ingredients, we will look at way to prevent these routes of entry. For example

### TO REDUCE INHALATION

- consider buying a product as a liquid rather than as a powder
- consider selecting ingredients which give off less vapors and have slower rates of evaporation; use water-based products wherever possible, rather than solvent-based products (this can reduce the flammability hazard as well)
- consider using a product as a pump spray rather than as an aerosol spray; use coarse-nozzle sprays not fine sprays. Fine aerosol droplets can be inhaled into the deep lung where they can do damage or be absorbed into the body to cause adverse health effects; but large droplets tend to fall out of the air (avoiding inhalation) or are stopped in the nose either one protects the lungs.
- if aerosols are needed, consider using carbon dioxide propellants rather than chlorofluorocarbons (CFCs) or isobutane-propane types. Consider using containers which can be closed or capped in between uses of the cleaning product; this can reduce evaporation (as well as accidental spills)

Certainly inhalation can be reduced by increasing ventilation when using a product or by the wearing of respiratory protection, but product substitution may be a more cost-effective alternative.

## TO REDUCE SKIN CONTACT or SKIN ABSORPTION

- consider using a product as a pump spray rather than as an aerosol spray; use coarse-nozzle sprays not fine sprays
- consider using water-based products rather than solvent-based products since the oily surface of the skin repels water-based products but absorbs solvents very well
- consider using diluted products to reduce the concentration of hazardous ingredients; diluting many corrosive products may reduce their hazard to that of an irritant
- when needed, use gloves, aprons, eye protection, or other protective clothing (such as boots).

## GERNERAL GUIDELINES FOR HANDLING CHEMICAL PRODUCTS

- Read labels and follow directions. Refer to material safety data sheets for additional information.
- Use the proper protective equipment (gloves, apron, eye protection).
- Replace caps and lids of chemical containers immediately after use.
- Wash spills off the skin or out of the eyes IMMEDIATELY. The faster you do this, the less damage that will occur especially to the eyes.
- Know the location of eyewashes and drench showers in your work area. If you have to, you could make do with a sink or water fountain for washing the skin or eye in an emergency.
- Wash your hands after using chemicals especially before eating or smoking.
- Use all chemicals with adequate ventilation. Wherever possible, select the cleaning product to match the ventilation your building has.
- Never mix chemicals unless you are specifically directed to do so. Chemicals can react together to give off poisonous gases, heat and steam, or bubbling and splashing back at you. Mixing is not always on purpose it can happen by pouring chemicals down the same drain (or toilet) without running water (or flushing) in between. Mixing can also happen by reusing a container or bucket without rinsing it out first.

The most common accidents involving mixing chemicals together are:

- AMMONIA with CHLORINE BLEACH
- ACID-TYPE TOILET BOWL CLEANER with CHLORINE BLEACH

These combinations give off poisonous or highly irritating gases or vapors.

Is this product sold as a concentrate? If so, what is the use-dilution of the product for general cleaning and for specialized or heavy-cleaning jobs? Consider reducing the product's hazards by using the highest dilution (weakest concentration) of the product which will do the job. Sometimes an MSDS will show the pH of the product, as a concentrate or as a use-dilution (this information is not required on an MSDS, but some manufacturers show it anyway). pH can be useful in showing how corrosive or irritating the concentrate or dilution will be.

## THE OSHA HAZARD COMMUNICATION STANDARD

Of great importance to custodians, janitors, and housekeepers is obtaining good information on the ingredients of the chemicals they work with. Without this information, it is difficult to ...

- assess workplace hazards
- trace health effects to their source
- choose products so as to minimize hazards and avoid serious health problems by avoiding troublesome ingredients or by choosing a product in a different form (such as a liquid rather than a powder to reduce a dust hazard)

The OSHA Hazard Communication Standard is an occupational safety and health regulation which came into being in 1985. The purpose of this regulation is to ensure that the hazards of all chemicals produced or imported are evaluated and that information concerning their hazards is transmitted to employers and employees. This Standard requires the manufacturers and importers of chemicals to assess the hazards of the chemicals which they produce or import. Then, employers are required to provide information to their employees about the hazardous chemicals to which they are exposed by means of a hazard communication program, labels (and other forms of warning), material safety data sheets (MSDSs), and informative training. Distributors are required to transmit the required information to employers.

