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CHEMICAL HANDLING PROCEDURES

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1. OBJECTIVES THE PURPOSE OF THIS PROCEDURE IS:-

1.1. To highlight some of the principal hazards to the use of chemical substances.

1.2. To propose a number of safety measures relating to the identification, storage and handing of chemicals.

2.INTRODUCTION

Chemical substances are used regularly throughout for a wide variety of purposes. Typical examples
are fuels, solvent, cleaning agents, lubricants and paints. Although many chemicals come in liquid form, others may be present as solids or gaseous, some chemicals may be present as a result of production processes, while others can be produced as a result of environmental factors, e.g. hydrogen sulphide gas can be generated in stagnant water containing traces of oil through the activities of sulphate reducing bacteria.

Virtually all-chemical substances are toxic to the human body. A toxic substance is one, which has a biological effect on the body, possibly causing breathing problems (asphyxiation), or damage to various tissues in the brain, kidneys, lungs or nervous system. All chemicals can have a biological effect on the body. The degree of risk or hazard will depend on how they are handled and the extent to which the body is exposed to them. One of the principal objectives of scientists engaged in occupational hygiene work is to reduce exposure levels to toxic substances to a minimum, by substituting less toxic materials, providing the protection against their effects, and / or reducing the time to which the body is exposed to them.

3. HAZARDOUS SUBSTANCES:

3.1 Effects on the body:

The effects on the body of exposure to chemicals can be chronic or acute, include immediate
discomfort, e.g. burning sensations, sore, etc while chronic effects from long term exposure and are usually not apparent until many years later. The effects of exposure can also be classed as local or systemic. A local effect is damage to an external part of the body, e.g. an acid burn on part of the skin, while a systemic effect is damage inside the body, e.g. to one of the body's internal organs.

Chemicals can be absorbed through the skin, inhaled into the lungs, or ingested through the mouth. However there are a number of inbuilt mechanisms, which protect the body from absorption of some classes of chemical through the skin. For example it is nearly impervious to hydroxyl, carboxyl and ionized substances, while hydrocarbons, fats and esters will go through it with relative ease. Compounds like Benzedrine can be detected in the urine within 30 minutes of coming into contact with the skin.

Certain critical organs have definite protective screens. A brain - blood barrier exists which prevents many ions from reaching the brain tissue, even when they are present in the blood. Inorganic lead encephalitis is hardly ever found in adults, as a result of this barrier, but it may be found in young children were the barrier is not fully developed.

The liver and kidneys perform the vital function of cleansing the body of most of the toxic substances, which enter it, but these organs may be damaged in the process. For instance, the effect of mercury can be most severe on the kidneys, which separate body fluids. The liver plays a major role in purifying the blood, and exposure to tetrachloride, for instance, may lead to the liver being overtaxed causing cirrhosis.

Acute exposures put additional stress on the liver and kidneys. The first effect of acute poisoning is usually severe stress, similar to shock, circulation and respiration and loss of the brain's blood supply. However, by blood shunting, the liver and kidneys are among the first organs to have their blood supply cut off to protects these organs from chemical damage. Long periods in this condition can cause them to atrophy or be damaged in other ways.

3.2 Occupational Exposure Limits:

Guidance notes on occupational exposure limits are updated annually.

Occupational exposure limits refer to control and recommended control limits. These are contained in various EEC and UK regulations and codes of practice, and have been determined after detailed consideration of available scientific evidence, to be reasonably practicable for industry. The recommended limits should not be exceeded. They are considered to represent good practice while not in themselves legally enforceable.

There are two types of exposure limit listed in the HSE guidance note - long term and short term. The long-term exposure limit is concerned with the total intake of the chemical over a long period and is normally based on periods of eight hours per day for situations where only very short exposure is required. Tables of short term exposure limits, based on the maximum level of exposure over a 10 minute period, should be referred to, e.g. for hydrogen sulphide the short term exposure limit is 15 PPM.

In cases where work shifts exceed 8 hours per day, the exposure limit must be reduced in proportion to the extra time a person is present in a contaminated environment, e.g. the occupational Exposure limit for hydrogen sulphide gas in air is 10parts per million (PPM). As this is for an 8 hours day, the limit would need to be reduced to 7 PPM if the normal working patterns require a 12 hours shift day.

4. IDENTIFICATION AND LABELING:

There are many international standards and regulations relating to the identification and labeling of dangerous goods. Probably the best-known are those issued by the International Air transport association (IATA). In addition, many nationally based safety regulations place a duty on manufacturers and suppliers to provide information, which will ensure that users are protected if they follow the written instructions. Labels giving accurate user information must be provided for the transportation and supply of individual chemicals.

