E

CONTROLS

INDEX

Introduction

In this section the general principles and methods involved in controlling chemical health hazards are discussed. The type of control or controls selected will depend upon the nature of the substance or agent and its route of entry into the body. The ideal situation would be to eliminate the hazard completely but since this is not always possible nor practicable, the aim should be to limit or reduce employees' exposure to or contact with the hazard to acceptable safe limits. As mentioned in our introductory section to this Guide, however, established safe limits should be used as guidelines only. Attempts should be made to keep employees' exposure to airborne concentrations of chemical contaminants well below these safe limits; in fact they should be kept as low as possible. This can often be achieved by the use of a combination of engineering, work practice and administrative controls, supplemented by the use of personal protective equipment.

Ideally personal protective equipment should not be seen as a control in itself, but should be secondary to any other controls adopted and act as a safeguard should these controls fail. In any event during the period that you are investigating controls needed, employees must be provided with the proper personal protective equipment.

The following is a brief description of each of the different types of industrial hygiene control measures:

Elimination

The first objective should be to eliminate the need for the toxic substance by changing the process or the equipment.

If this is not feasible, then a thorough search should be made for a less toxic substitute (for example, in some cases less toxic chlorinated hydro-carbons are used in place of carbon tetrachloride; petroleum solvents for benzene; calcium carbonate for silica parting compounds in foundries; other phosphors for beryllium phosphors in fluorescent lighting). Suppliers should be able to recommend less toxic substitutes for the intended use but if this information is not forthcoming from them, contact the Industrial Accident Prevention Association for advice.

Engineering Controls

Some examples of engineering controls are: ventilation, isolation, enclosure and design of the workplace, plant or equipment.

a) *Ventilation* is used to control airborne hazards generated in the form of dust,

fume, smoke, vapour or mist and can be either general or local. General ventilation, however, is only appropriate for nuisance material and environmental control. Toxic substances are simply dispersed, not removed. (See Appendix E1 for some general notes on ventilation systems which you might find useful.)

b) *Isolation* can involve either isolating the process or the worker, e.g., by (i) physically enclosing the machine or process to limit the numbers of workers exposed to the hazard or (ii) operating the machine at a time when fewer workers are exposed to the hazard.

Work Practices

Work practices can be defined as procedures for carrying out specific tasks which, when followed, will ensure that the employees' exposure to hazardous situations, substances, and physical agents is controlled by the manner in which the work is carried out. Effective work practices include:

(a) Safe work practices to ensure that substances are handled safely. These may require that personal protective equipment is used or worn when performing specific jobs.

(b) Proper housekeeping procedures, e.g., prompt cleaning up of dust, dirt, spills, splashes and overflows, regular waste disposal, provision of adequate and proper storage facilities

(c) The use of vacuuming or sweeping compounds to clean the workplace or the work area in which the toxic substance is handled, used or stored

(d) Prohibition of smoking on the job or in the area of exposure.

(e) Provision and use of separate eating and washing facilities if an ingestion hazard is involved.

(f) Provision of double locker rooms, shower facilities and clean work clothes in certain circumstances, e.g., where exposure to lead is the hazard.

(g) Facilities for vacuuming clothes prior to leaving the area of exposure.

(h) Procedures to deal with emergencies such as chemical fires and spills, as well as first-aid procedures.

Administrative Controls

Control whereby the *period of time* of exposure to the hazard is limited or reduced. This is done mainly by reducing the employees' work periods in highly hazardous operations through:

- work-rest regimes
- job rotation
- adjusting work schedules to space out high exposures

Education And Training

Education and training of both supervisors and employees is essential if the control measures provided are to be effective. Training must be provided in:

(a) the hazards of the substance or agent. Employees should be trained to interpret any hazard rating code you may adopt

(b) the precautions required to be taken in the handling, use, storage and disposal of the substance

(c) the use, care and maintenance of personal protective equipment

(d) emergency procedures

Such training should be provided not only to new employees but also to all other employees on a regular basis as part of an on-going training program.

It is not intended to provide guidelines for setting up such a program but since any training provided needs almost daily reinforcement, we have added a section on "Communications" (See Section F) suggesting different methods whereby employees are at all times alerted to the hazards of the substance and the precautions they should be taking. *We would like to emphasize, however, that the communications method you select should supplement and not be a substitute for your training program.*

Long Term Controls

Any controls instituted will be effective only to the extent that they are properly functioning or properly followed. Therefore, it is essential to establish a program of control procedures involving:

- regular inspections to ensure good housekeeping, adherence to procedures and rules, checks on engineering controls, etc.
- preventive maintenance program
- training and ongoing education or "hazard awareness" programs
- periodic air sampling
- medical surveillance
- record keeping
- etc.

APPENDIX E1

Ventilation Systems

EXTRACTED FROM:

APPLICATION OF VENTILATION TO CONTROL HAZARDS
H.M. Nelson, P. Eng.

GENERAL VENTILATION is the removal of air from, or the supply of air to a general work area. The work area may be a building or a room, or an area of either. It can be natural ventilation which depends on winds and on stack effect in the area or it can be mechanical which requires an air-moving device.