You should use this regulation to obtain material safety data sheets (MSDSs) on all the products you use by asking your distributor, manufacturer, or sales representative to provide them. Try to obtain MSDSs before you purchase products to compare them with respect to their health hazards. MSDSs are useful for writing bid specifications, as well, to help you obtain the products you want. You may wish to deal only with manufacturers who respond to your requests for product information.

## *An Overview of Occupational Diseases Typical of Custodians, Janitors, and Housekeepers*

### HEALTH STUDIES

The principal health problems confronting custodial workers tend to involve:

- Inhalation of aerosols, vapors, powders or dusts, and particles or fibers, resulting in irritations or allergies (asthma) or the respiratory tract
- Skin contact with cleaning liquids causing skin irritation, allergies, loss of skin pigmentation, skin burns (this includes eye damage or irritation as well)
- Skin contact with some types of gloves causing skin allergies or loss of skin pigmentation
- Skin contact with wash or rinse waters used in cleaning stainless steel can involve sufficient contact with nickel in solution to bring about nickel allergy
- Skin absorption of liquids such as solvents or disinfectants
- An elevated risk of bladder cancer compared to the general population

Custodial workers are especially exposed to the risks of sensitization (becoming allergic to the products they work with). In small workplaces, if only one person experiences a health problem in relation to a product, that person tends to think of him/herself as an isolated case and the problem as not being work-related. Since many of the reactions to chemicals are allergic-type reactions, only the sensitive individual will respond anyway, so numbers are not significant in indicating risk.

Many allergic reactions to products involve fragrances and frequently dyes used to color products. These can be forestalled by using unscented products (including those without masking fragrances) and by changing colors.

In most cases of occupational allergy, improvement tends to occur when away from the job as long as the exposure ceases. For example, you are not likely to see improvement with workers sensitized to rubber gloves who continue to use them at home.

The following is a preview of the major health problems in janitorial workers arising from inhalation, skin contact, skin absorption, and long term exposure.

**INHALATION** of aerosols, vapors, and particles can occur from the use of aerosol products such as those using propellants. Many products which are purchased as powders can produce dusts when they are

handled or used. Some cleaning products are applied so as to dry to a powder and then be vacuumed. Fine dusts can be inhaled and can cause irritation of the respiratory tract or asthma.

Inhalation of the propellant itself can also occur. Propellants and solvents or solvent carries such as fluorocarbons (Freon 11), methylene chloride, 1,1,1-trichloroethane, isobutane, propane, and ethanol have been linked to a variety of adverse health problems. Because of the close contact between the air sacs of the lungs and the bloodstream, these chemicals enter the blood through inhalation and are carried throughout the body to cause effects on other body systems. Moreover, hydrocarbon propellants and solvents are highly flammable and can cause a blowtorch effect if ignited.

Asbestos fibers may be released into the air if proper floorwax removal procedures are not followed. USEPA guidelines for wax stripping and provided later in this manual.

**SKIN CONTACT** with cleaning liquids can be a problem since many products contain ingredients which are able to remove greases, oils, and greasy dirt from surfaces. This means that these same products can remove skin oils, causing skin to dry out and even crack or bleed. Repeated skin damage may even increase the potential for developing a skin allergy to an ingredient.

Cleaning products which contain acids, caustics, or harsh germicides can cause skin irritation or even skin burns. The eyes are particularly susceptible to damage from these kinds of products. Some phenolic germicides have caused custodial workers to experience a loss of skin pigmentation which gives the skin a pale pink appearance (looking just like a skin burn). Patches of nonpigmented skin can be very disfiguring and avoiding the use of the germicides has not always caused this condition to reverse itself and the skin pigmentation to return to normal.