Typical information to be included on labels includes;

- Name and address of manufacturer and/ or supplier.
- Trade and chemical names of the substance.
- An indication as to the particular risks involved in handing or using the substance.
- Warning about safety factors to be observed.
- Pictorial representation of the main hazard (s).

The pictorial representations in the visual aid are those devised by British standards, but are also widely used outside the United Kingdom.

All chemicals should be appropriately labeled, even when they are not considered to be dangerous, since unlabelled chemicals invite the assumption that they are harmless in every situation.

4.1 Location And Type Of Label:
Labels must be securely fixed to containers and clearly visible. They should be made of a material, which is capable of surviving 3 months immersion in seawater. Tie on labels are not advised as they can be easily damaged or removed. Labels should remain on empty containers, as the risk to handlers may be just as great if the containers were still full.

4.2 TYPES OF HAZARD:

4.2.1 Flammable material:
Practically all combustion takes place between oxygen and a fuel in its vapor or other finely divided state. Excess heat may cause some of the chemical to vaporize and can easily lead to the presence of a flammable atmosphere, e.g. paint thinners. The flash point of a chemical classified as flammable should be less than 38 c (100f).

4.2.2 Toxic materials:
Any substance, which has an effect on the body should be classified as toxic, e.g. for hydrogen sulphide the effect may be a short term acute response such as eye irritation, or the result of long term exposure may be chronic leading to the development of some form of occupational disease.

4.2.3 Corrosive materials:
These include string acids and alkalis, e.g. caustic soda. These materials tend to destroy their containers and leak into the storage area. Some are stable, while others react violently with moisture. Acid mists corrode structural materials and equipment as well as being harmful to personnel.

4.2.4 Harmful/ irritant substances:
The combined transport and user label identifies materials not covered by other classifications, but may still cause some minor damage to the body, e.g. ethylene glycol (anti - freeze) can be irritating to the eye and to the skin.

4.2.5 Oxidizing agents:
Oxidizing agents releases oxygen, either at room temperature or when subjected to heat. They should always be stored in a separate area from other chemicals, as they can provide the oxygen needed to fuel a fire in the event of unfavorable conditions occurring, examples are chlorates.

4.2.6 Explosives:
This classification includes materials, which, under certain conditions of temperature, shock or mechanical action, can decompose rapidly to cause an explosion. Explosives should be stored in a separate area, well away from highly populated locations and only be used by trained personnel.

5. STORAGE OF HAZARDOUS SUBSTANCES;

5.1 Storage areas:
- Hazardous chemicals should be stored in separate storage areas away from densely populated or

high-risk areas.
- The floor should be sealed, to prevent leakage of spilled chemical into other areas, and there should be rallied sills on doorways, to provide bundling or containment within the store.
- The area should be well ventilated to prevent the build up of toxic, flammable or explosive fumes.
- The storage area should comply with manufacturer's recommendations regarding temperature, humidity, etc.
- There should be sufficient access space to prevent containers being accidentally dislodged and damaged.
- Incompatible chemicals e.g. flammable substances and oxidizing agents should not be stored in same area.

5.2 Receipt and storage arrangements:
- Newly received containers should be checked for leaks before they are brought into storage.
- Chemicals should be stored in their original containers.
- Containers should not be stored above head height.
- If there is a danger of certain old chemicals corroding containers, decomposing, owing or giving off gas, these must be used in strict rotation ands only small stocks held.
- All areas must be free from litter, and spills must be wiped up as they occur.
- Empty containers should be removed, and disposed of as hazardous waste.
- Appropriate hazard warning signs must be disposed of as hazardous waste.
- Appropriate hazard warning signs must be displayed on all access doors.
- Hazardous chemicals should not be dispensed or mixes, in the storage area.

5.3 Future developments;
- If a hazardous chemical were used in large quantities, bulk storage containers with fixed pipe work should be used. This would eliminate many handling hazards.

6. HANDLING AND MIXING:
- Chemicals should not be mixed or diluted unless the label clearly states that it is safe to do so.
- Hazardous chemicals should be mixed in a separate room suitably equipped for this purpose, by personnel who are fully protected for the work to be carried out.

6.1 Mixing hazardous chemicals:
- Mixing should only take place within a bundled area large enough to contain all chemicals being mixed.
- The mixing area should be well ventilated, with forced ventilation or extraction where required.
- Platforms and working surfaces should be at the correct height to eliminate lifting and unnecessary handling of containers.
- The area should be tidy and free from tripping hazards.
- Checks should be made on whether spills may be flushed into drains, or disposed of in some other way.
- The area should be equipped with and emergency shower and eyebaths.
- Mixing containers should be thoroughly cleaned before use they should be constructed of suitable material for the chemicals being used.
- When diluting a chemical, it should be added to water, e.g. add acid to water- not the other way round, unless instructions on the label state otherwise.
- When transferring chemicals, the new containers should be fully labeled and personnel using the chemical made fully aware of associated hazards and safety precautions.