Natural ventilation should be used only where nuisance materials in low concentrations are present or where hot processes generate a high stack effect so that outside weather conditions have relatively little influence on air flow. Natural ventilation of an area normally means there are large openings at floor and roof level, which allow free movement of air. Heating of this type of building may be difficult with attempts made to provide comfort by using radiant heaters or other unit heater devices. The volume of natural ventilation can be calculated, using the height of the building and the temperature difference between inside and outside air. As the temperature difference approaches zero, as one might expect in the summer, then air movement approaches zero. In any building though, there is a constant air movement through infiltration or diffusion. The rate of air movement depends on the tightness of the construction building materials used, and openings including doors and windows. A good rule of thumb is to assume one air change per hour through infiltration unless the building is of unusually tight construction. If such an assumption fulfills minimum ventilation requirements, no mechanical ventilation is usually considered necessary.

Mechanical general ventilation is used where nuisance material or materials of low toxicity are encountered. It can be used also for reducing heat. It is called dilution ventilation because it tends to dilute the contaminant to acceptable levels.

There are certain limitations in the use of dilution ventilation, as follows:

1. Volume of air required may be so large as to be impractical. Suppose a dip room is 40 ft. x 40 ft. x 12 ft. high, in which 45 gallons of toluol per day are evaporated. General ventilation requirement is around 65,000 cfm. or about 3½ air changes per minute, at a cost of about $8,000 – $10,000 a year to heat incoming air.
2. The rate of generation of the contaminant should be fairly uniform.
3. Since some uncertainty is always present regarding efficiency of dilution, from

4 to 10 times the theoretical amount of air required to dilute to the TLV must be used for ventilation

4. Costly equipment must be installed.
5. General ventilation should not be used where highly toxic materials are used (lead, mercury, beryllium, cadmium, carbon tetrachloride, benzol, carbon disulphide, etc.).

The important things to look for in general ventilation:

1. The source of contaminant should be between the operator and the exhaust source. This, of course, is the ideal, but often cannot be strictly adhered to.
2. Insure that there is sufficient replacement air for the exhaust system. Insufficient replacement air is probably the most frequent cause of ventilation failure Heated replacement air is ideal because the source can be located at any point. Without proper supply air, replacement air may come down gravity vents or other openings, and possibly disrupt other ventilation equipment, cause uncomfortable drafts or cause backdrafting of heaters with possible carbon monoxide contamination.
3. The exhaust outlet should be located so that the contaminant cannot re-enter the building through windows, doors or air supply.

Normally, a more efficient way is to remove the contaminants at their source of generation by a local exhaust system that prevents the material from entering the general work area. Local exhaust requires careful design and installation with regular maintenance to keep it operating. Its initial cost will often be higher than for general ventilation and its upkeep will be costlier. However, with the lower air volumes, heat losses are kept to a minimum. As stated earlier, it is the only way to provide adequate control of highly toxic materials.

A local exhaust system consists of three or four components.

1. *The Hood*, the entrance to the system, is designed so that the incoming air captures the hazardous material and carries it with it.
2. *Ducting* is the system of piping through which the exhaust air flows to the outside.
3. *The Air Mover* is usually a fan or a blower. An ordinary propellor fan usually does not have the characteristics to supply suction for a local exhaust system, so that almost always a centrifugal, vane axial or tube axial fan is used.
4. *A Collector* removes the contaminant from the air stream before the exhaust air is discharged to the outdoors. A collector may or may not be installed, depending on the value of the product exhausted or on its nuisance or health significance when put in the outside air. In certain cases with very efficient collection it may be possible to return the air to the workroom.

The hood is the most important item As long as it performs satisfactorily, it is of little consequence how this is achieved, except in unusual circumstances (e.g. flammable solvents or powders). In order to function, the hood must

1. Arrest or use any motion inherent in the contaminant due to heating, rotating, oscillating, agitation, etc.

2. Move the contaminant into the hood away from the operator.

A hood should enclose an operation as fully as possible. If the operation cannot be restricted, the hood may be an open pipe. On the other hand, if it is an automatic process, it may be completely enclosed. For the most completely enclosed operations, some openings must be maintained so that replacement air can leak in.

Capture velocity is defined as the air velocity at the point of contaminant generation that is required to influence the flow of this material in the desired direction. If the contaminant is generated inside a hood, the capture or control velocity is the face velocity of air into the hood. If the contaminant is outside the hood, the capture velocity is at the point of contamination generation.

In general capture velocities are as follows:

Conditions of Dispersement of Contaminant	Examples	Capture Velocity in feet per minute
Released with practically no velocity into quiet air	Evaporation from tanks, degreasing, etc.	50 - 100
Released at low velocity into moderately still air	Spray booth, intermittent container filling;low speed conveyor transfers; welding; plating; pickling	100 -200
Active generation into zone of rapid air motion	Spray painting in shallow booths, barrel filling; conveyor loading, crushers	200 - 500
Released at high initial velocity into zone of very rapid air motion	Grinding, abrasive blasting; tumbling	500 - 2000

For comparative purposes, 88 feet per minute (fpm.) is the same as one mile per hour.