**SKIN CONTACT** with the components in some types of gloves has caused skin allergies. The ingredients added to some rubber gloves has resulted in a loss of skin pigmentation for glove wearers. Hopefully, this problem has been solved since glove manufacturers made aware of the skin condition have changed their glove formulations.

Skin contact with wash or rinse waters used in cleaning stainless steel can involve sufficient contact with nickel in solution to bring about nickel allergy. As wash or rinse waters are used over and over again for cleaning stainless steel, nickel (from the stainless steel) builds up on concentration in the water. To avoid this problem, the nickel concentration should be kept lower than the level which can lead to allergy so wash or rinse water should be changed frequently.

**SKIN ABSORPTION** of liquids such as solvents or disinfectants can enable these chemicals to be taken into the blood stream to cause their adverse health effects elsewhere in the body (just as can occur with inhalation). The face, chest, and groin area are especially permeable to such chemicals, even more than the hands and feet, so it is particularly important to use plastic aprons to avoid splashes on the front of the body and to avoid the wearing of soaked clothing.

Epidemiological evidence suggests that janitors and maids may experience an ELEVATED CANCER RISK when compared to the general population for cancer of the bladder. The difficulty with these studies is that the risk covers the profession as a whole, but does not show which particular chemicals may be responsible among many potential exposures.

## BASIC CLEANERS

This section deals with general cleaners which consist of detergents with a few additives. The simplest products are like these. More vigorous cleaners may also contain acids or caustics or alcohol-like solvents. The ingredients discussed below may have more than one function in a product.

To understand how cleaners work, we will start by looking at dirt, soil, and stains. Every cleaning process consists of ...

- the surface to be cleaned
- the soil or dirt to be removed, and
- the cleaning solution, a liquid applied to the surface to remove the soil.

Surfaces and soil exist in considerable variety. To clean effectively, a cleaning product should ...

- remove the soil from the surface to be cleaned
- suspend the soil in the cleaning solution, and
- prevent the redeposition of the soil onto another part of the surface.

When we clean, we expect to remove the dirt an enable it to be washed away we want to get rid of it, not simply spread it around. We tend to conclude that a product has failed to do its job if the soil is redeposited and we cannot rinse the surface clean, even if the soil was removed initially. For example, if we add a cleaning product to the toilet bowl and scrub the surface with a brush, we expect the suspended soil to be able to be flushed down the toilet. We do not want the soil to resuspend itself as a ring around the surface of the water which then refuses to flush. Similarly, in doing laundry, we expect the detergent to remove the soil from the fabric, suspend it, and enable it to leave the washing machine in the rinse water. We do not want to see greasy white or gray streaks or clumps of detergent-and-soil to be redeposited on the fabric.

Dirt, soil, films, and stains may not only be simply deposited on surfaces such as floors, walls, furniture, tile, and fixtures, but may also be attached to these surfaces. Cleaning agents must break this attachment in order to lift or remove the soil. This is done by adding a variety of ingredients to the wash water to improve its ability to remove dirt.

Since dirt consists of a variety of materials which differ in their chemical structure and in the way they attach to the soiled surface, more vigorous chemicals may be needed to remove some kinds of dirt than others. Moreover, porous surfaces tend to be more difficult to

clean (and disinfect) than those with smooth, hard finishes. For example:

- OILS, GREASE, OILY-COATED SOOT, and FATS may be removed using detergents, caustic (or basic) chemicals, or solvents.
- WAXES may be removed with caustics or solvents.
- RUST STAINS, HARD-WATER SPOTS, and SOAP FILMS may be removed using acids, bleaches, or specialized additives.
- ACIDS, such as fruit juices or tomato sauce, or STAINS, such as blood or coffee, may require the use of bleaches.
- BODY SOIL, consisting of dead skin cells, body oils, and salts from perspiration (which are cooked onto fabric with body heat) may require the use of enzyme cleaners

When dirt or stains are difficult to remove, more vigorous and usually more hazardous chemicals are needed. It may be possible to select less hazardous general purpose cleaners, and only use the more vigorous products when needed. As we will see throughout this manual, there are generally choices as to the ingredients in a product and their associated hazards, so we can select products of lesser hazard most of the time.