- Empty containers should be removed from the mixing area and disposed of as hazardous waste.

6.2 Emergency procedures:
- MATERIAL SAFETY DATA SHEET (MSDS) should be available for every chemical in use.
- This data sheet should specify detail procedures to be followed in an emergency, including.
- Whether access to the contaminated area should be prevented.
- The necessity for using protective clothing.
- Disposal procedures.
- Protection of drains and other local services.
- First Aid treatment

6.3 Long term improvements:
- Steps should be taken to eliminate mixing by attempting to buy chemicals ready mixed. Alternatively, component chemicals may be purchased in a safer form, e.g. solid rather than liquid, eliminating splashing, or in pellet form rather than as a powder, reducing levels of airborne dust.

7. EXTERNAL BODY PROTECTION:
- Personnel must be fully protected when handling hazardous chemicals.
- Equipment used for other activities is unlikely to meet the requirements for chemicals, e.g. normal coveralls would become saturated, allowing absorption of chemical through the skin.

7.1 Body protection:
- A chemical suit offers the most complete form of body protection for handling very hazardous chemicals. It should have in-built boots, gloves and hood. This has the advantage of preventing liquids running down the suit into the gloves and boots.
- If separate boots are used, these must be made of plastic or synthetic rubber as leather may crack allowing liquids into contact with the skin.
- If separate gloves are used, these should be of the gauntlet type so that the wrists are fully protected, unless there are particularly good wrist seals on the suit.
- The permeability and chemical resistance of gloves and boots should be checked out before using them when handling particular chemicals.
- Chemical suits, boots and gloves should be thoroughly hosed down before any attempt is made to remove them.
- If contact occurs between a corrosive chemical and the skin, the affected areas should be flushed with copious quantities of water and first aid sought.

7.2 Eye and face protection:
- The main types of eye protection are spectacles, goggles, visors or face shields, space like helmets with in-built face shields.
- Spectacles and goggles designed as suitable for general use are unlikely to meet the requirements for handling chemicals since these only protect against impact and possibly airborne grit.
- Protection is required against chemical splashes, chemical dusts and, possibly gases and vapors.
- Close fitting goggles, which comply with an internationally recognized standard, should be used for work with chemicals e.g. British standards institute BS 2092 D for chemical dusts, BS 2092 c for chemical liquids, and BS 2092 g for adequate protection for the eyes. If these are used, approved goggles should be worn under them to afford the correct level of eye protection.
- Contact lenses should not be worn for work with chemicals, except under approved goggles.

8. PROTECTION FROM SKIN CONTACT, INQESTION AND INHALAION

8.1 Protection from Skin Contact:

- The skin should always be protected from chemicals, even when there id no obvious danger, e.g. from oils or solvents.
- Dermatitis can be caused by regular contact with oils and solvents and the resulting skin inflammation can be painful and lead to subsequent infection.
- Protection can take the form of chemical suits, gloves or barrier creams regular washing also helps.
- Cuts and wounds should be protected by clean, waterproof dressings.
- Coveralls saturated in chemicals or oils should be removed and laundered, as there is virtually constant contact between the substance and the skin.

8.2 Protection from ingestion:

- Swallowing any industrial chemical is likely to lead to irritation and illness and all possible steps should be taken to avoid doing so.
- Food and drinks should not be consumed in any area where chemicals are handled or stored.
- Smoking should also be prohibited in areas containing chemicals, as there is also the danger of fire or explosion or of a chemical reaction leading to a toxic substance being present.
- Protective clothing should be removed and hands thoroughly washed before any food is consumed.
- If a chemical is accidentally swallowed the mouth should be rinsed several time with water, 3 or 4 glasses of milk or water swallowed unless the manufacturer's instructions state otherwise.
- Vomiting should not be induced, unless the manufacturer's instruction says so.
- In areas where poisonous substances are used, antidotes should be readily accessible and all personnel should be instructed on where to find and how to use them.
- Medical attention should always be sought if any chemical substance is accidentally ingested in case there are long-term effects, which need to be dealt with.

8.3 Protection from inhalation:

- All chemical fumes, gases, vapors and dusts should be treated as harmful.
- Many fine particle dusts are invisible but can be hazardous if inhaled into the lungs.
- Fabric-type dust masks are only suitable for large particle dust e.g. prelates, but offer very little protection against restorable dust.
- Dust respirators provide protection from fine particle dust but only if high irradiancy filters are used.
- Cartridge gas- and vapor filters depend for their efficiency on using the correct absorbent or combination of absorbents.
-There is no indication of the remaining capacity of a respirator or of the point when failure will occur.
- In situations with a high level of contamination, or where the atmosphere may be deficient in oxygen, positive pressure breathing apparatus should always be used.