Standard hoods commonly encountered

SPRAY BOOTHS — The operator may be inside or outside of the booth. If he is inside, we have a special type of general ventilation. In most cases, spray booths are exhausted at a face velocity of from 100 - 150 fpm. In large booths, if conditions are

good, a lower velocity may be tolerated. In shallow booths, a higher velocity may be necessary.

When a high-quality, dust-free finish is required, a spray booth may be pressurized by supplying filtered tempered air behind the operator in a greater quantity than exhausted. The excess air must be removed from the booth.

Spray booths can be operated with downdraft exhaust. Downdraft exhaust is used particularly in automobile spray booths where operators must work on both sides of the car. The automobile spray booth also must be exhausted so that there can be colour changes from car to car without colour contamination.

DRYING OVENS are difficult to exhaust properly because of convection currents set up by the heat of the oven. A high air exchange increases heating loads and is unsatisfactory. Usually enough air is exhausted from the oven to dilute flammable vapours. In addition, secondary exhaust, such as canopies, may be necessry at the oven entrance and exit to remove vapours.

ABRASIVE BLASTING is a special case of general ventilation when a large chamber is used. Both exhaust and supply air systems must be used to provide adequate ventilation. Air flow can be either down-draft or lateral, depending on use. Down draft requires 60 - 100 fpm. air velocity, lateral requires 100 fpm. The operator must wear an approved air supplied respirator.

Small cabinets require 20 air changes per minute with velocity into all openings of at least 200 fpm. Because the operator works outside the cabinet, respiratory protection should not be necessary.

PICKLING, PLATING AND HOT-DIP TANKS with cold or room temperature solutions, as a rule, do not require local exhaust except in the case of nitric acid pickling tanks and chromium plating tanks. Normally cyanide plating tanks at room temperature do not require local exhaust.

Tanks containing hot liquids require local exhaust. In many cases ventilation is required to reduce steam in the air as much as a toxic contaminant. The exhaust rate required is from 120 to 250 cfm. per square foot of tank area. In most cases the tanks are exhausted through slots along the sides. Velocity of air into the slots should be from 1500 to 2500 fpm. If a series of slots is installed, or if a larger opening is being used and doing a satisfactory job, no change is needed. The slot velocity has little to do with the control of the vapours, but with the uniform operation of the slot. The mass air movement is what controls the contaminants.

A canopy hood over the tank with adequate exhaust capacity will control vapours, but is unsatisfactory if someone must work over the tank.

ARC WELDING. General ventilation is usually satisfactory for ordinary steels. If local ventilation is used, it can be by a partitioned area with high air exchange, a canopy over the welding exhausted at about 150 fpm. face velocity, or an open pipe, preferably flanged, with exhaust volume up to 1000 cfm. placed not more than one foot from the work.

CONVEYOR BELTS. When handling dry materials, conveyor belts should be enclosed at transfer points. The exhaust flow rate must exceed the belt speed, and should be not less than 150 fpm.

BUCKET ELEVATORS should be enclosed completely with exhaust takeoffs at the top and at the boot or transfer point from conveyor. Exhaust flow rate into all openings should be not less than 150 fpm.

BENCH OR PEDESTAL GRINDERS should be equipped with an enclosure around the wheel, with a projecting lip at the bottom to capture dust thrown down by grinding. Exhaust rate depends on size of wheel but ranges from 300 to 2000 cfm. A face velocity of at least 500 fpm. would have to be maintained at the hood openings.

PORTABLE GRINDERS AND DISCERS should be exhausted with face velocity of 200 to 400 fpm. when used on downdraft grilles.

SWING GRINDERS should be in booths with a face velocity of 100 - 150 fpm.

MIXERS (VOLATILE LIQUIDS OR DRY DUSTY MATERIALS) should be completely enclosed and exhausted to provide 100 - 200 fpm. into inspection holes and other openings. If a volatile liquid is used in a sealed mixer, a vent to atmosphere may be satisfactory.

REACTION VESSEL should have an exhaust system similar to above.

BAG-FILLING OPERATION can take place in a booth or enclosure and must be exhausted at about 100 - 200 fpm. face velocity. A hood can be fitted near the bottom of the hopper and exhausted at about 500 fpm. face velocity.

BARREL-FILLING OPERATION booth or enclosure should be exhausted to give 150 fpm. at face of booth. A semi-circular slot at the top of the barrel is satisfactory. It should be exhausted at a rate of 100 cfm. per square foot of barrel top. An exhausted lid, with feed spout attached, can be placed over the barrel. Exhaust rate should be 150 - 500 cfm.

MELTING POTS are usually enclosed with openings or doors for ladling and removing dross. Face velocity into openings or open doors should be 200 - 250 fpm. The pot can be partially covered and exhausted so that face velocity at open part is at least 200 fpm. The dross receiver used in conjunction with the melting pot will require similar ventilation.

MELTING FURNACES (NON-TILTING) should be exhausted to give face velocity of 200 fpm. into all openings. Exhaust air must, in addition, remove products of combustion.

MELTING FURNACES (TILTING) usually have a canopy with sliding doors fitted. Exhaust rate should be about 200 fpm. per square foot of canopy area. Several methods are available to make the hood follow the furnace through the tilting cycle. The canopy dimensions can be increased so that the furnace is covered during tilting.