A number of products are multi-purpose; other abilities can be built into cleaning agents. For example, DIRT-REMOVERS can be combined with:

DISINFECTANTS
AIR-FRESHENERS
STAIN REMOVERS
ABRASIVES

to enable one-step cleaning. however, when this is done, we tend to find that the number of ingredients in a product increases far more than we might expect from just the number of additives added. This often occurs because additives are not always compatible with each other. Sometimes additives will ...

- react with each other, making them form clumps or precipitates which settle out
- interact with each other and prevent each other from performing their functions
- shorten the products useful life or shelf life

To prevent this from happening, even more ingredients must be added.

As a result, all-purpose cleaners can have a disadvantage with more ingredients, each ingredient makes up less of the product. So you may

need to use more product to do any particular job which makes use of only one or two components of the product. So, for some cleaning jobs, you may wish to consider whether a specialty product for removing just one particular kind of soil may be a better choice. When dirt or stains are difficult to remove, more vigorous (and usually more hazardous) chemicals are needed this should alert you to be more cautious.

## GENERAL PURPOSE CLEANERS

These cleaners are usually based upon detergents (surfactants) with special purpose additives. The simplest products are almost all detergent; more vigorous cleaners may also contain acids or caustics or alcohol-like solvents. The types of ingredients and their functions are described below; the names of ingredients are also shown to assist you in reading material safety data sheets or labels.

All-purpose cleaners may consist of:

**SURFACTANTS:** these are detergents and sometimes soaps. Surfactants alone do not possess any soil-lifting ability, they enhance this ability for water or solvents. "Surfactant" is a contraction of the term "surface-active agent." This indicates that a surfactant is able to alter the surface tension of the water so that water can wet or penetrate surfaces and textiles, rather than "bead-up" on them. By lowering the surface tension of water, water is better able to disperse oils and greases, rather than just float them.

Anionic detergents:

linear alkyl benzene sulfonates such as:
- ammonium dodecylbenzene sulfonate
- ammonium tridecylbenzene sulfonate
- sodium dodecylbenzene sulfonate
- sodium tridecylbenzene sulfonate
- potassium dodecylbenzene sulfonate
- potassium tridecylbenzene sulfonate
- magnesium dodecylbenzene sulfonate

sodium alkyl sulfonates such as:
- sodium tetradecyl sulfonate
- sodium pentadecyl sulfonate
- sodium hexadecyl sulfonate
- sodium heptadecyl sulfonate
- sodium octadecyl sulfonate
- ammonium alkyl sulfate
- sodium alkyl sulfates (includes sodium lauryl sulfate, Duponol C. Drene, Dreft, Teepol, Gardinols, Tergitols)
- potassium alkyl sulfate
- magnesium alkyl sulfate

ammonium alkyl ethoxylate sulfate
sodium alkyl ethoxylate sulfate
potassium alkyl ethoxylate sulfate
magnesium alkyl ethoxylate sulfate
sodium xylene sulfonate
potassium xylene sulfonate
sodium toluene sulfonate
potassium toluene sulfonate
alkyl glyceryl sulfonate

Nonionic detergents:

alkyl ethoxylates or alkyl polyethylene glycol ethers such as
laureth 9 (dodecyl alcohol nonoxyethylene ether
ethoxylated alkyl phenols such as
ethoxylated nonyl phenol (common trade names are Igepal, Nonoxynol)
ethoxylated octyl phenol (common trade names are Triton X-45, X-100, X-102, X-114)
ethoxylated lauryl phenol (common trade name is Brij)
alkyl amine oxides such as
lauramine oxide

