D

THE WORKPLACE SURVEY

INDEX

Note: The form referred to above is contained in a pocket in the inside back cover

Introduction

In the previous section, the objective was to identify substances used or stored in the workplace which had potentially toxic effects. A system for rating such substances according to the type and degree of the potential hazards was suggested. However, in order to evaluate the extent of the *actual hazards* to which employees may be exposed in the workplace because of the presence of these potentially toxic substances, it is necessary to investigate:

- The nature of the work being done. Is a particular process continuous or intermittent? Is an activity routine or occasional? (This will help determine length of exposure to any associated work hazards)
- The type of process in which substances are being used.
- Whether any other toxic substances are being generated as a result of the process.
- The adequacy of existing controls in the workplace (e.g. ventilation).

This section, therefore, is designed to help you in these further investigative steps. This includes a job hazard analysis and a walk-through survey. Suggested procedures for these are outlined.

Objectives:

1)To identify the potential and actual chemical hazards associated with the use of these substances in the workplace.
2)To identify problem areas where you can institute immediate basic control measures.
3)To identify problem areas about which you may need to consult a specialist.

STEP 1

Prepare Floor Plan

In preparation for your workplace survey, you should make a fairly large plan of your plant marking in·

- receiving and storage areas
- work stations
- jobs/activities carried out in each work area/work station
- substances used and stored in different areas
- eating areas
- toilet facilities
- first aid stations