FOUNDRY SHAKEOUT equipped with an enclosure should be exhausted with 200 fpm. velocity into the opening. A single side-draft hood should be exhausted at the rate of at least 500 cfm. per square foot of grate area. A double side-draft hood should be exhausted at the rate of at least 400 cfm. per square foot of grate area. Downdraft exhaust should have 600 cfm. per square foot grate area. For shakeouts where downdraft exhaust is used, the flask should not completely cover the grate, as this would render the ventilation useless.

The above are a few of the standard methods of locally ventilating specific operations. They are not the only methods which can be used, nor are the exhaust rates quoted necessarily the correct ones for every job. When conditions are good, as in a

large building with no interfering drafts, no interfering exhaust systems, and with a well-run operation, the rates quoted can sometimes be decreased. When large hoods are used at an operation, the exhaust rates can sometimes be lowered because the mass air movement is high. When proportions of the hood, tank, or other component of the operation are unusual, it may be necessary to increase the exhaust rate, or it may be possible to decrease it. If a highly toxic material is used in an operation, exhaust rates may have to be increased, or the hood or enclosure may have to be re-designed. If there are cross-drafts or other interfering exhaust systems in the area, the rate of exhaust may have to be increased. If an exhaust system works, it should not be changed even though it may not conform to standard practices.

Remember that a local exhaust system draws air from the room or building where it is located. One definition of general ventilation is "the removal of air from a room or building, or an area of either." The local exhaust fulfils this definition. If some process in the area, where local ventilation is used, requires general ventilation, don't forget that the existing local exhaust may be sufficient to do the job, or at least to do part of it.

F

COMMUNICATIONS

INDEX

The forms referred to above are contained in a pocket in the inside back cover.

Introduction

Three distinct methods of communicating chemical hazards to your supervisors and employees are described here. *Whichever method you select, it is important to remember that it cannot, singly or in combination with the other methods, take the place of an education and training program.* These methods are:

I. LABELLING

II. INFORMATION SHEETS

III. WARNING SIGNS

Ideally you should use all three methods. To start with, you may want to select the method most feasible to you at this time, bearing in mind that specific legal requirements and regulations issued at some future date may make all three methods mandatory.

I. Labelling

Purpose:

1) To identify the chemical composition of the substance in the container or at least to identify those ingredients which contribute significantly to its potential hazards.

2) To alert all employees handling the container of the potential hazards of its contents.

3) To draw attention to the necessary basic precautions.

Items 2 and 3 must be supported by more detailed information to supervisors and employees concerned (See II – INFORMATION SHEETS). The information on labels is meant only to serve as a reminder that there are more specific precautions and procedures to be followed. *In no way should labelling be considered as a substitute for training.*

All containers whether used to store, dispense, process or transport a toxic substance within the workplace should bear some form of precautionary labelling. Thus, there should be labels on cans, packages, process vessels, storage tanks, pipelines, etc.

There are two important labelling system considerations:

1) These labels should not in any way be confused with any labelling standards relating to the transportation of dangerous goods.

2) Should you decide on a labelling system for your workplace, we must emphasize the importance of a standardized label and code with which the workers can become familiar. Your hazard rating system (Section C) will be an integral part of your labelling system. It is essential that your employees fully understand it and realize that even though a substance may have a "high" health hazard rating, it need not be a hazard to their health if instructions and procedures are followed.

Labelling Procedure

Establish a procedure whereby:

- All your existing supplies of toxic substances are labelled.

- Future supplies of these and other approved toxic substances are labelled *on receipt, prior to being released* either to the stockroom or the using department.

You may receive containers labelled in compliance with federal or provincial legislation covering the transportation of dangerous goods. You should bear in mind that these labels relate to transportation hazards and should not automatically be considered as appropriate in your circumstances. *Your own labels should replace them.*

- Labels on containers used to dispense or process substances are replaced when they become defaced.

Form #CH6 is a sample label you may wish to consider using. It shows the kind of basic information you should include on the label, i.e.:

(a) Principal toxic ingredient(s) in substance

(b) Hazard rating code

(c) Basic precautions, e.g.
Avoid vapour inhalation, skin or eye contact.
Use with ventilation.

(d) Storage precautions

(e) First-Aid procedures

(f) Personal protective equipment to be used. (See Figure 5 for suggested PPE Code. Your employees should be trained to interpret the code. Wallet cards with the code printed on them would provide your employees with a handy reference.)

A completed label should be stapled to the respective chemical control index card (see Section C) maintained by the Chemical Control Co-ordinator. A copy of the card, with label, should be forwarded to the purchasing department to enable them to ensure that there is a supply of labels. Depending upon quantities used, you may either:

(a) Print the label in its entirety for the substance.

(b) Have a supply of labels printed in bulk with blanks for filling in information regarding a particular substance.

If labels are printed on tear-off adhesive backed paper, this would facilitate affixing to containers or packages. However, there is no reason why photocopies cannot be made for use as needed.