**BUILDERS:** combat water hardness and avoid the complexing of hardness with surfactant which leaves films or residues or reduces cleaning effectiveness. Such as

sodium sesquicarbonate
tetrasodium pyrophosphate
potassium phosphate
tetrapotassium pyrophosphate
sodium tripolyphosphate
trisodium phosphate
sodium silicate or metasilicate
chelating agents such as
EDTA (ethylene diamine tetracetic acid)
NTA (nitriloacetic acid)

**DISINFECTANTS/GERMICIDES/PRESERVATIVES:** many detergents, and some additives, can spoil readily, especially if diluted. This type of ingredient acts as a preservative in low concentrations; in higher concentrations, it gives the product the ability to disinfect as it cleans. See the section on disinfectants for more information on the disinfectant-cleaner type of product.

**EMULSIFIERS:** to keep product from separating, such as

MEA (monoethanolamine)
DEA (diethanolamine)

TEA (triethanolamine)
isopropylamine

**FRAGRANCES:** to provide a pleasant fragrance or to mask the odor of the ingredients, such as pine oil

**COLORS:** to dye the product a pleasant shade; also useful in identifying different cleaners

**SOLVENTS:** to act as dispersing agents and to assist in grease-lifting ability of the products, such as

alcohols, such as ethanol, isopropanol
cellosolves, such as butyl cellosolve (butoxyethanol), ethyl cellosolve (ethoxyethanol)
stoddard solvent ( a type of mineral spirits)
mineral spirits or petroleum distillates

**SOIL-SUSPENDING/ANTI-REDEPOSITION AGENTS:** to prevent soil from being left behind as a film and to enable clean rinsing, such as

carboxymethylcellulose
PVP (polyvinylpyrrolidone)

**ACIDS:** to assist in dissolving hard water spots and films, such as

acetic acid (vinegar)
sulfuric acid
hydrochloric acid (muriatic acid)
hydrofluoric acid
formic acid
oxalic acid

**CORROSION INHIBITORS:** to prevent acid or caustic-containing products from corroding metal surfaces.

**BASES/CAUSTICS:** to assist in grease-lifting by reacting with fats/oils to form water-soluble soaps, such as

sodium hydroxide
potassium hydroxide
ammonia
amines; also used as emulsifying agents, see above, such as MEA, DEA, TEA or isopropylamine

**ABRASIVES:** for scouring, such as

silica or silica flour
pumice

calcium carbonate (less harsh or scratchy)

**ENZYMES:** to break the chemical bonds between the soil and the surface to be cleaned, such as proteases from the bacterium bacillus subtilis

## ADVERSE HEALTH EFFECTS ASSOCIATED WITH GENERAL CLEANERS:

Surfactants (detergents and soaps) are skin and eye irritants and can produce a roughening of the skin surface or swelling and irritation thus altering skin permeability and moisture content. Surfactants dissolve oils on the surface of the skin or natural skin moisturizers within the skin, causing chapping and roughness. This is worse in dry weather due to the low relative humidity. Since the human skin uses body oils as a protective mechanism, chemicals which remove natural skin oils can defat and dry the skin or can penetrate the skin and damage tissue – this is especially the case for detergents, caustics and solvents. So, the properties of detergents, caustics and solvents which make them good cleaners also make them good drying and damaging agents for the skin. The eyes, having no such protective mechanism, are particularly susceptible to burns or damage from acids, caustics and solvents.

Irritation of the nose, throat or upper respiratory tract may result from inhalation of dust from detergent or soap powder products or inhalation of mists or droplets from aerosol spray or pump spray products.

Eye and skin irritation from surfactants appears to depend considerably upon the degree of alkalinity, or pH. For example, sodium soaps have a pH of approximately 9.8. Some manufacturers indicate the pH of the product, concentrate or use-dilution on the material safety data sheet. Acid-containing products will have a pH under 7; base-containing products will have a pH above 7. The further the pH is from the neutral value of 7 (the pH of pure water), the more likely it is that the product will cause irritations or burns to the skin and eyes.