Basic Floor Plan

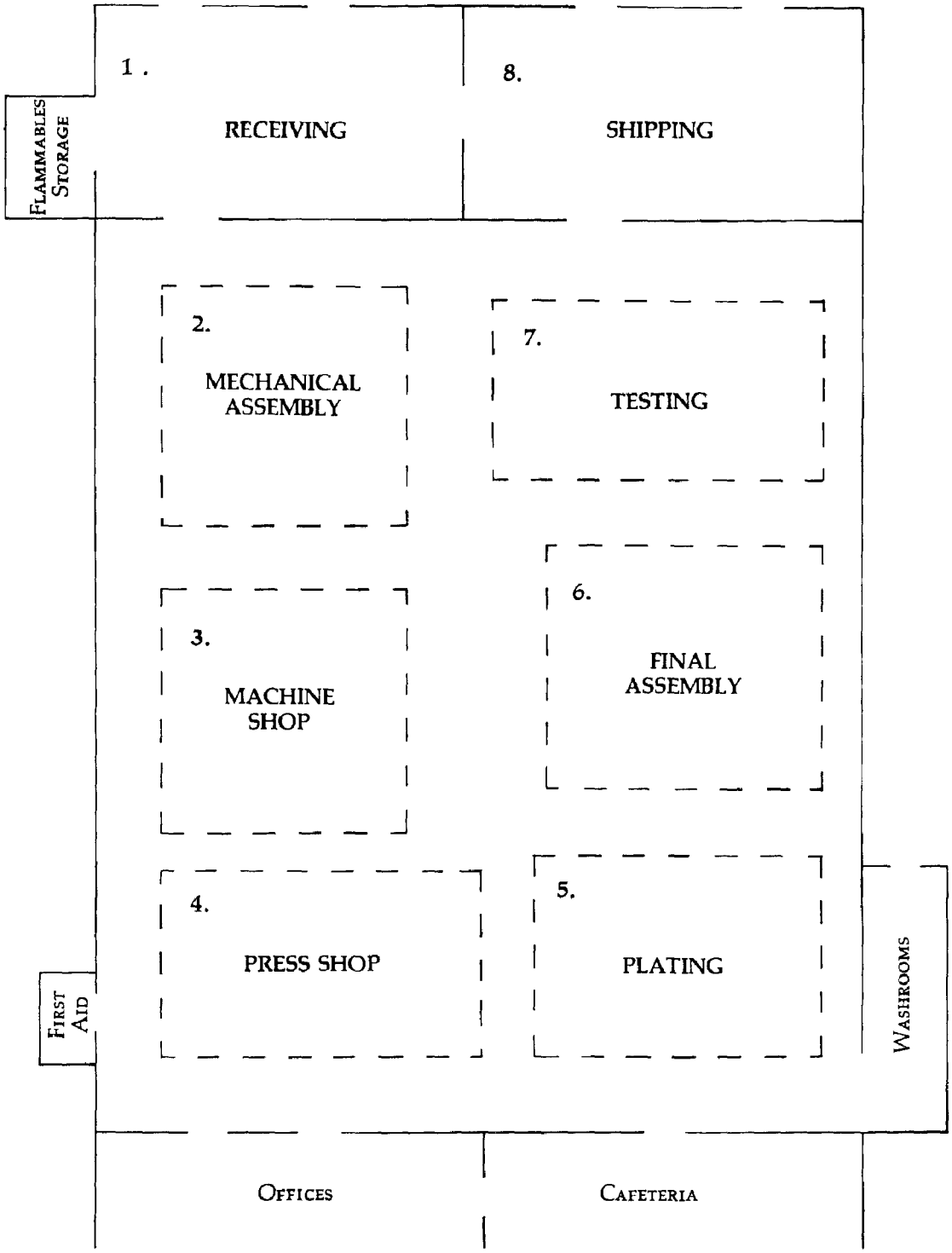


FIGURE 2

Floor Plan Showing Activities, Potential Health Hazards & Existing Controls

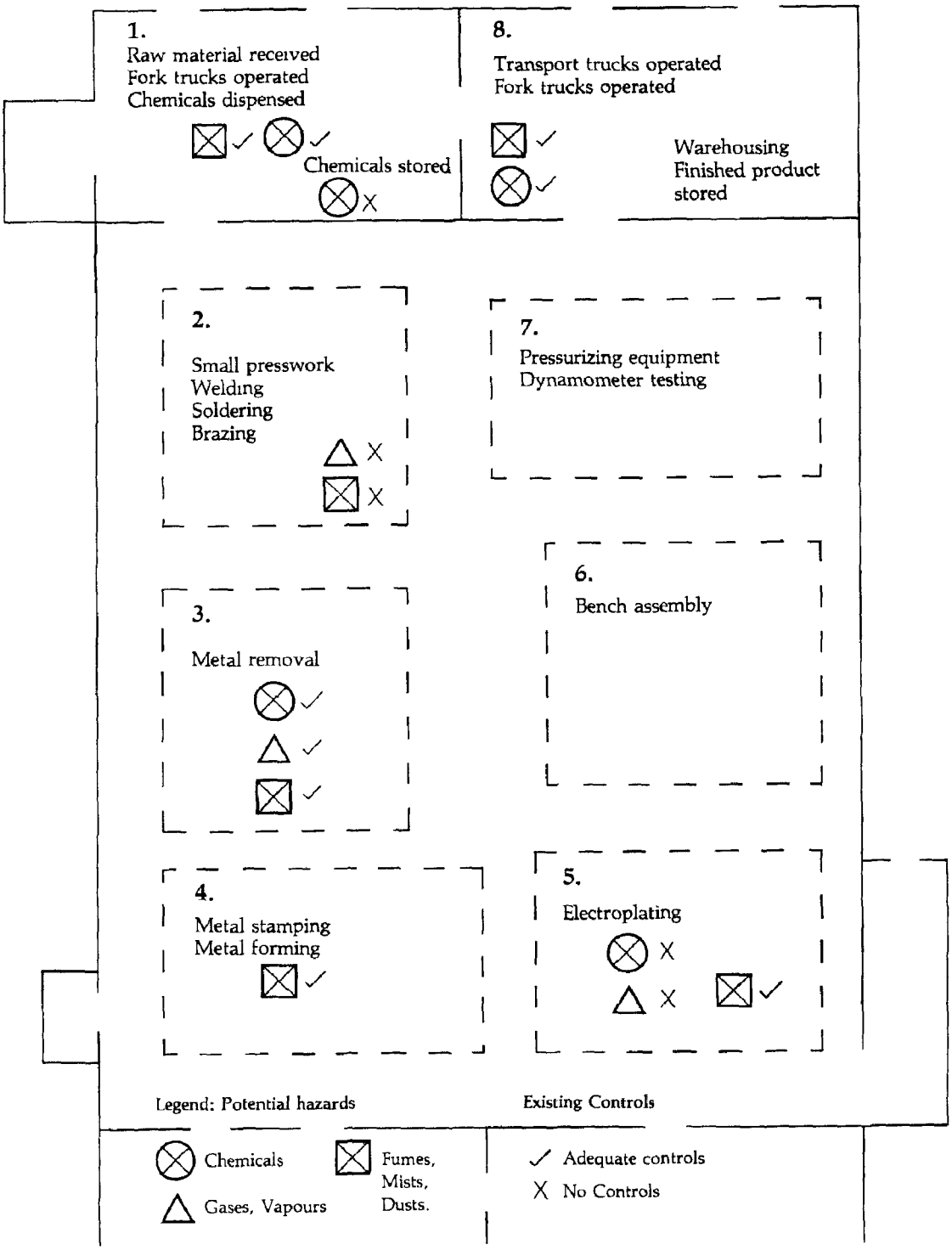


FIGURE 3

STEP 1 (cont'd)