Personal Protective Equipment Code

PPE-1 Leather gloves + cartridge filter respirator

PPE-2 Synthetic gloves

PPE-3 Synthetic gloves + synthetic apron + splash goggles or face shield

PPE-4 Synthetic gloves + synthetic apron + goggles or splash goggles + cartridge filter respirator

PPE-5 Airline mask or face shield + synthetic gloves + synthetic apron

PPE-6 Airline mask or face shield + synthetic apron + synthetic boots

PPE-7 Full suit + airline hood + synthetic gloves + synthetic boots

The term "synthetic" covers rubbers (latex, neoprene, etc), polyethylene, polyvinyl chloride and other impervious materials. Synthetic materials are impervious only to specific organic compounds Suppliers can recommend the most appropriate material for specific use.

There may be different combinations of personal protective equipment required depending upon the nature of the hazard.

FIGURE 5

II. Information Sheets

Purpose:

1) To inform supervisors and employees involved of:
   (a) the hazards of the substance
   (b) the precautions and procedures to be followed in its handling, use, storage and waste disposal
   (c) the proper use of emergency measures and procedures
2) To form a base for your:
   (a) employee induction program
   (b) retraining program

These information sheets will provide a good base for your chemical training program. *They should not, however, be considered as a substitute for training.*

Procedure:

Form #CH7 "Information Sheet on the use of —" is a suggested form for communicating information to your supervisors and employees. The information necessary for completing the form should be obtained from your supplier's Material Health & Safety Data Sheet.

You may wish to provide:

(a) each supervisor and employee involved with a copy of the information sheet, or

(b) each department involved with a copy of the information sheet, and it should be readily accessible to supervisors and employees.

In either case, a written explanation of your hazard rating system and personal protective equipment code should also be provided.

III. Warning Signs

Purpose:

To alert employees that they are entering an area which is hazardous and that certain precautions are needed.

Procedure:

This can be done by means of:

1) Warning signs depicting the general nature of the hazard.

2) Prohibitory signs (e.g. No Smoking). Consideration should also be given to signs drawing attention to emergency facilities (i.e. showers, eye wash fountains).

3) Pictorial signs of personal protective equipment required to be worn (see Figure 6).

Appendix F1 gives some examples of signs in common use.

Protective Equipment for Handling Hazardous Materials

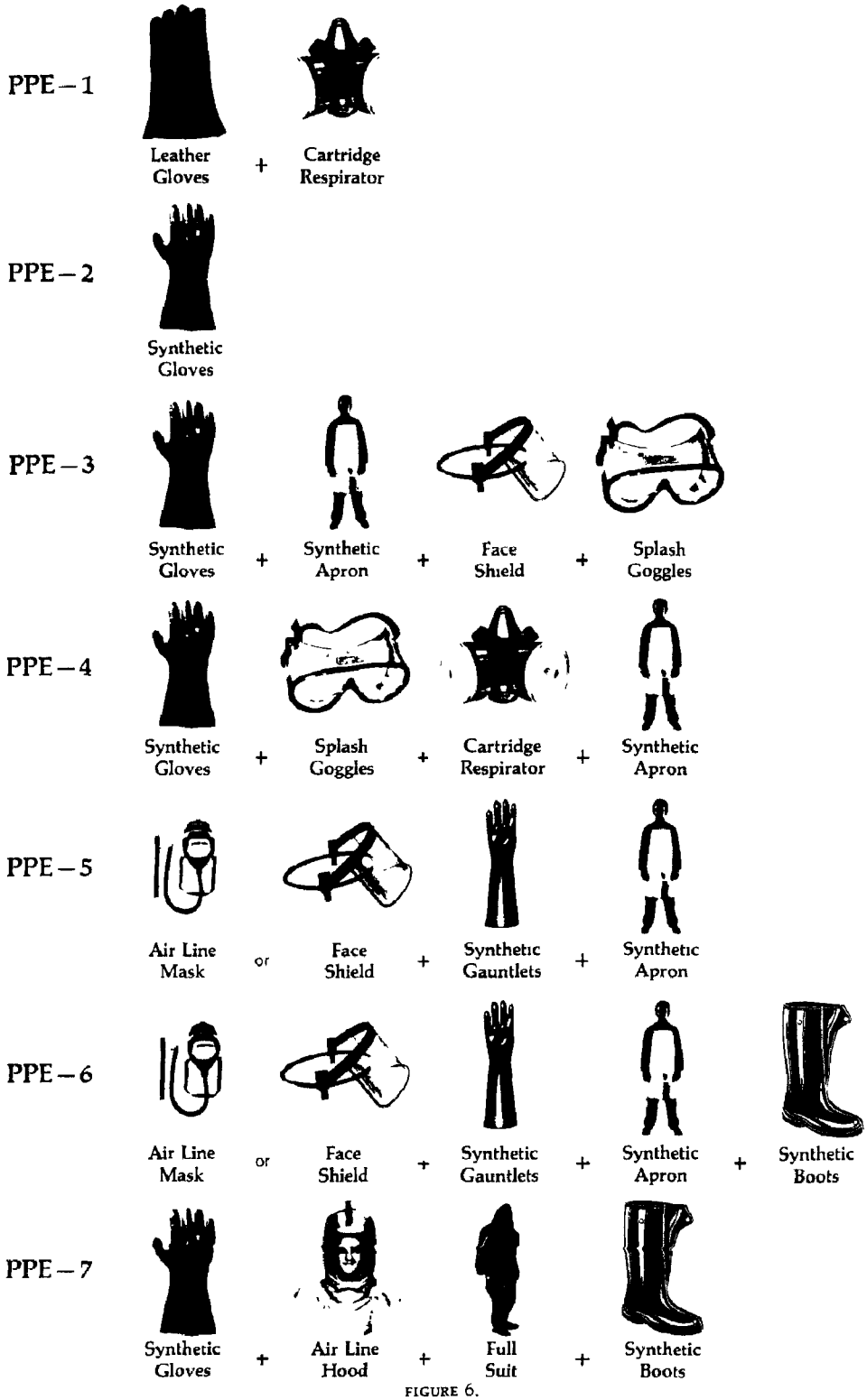
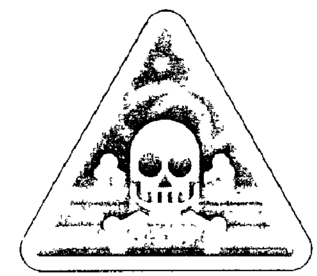
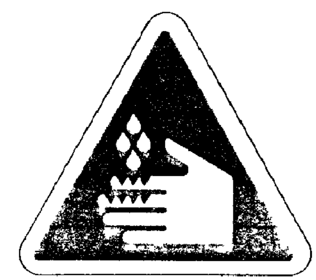
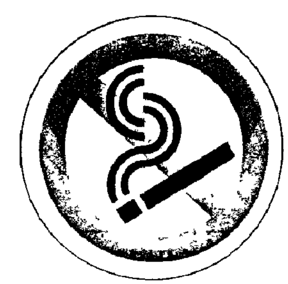