Surfactants can also enter and pass through the outer layer of the skin, interacting with skin proteins and causing swelling of the skin, possibly because detergent anions cause skin's keratin protein to uncoil and expand, becoming more permeable. Fortunately, this effect is reversible and the skin can recover from the effects of detergent exposure and immersion. The greatest swelling results from surfactants with a carbon chain length of 12; these are usually anionic surfactants with the word "lauryl" in them. Anionic detergents in general can be moderate to marked skin irritants, and marked to severe eye irritants. Sodium lauryl sulfate, a common anionic detergent, has been reported to have caused allergic contact dermatitis, but the causative agents tend to be traced to impurities such as nickel,

sultones, or chromium. Thus, the sensitization actually was developed prior to contact with the surfactant which, due to the impurities, simply aggravated an existing condition.

On the other hand, nonionic surfactants do not appear to cause this swelling and, as a rule, produce less skin damage than ionic surfactants. A higher concentration of nonionics is needed to produce the irritation of anionics. Nonionic surfactants rarely sensitize, even at full-strength, or irritate human skin.

Allergic reactions (dermatitis or asthma) may result from exposure to enzyme detergents. (See section on laundry detergents for more information on enzyme problems.)

If a detergent product alone does not provide sufficient cleaning action, especially for greasy dirt or hard water deposits, more vigorous cleaning agents may be needed, consisting of surfactants aided with acids, bases (caustics, alkalis), or chelating agents. These additives assist in breaking the bonds attaching the soil to the soiled surface. Acids and bases are more vigorous cleaners, but at the same time are corrosive in nature and more hazardous to work with.

Acids and acid mists can cause severe lung irritation, erode the skin and respiratory tract tissue, and are particularly damaging to the eyes. Repeated contact with dilute solutions of acids can cause dermatitis. Repeated or prolonged inhalation of acid mist can cause inflammation of the upper respiratory tract leading to chronic bronchitis. However, people repeatedly exposed to low concentrations of acid vapor can gradually lose sensitivity to irritation.

Acetic acid is irritating to eyes, skin and mucous membranes; at high concentrations it is corrosive.

Hydrochloric (muriatic) acid is corrosive and irritating to skin, eyes, and the mucous membranes of the respiratory tract. Severe exposures can result in lung damage.

Hydrofluoric acid is extremely irritating and corrosive to skin, eyes and mucous membranes. Inhalation of the vapor may cause ulcers of the upper respiratory tract. It causes severe skin burns which are slow in healing; deeper tissues may be affected, becoming blanched and bloodless. If hydrofluoric acid-containing products must be used, consider having solutions of benzalkonium chloride available to wash and soak affected skin.

Formic acid is principally an eye and skin irritant.

Oxalic acid is highly corrosive.

Sulfuric acid and sodium hydroxide (caustic soda, lye) can remove water from tissue, causing charring and severe burns on contact with skin. The diluting and mixing of acids or bases with water generate a great deal of heat; this causes local boiling and can produce bubbling and splash-back.

Where removal of hard water deposits is needed, chelating agents such as EDTA or NTA may prove considerably safer to work with than acid-containing descalers. EDTA is an irritant and a teratogen in animal experiments

The chelating agent, EDTA (ethylene diamine tetracetic acid or its acetate salt), has been implicated in allergic dermatitis-type reactions, as well as cross-reacting with ethylenediamine (a common stabilizer for rubber latex. A case history of a dermatitis outbreak in an engineering factory involved "an ethylenediamine-type chelating agent" in which 15 workers were affected on the hands and fingers, one worker on the palms, and another worker on the forearms. Chelators are used to complex water hardness (calcium and magnesium, sometimes iron) to prevent its interference with the detergency of the surfactants and to enable the removal of soap scums and hard water scale from surfaces.

Caustic mists, vapors, and dust cause small burns, damage eye tissue, and can cause damage to the airways and to lung tissue varying from mild irritation of mucous membranes to severe inflammation. Prolonged contact with even dilute solutions of bases or caustics can have a destructive effect on tissue, such as eye irritation, drying of the skin, or dermatitis.

Ammonia or ammonium hydroxide, a base or caustic, is highly water-soluble, so its vapors dissolve readily in the moisture of the eyes and upper respiratory tract. As a result, it is an eye and lung irritant and should always be used in a well-ventilated area. The amine-type caustics such as morpholine, triethanolamine, or ethanolamine are also skin irritants. Sodium hydroxide (lye) and potassium hydroxide, whether used as pellets, in solution, or as mists, vapor, or dusts, are corrosives. Both tend to be poisons and are irritating to skin, eyes, and mucous membranes. Because of their penetrating properties, they are extremely damaging to the eyes. Skin injuries may be extremely severe with deep burns and ultimate scarring.

The glycol ether solvents, also called cellosolve solvents (such as 2-butoxyethanol or butyl cellosolve), can be irritants of the skin and eyes and upon inhalation. Animal studies (but not human data so far) have implicated these solvents in possible reproductive effects in both sexes. OSHA is currently contemplating regulatory action on the glycol ether solvents.

See the section on disinfectant cleaners for more health information on preservatives. Formaldehyde, a common preservative, is highly irritating to skin, eyes, and membranes and a possible tumor-causing agent of the nasal passages. Frequent or prolonged exposure can cause hypersensitivity leading to contact dermatitis.

Alcohols, often used as dispersing agents as well as disinfectants, include ethyl alcohol (ethanol), isopropyl alcohol (isopropanol), benzyl alcohol, and glycols such as ethylene, propylene, and triethylene glycol. Ethyl alcohol may cause headache and irritation of the eyes, nose, and throat. Inhalation, if long continued, can cause drowsiness and lassitude, loss of appetite and inability to concentrate. It is also a flammable liquid. Isopropyl alcohol is an eye irritant, local irritant, and in high concentration is narcotic. Splashes in the eyes can cause corneal burns and eye damage. Its ability to cause mild irritation of eyes, nose, and throat at low levels provides a warning to discontinue exposure. Isopropanol is readily absorbed by the skin. Inhalation of large quantities of vapor may cause flushing, headache, dizziness, mental depression, nausea, vomiting, narcosis, anesthesia, and coma. It is also a fire hazard.

## PROTECTION AND PREVENTION

### Product selection and substitution:

- Use simple product formulations, such as detergents without vigorous caustics, acids, solvents or germicides wherever possible for general cleaning. See section on disinfectant-cleaners for more information.
- Use nonionic detergents instead of anionics. Use mild detergents instead of soaps.
- If a product is purchased as a concentrate, use the highest dilution which will do the job.
- Use products with a pH as close to 7 as possible.
- Use chelating agents to remove hard water spots and soap scum, rather than acid-containing products.
- Use weak potassium hydroxide or sodium hydroxide solutions for removing greasy soil to avoid the eye and nose irritation of ammonia.
- Use caustics instead of solvents for removing greasy soil to avoid inhalation of solvent vapors and their health effects and possible flammability reactions.
- Avoid products with added fragrances and colors to avoid potential allergic reactions.

### Engineering controls:

- Do not smoke around flammable or volatile solvents.
- Use adequate ventilation for volatile solvent-containing products or products which give off irritating vapors or dusts.
- Be prepared to handle spills of acids, caustics or solvents with the appropriate neutralizing agents or absorbants.

### Personal Protective Equipment:

- Wear gloves when using these products. Match the glove material to the product; also match the glove material to the solvent for solvent-containing cleaners to avoid having the solvent migrate through the glove to the skin or dissolve the glove itself.
- Wear eye protection when using vigorous cleaners, especially acids, caustics, irritating solvents, dusts or aerosol sprays.