FIGURE 6.

REFERENT	DESCRIPTION	EXPLANATION	EXAMPLE
POISON	Skull and Crossbones	Danger: Poison	
CHEMICAL BURN	Drops descending on a hand with index and second fingers disintegrating	Danger: Chemical Burn	
SMOKING	Smoking cigarette	No Smoking	

REFERENT	DESCRIPTION	EXPLANATION	EXAMPLE
BREATHING PROTECTION	Front View of Head Wearing Respirator	Breathing Protection Must Be Worn	
SHOWER	Drops Spraying From Side View of a Shower Head	Emergency-related: Shower	
EYE WASH	Drops Spraying to Side of an Eye	Emergency-related: Eye-wash	

Courtesy: Canadian Standards Association

G

GLOSSARY

Definitions of terms as used in this guide or commonly used.

ABSORPTION – The taking up or penetration of substances into the body; passage of substances to the blood, lymph, and cells, as from the skin, gastrointestinal tract, pulmonary tract or other tissue.

ACGIH – American Conference of Governmental Industrial Hygienists.

ADMINISTRATIVE CONTROLS – Controlling, limiting or reducing the period of time of exposure to a regulated or a toxic substance or physical agent.[1]

AEROSOL – An airborne suspension of solid or liquid particles.[2]

AGENT – Any substance, force, radiation, organism, or influence which affects the body, a part of the body, or any of its functions. The effects may be beneficial or injurious.

AIR MONITORING OR SAMPLING – Measurement and determination of quantities and types of atmospheric contaminants.

AIRBORNE – Carried by the air. In industrial hygiene this refers to solid or liquid particles or vapours and gases suspended in or mixed with the air.

AREA SAMPLING – Collection of a sample of air representative of that of the general work area(s) for the determination (by further analysis) of the type and concentration of contaminants present.[3]

BADGE – Personal monitor used to determine time-weighted-average concentrations of certain air contaminants.

BIOLOGICAL AGENT – Any organism which affects the body, a part of the body, or any of its functions. The effects may be beneficial or injurious.

BIOLOGICAL MONITORING – An assessment of the amount of the contaminant of concern that has actually been absorbed by the workers. This must be determined by some clinical measurement on the individual. In the industrial hygiene profession this can be derived from direct quantitative analysis of body fluids, tissue, or expired air for the presence of the substance or metabolite.[4]

BREATHING ZONE – The vaguely defined envelope of air surrounding the worker's head, which is thought, based on observation and the nature of the operation, to have approximately the same concentration of the contaminant being measured as the air breathed by the worker.

CARCINOGENS – Chemical, physical, or biological agents capable of producing cancer in man or animal.

CHEMICAL AGENT – Any chemical substance which affects the body, a part of the body, or any of its functions. The effects may be beneficial or injurious.

COMBINED EFFECT – Effects of simultaneous exposure to multiple physical, chemical or ineffective agents in the working environment, as is usually the case in occupational exposure; these effects may be independent of each other, or represent the aggregate effect of the same agents when considered separately (additive effects); in rare cases, they may be either stronger than the aggregate effects (synergistic effects) or weaker than if they had been separate (antagonistic effects).[2]

CONTAMINANT – Solid, liquid or gaseous matter, micro-organism, odour or any combination of them, likely to impair the quality of the working environment.[2]

CONTROLS – Measures, including devices, to regulate a process, action, system, apparatus or machine within prescribed limits or standards of safety and operational effectiveness. Controls can be divided according to time factor into interim and long-term controls, and according to strategies used administrative, engineering, safe work practices and use of personal protective equipment (see individual definitions).

DECOMPOSITION – Separation or breakdown of a material (may be chemical or physical).

DESIGNATED SUBSTANCE – A biological, chemical or physical agent or combination thereof prescribed as a designated substance by a regulation made under the Occupational Health & Safety Act and exposure to which is prohibited, regulated, restricted, limited or controlled.

DUST – Particulate type of airborne solid contaminant, the particle size being greater than that of a fume. Dusts are usually produced by the mechanical erosion of a solid. They can have various biological effects (e.g. fibrogenic, toxic).

EMBRYOTOXIN – See TERATOGEN.

ENGINEERING CONTROLS – Controlling, limiting, or reducing the exposure to a regulated or toxic substance or physical agent by ventilation, isolation, enclosure, and design of the workplace, plant, and equipment by one or more of such means.[1]

EXPLOSION – An effect produced by the rapid release of gases or energy (relatively great, if short lived, pressures are brought to bear upon the surroundings).

EXPLOSIVE LIMITS – The upper (UEL) and lower (LEL) values delineating the range of vapour concentration in air at which the propagation of flame occurs on contact with a source of ignition.

EXPOSURE – Allowing the body to be subjected to external influence either physical, chemical or biological, through one of the major routes of entry (inhalation, absorption or contact). Also see THRESHOLD LIMIT VALUES.

EXPOSURE CRITERIA – The airborne concentrations of chemical, biological or physical agents to which nearly all workers may be exposed without experiencing any adverse effects.

1. CEILING EXPOSURE CRITERIA (CEC) – the maximum exposure to an airborne concentration of a chemical, biological or physical agent that is not to be exceeded for an instant.
2. SHORT-TERM EXPOSURE CRITERIA (STEC) – the maximum airborne concentration of a chemical, biological or physical agent to which workers may be exposed from time to time, provided exposure is for not more than 15 minutes, is not more often than four times in a work day, and at least 60 minutes have elapsed from the time of the last previous exposure.
3. TIME-WEIGHTED AVERAGE EXPOSURE CRITERIA (TWAEC) – the time-weighted average concentrations or levels of an agent for a 40-hour week to which, it is believed, nearly all workers may be exposed day after day without experiencing adverse effects. (1)

EYE CONTACT – The result of a substance getting into the eyes. Severity of effects will depend on the nature of the substance, the amount involved, and first aid received.

FIBRE – (respirable) – Any organic or mineral structure or composition which by reason of their (its) length/diameter ratio may become deposited in the lung tissue and thereby cause harmful health effects.[2]

FLAMMABLE LIMITS – The upper and lower concentration limits of a combustible in an atmosphere through which a flame, once initiated, will continue to propagate at the specific temperature and pressure.

FLASHPOINT – The minimum temperature at which a liquid within a container gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.[5]

FUME – Aerosol of a finely-divided solid, consisting of particles of less than 1 micrometer in diameter, generally formed either by combustion in the air, which causes solid particles to be airborne (metallic oxides, ashes, soot) or by the condensation of a vapour.[2]

GAS – A state of matter in which the molecules are unrestricted by cohesive forces. They are formless "fluids" that expand to occupy the space or enclosure in which they are confined.

HAZARD – The possibility of impairment to health following exposure to a specific substance; the level of the hazard depends not only on the toxicity of the substance itself, but also on the use and absorption rate.

HAZARD ANALYSIS – Search for and recognition of possible exposures.

HAZARD RATING CODE – A system for quantifying and communicating the hazards associated with given substances or procedures.

HAZARDOUS MATERIAL – Any material or substance which, if improperly handled, can be damaging to the health and well-being of man.[6]

HYPERSENSITIVE – The condition of being affected by substances that do not affect most people.

INDUSTRIAL HYGIENE – That science and art devoted to the recognition, evaluation and control of those occupational environmental factors which can induce injurious effects in man.

INHALATION – To take into the body by way of the respiratory tract.

INGESTION – To take into the body by way of the digestive tract.

INTERIM CONTROLS – Those which are instituted immediately for temporary control only until more permanent long-term control strategies can be put into effect.

I.R. – Regulation covering Industrial Establishments made under the Ontario O.H. & S. Act.

IRRITANTS – A substance, generally in the form of a gas, aerosol, or dust, or agent able to cause inflammatory reactions of the respiratory tract, conjunctive tissues or skin.[2]

LEGAL REGULATION – Rule or order prescribed by government. In Canada, generally passed by cabinet, pursuant to an act of Parliament or Legislation.

LEGAL REQUIREMENT – That which is demanded of a person or body by statute, regulation, common law, or by-law.

LOCAL EXHAUST – Capturing a contaminant at its source, usually by use of hoods, ducts or vents located near or directly over the source.

LONG-TERM CONTROLS – Control strategies meant to be more or less permanent. Includes all standard approaches and administrative, engineering, work practices and if only absolutely necessary or as an additional safeguard, use of personal protective equipment.

LOWER EXPLOSIVE LIMIT – (LEL) – See EXPLOSIVE LIMITS

mg/m^3 – Milligrams of a substance per cubic metre of air.

MISTS – Suspended liquid droplets generated by condensation of liquids from the vapour back to the liquid state, or by breaking up a liquid into a dispersed state (by splashing, atomizing, etc.)

MONITORING – Systematic surveillance of the hazards to which workers are exposed. It may be carried out either by environmental (workplace) or biological (worker) measurement.

MUTAGEN – Substance or agent capable of causing sudden and lasting changes in one or more hereditary features, generally by modifying one or more genes. These changes may or may not be transmitted to descendants.

NUISANCE DUSTS OR PARTICLES – Those which have little adverse effects on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control.

OCCUPATIONAL HEALTH – As a practice should aim at promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention among workers of departure from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological equipment; the adaptation of work to man and each man to his job.[7]

ONTARIO O.H. & S. Act – An Act respecting the occupational health and occupational safety of workers in Ontario. It is administered by the Ontario Ministry of Labour.

PARTICLE – A small discrete mass of solid or liquid matter.

PARTICULATE MATTER – Aerosol which includes solids, condensed fumes, etc.

PERSONAL PROTECTIVE EQUIPMENT – Devices worn by the worker to protect against hazards in the environment. Respirators, gloves, and ear protectors are examples.

PERSONAL MONITORING – A technique used to determine the concentration of a chemical, physical or biological agent present in the breathing zone of the worker. This is done by means of a sampling device worn on the worker's person.

PHYSICAL AGENT – Any physical force, radiation or influence which affects the body, a part of the body, or any of its functions. The effects may be beneficial or injurious (noise, radiation, heat).

ppm – Parts of gas or vapour per million parts of air by volume at room temperature (25° C) and pressure (760 mm). For example 1 cubic centimetre of gas in 1 million cubic centimetres of air has a concentration of 1 ppm.

REACTIVITY – That property of a substance indicative of its stability under various conditions.

RESPIRABLE PARTICLES – Particles which are of a size capable of reaching parts of the respiratory tract.

ROUTE OF ENTRY – The method of passage into the body. In this case, we consider entry by absorption, inhalation, and direct contact.

SKIN CONTACT – The result of a substance getting on the skin. Severity of effect depends on the nature of the substance, the amount involved, and immediate action taken (i.e. first aid).

SMOKE – Consists of carbon or soot particles (usually less than 0.1 micrometers in size) and results from the incomplete combustion or carbonaceous materials such as coal or oil.

STANDARD (OF EXPOSURE) – See EXPOSURE.

STEL – SHORT-TERM EXPOSURE LIMIT – See EXPOSURE LIMIT.

SUBSTANCE – Any chemical compound or mixture, raw material, or intermediate used in any process or operation.

SUSCEPTIBILITY – The capability of being affected; vulnerability.

TERATOGEN – An agent capable of causing deformity of the fetus. The term EMBRYOTOXIN is increasingly being used. It includes any substance or agent which can cause harm to the fetus and includes teratogens.

THRESHOLD LIMIT VALUES (TLV) – Term copyrighted by ACGIH and used by them for defining permissible exposure limits. They are meant to be used merely as guidelines. For a full description, refer to the TLV booklet. (See Reading List).

TIME-WEIGHTED AVERAGE EXPOSURE CRITERIA (TWAEC) – See EXPOSURE CRITERIA.

TOXIC – Injurious to health when taken into the body (by any route of entry).

TOXICITY – A relative property of a chemical agent; refers to a harmful effect on some biologic mechanism and the condition under which this effect occurs.

UNSTABLE – Compounds which readily decompose or change into other compounds.

UPPER EXPLOSIVE LIMITS (UEL) – See EXPLOSIVE LIMITS.

VAPOUR – The gaseous phase of substances that are normally in the solid or liquid state at room temperature and pressure. Evaporation is the process by which a liquid is changed into the vapour state and mixed with the surrounding atmosphere.

VENTILATION – The simultaneous supplying and exhausting of air to an enclosed machine, room, or entire building. The ACGIH Ventilation Manual specifies methods for control of various toxic airborne contaminants. (See also general ventilation, local exhaust.)

VOLATILE – Evaporating easily; passing off readily in the form of vapour.

WORK PRACTICES – Procedures for carrying out specific tasks, which, when followed, will ensure that worker's exposure to hazardous situations, substances, and physical agents is controlled by the manner in which the work is carried out.

(1) Ontario Ministry of Labour definition.

(2) International Labour Office. ENCYCLOPEDIA OF OCCUPATIONAL HEALTH & SAFETY.

(3) National Safety Council definition.

(4) Clayton & Clayton (eds) PATTY'S INDUSTRIAL HYGIENE & TOXICOLOGY.

(5) National Fire Code of Canada, 1977.

(6) The Condensed Chemical Dictionary, 9th edition (1977).

(7) World Health Organization definition.

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* Basic books which we feel are good reference texts for anyone intending to apply or get a better understanding of principles of Occupational Health. Where possible, approximate costs and suppliers' addresses are included.