You will be using this floor plan to mark in relevant data as it is collected. Figure 2 is a basic floor plan. Based on information obtained through the preliminary survey, you can identify on this floor plan where chemicals are stored or used.

Figure 3 will give you an idea of the kind of information you can usefully record on the floor plan in conjunction with your job hazard analysis and walk-through survey.

You will find this method of recording hazards useful for other types of inspections (e.g. fire and emergency) You may need a separate floor plan for each type of inspection to avoid over-crowding of information. You should also find these useful for developing checklists for inspection.

(If you use a transparent overlay for making your floor plan, you will be able to make corrections without having to transfer all the other information on to a new floor plan. The use of overlays will also allow you to place one over the other so that you can see at a glance all of the hazards in a particular area.)

STEP 2

Identify Potential Job Hazards Associated With Substances Used Or Generated

In order to identify potential job hazards, follow the procedure in Appendix D1, using Form # CH5 "Health Hazard Survey Table". Prior to this, you should become familair with typical industry hazards which may apply to your plant (See Appendix D2).

STEP 3

Conduct Walk-Through (Controls) Survey

Having completed Step 2, you are now in a position to conduct a walk-through survey to examine your existing controls. This survey should be done by the Chemical Control Co-ordinator with perhaps the department's supervisor and a member of your health and safety committee.

Care must be taken in selecting the appropriate time for the walk-through survey. Ideally the survey should be conducted at a time of maximum production activity.

You should first prepare a checklist of the items you must examine during this walk-through survey. In preparing a check-list, you should consider all identified potential job hazards. These may be either airborne or direct contact hazards (e.g. picking up soaked rags with bare hands, chemical splashes on body or in eyes, etc) Appendix D3 will give some suggestions for items to be included in a checklist —please treat these as a guide only; you must prepare your own checklist depending upon your individual needs.

Record your observations, noting the condition of the equipment, the existence or lack of controls, etc. Make a note of the number of employees in addition to the operators who are exposed to the hazard.

During this survey, it may be necessary for your maintenance engineer to check ventilation systems. Any defects in the system or in the equipment must be immediately corrected.

Summarize your findings in the Hazard Evaluation portion of Form # CH5.

STEP 4

Initiate Immediate Action

An analysis of the data you have collected will reveal areas in which you can take immediate action. Appendix D3 also gives examples of some recommended control action you can take at this stage in respect of deficiencies noted. They are, for the main part, simple control measures which may be all that are needed to keep your chemical hazards under control. Even if results of the air sampling you may be doing at the next step show that exposure to these hazards is well within suggested safe limits, you should have these basic controls in place. This is because your aim should be to keep exposures as low as possible when dealing with chemical health hazards.

STEP 5

Conduct Initial Air Sampling

After you have corrected all observed defects in your ventilation systems, you will be ready to conduct initial air sampling to determine whether exposures to airborne concentrations of toxic chemicals are within recommended safe limits. Depending upon your situation and available expertise, you may require a consultant to carry out air sampling. However, commercially available detector tubes and badges may be appropriate in some circumstances. Use of these requires a minimum amount of training Other more sophisticated methods require specialized training.
The following are some important considerations in the selection and use of proper air sampling equipment:

1)That you know exactly what you are sampling for and an approximation of expected levels.

2)That you read the manufacturer's specifications, usage instructions and other information for each piece of air sampling equipment used.

3)That the presence of other substances in the air can interfere with the collection and/or analysis of the particular contaminant under investigation.

4)That the sample is taken properly from the employee's breathing zone.

5)That you become aware of the limitations of air sampling methods. Results relate to the time at which the sample was taken whereas concentrations may vary at different periods and times of the day. Therefore, there should be careful selection of sampling sites, the number of samples taken and the timing of the sampling periods. Samples other than those of the direct reading type should be sent to a recognized laboratory for analysis (See Appendix D5).

6)That any recognized techniques are considered. In Ontario, air sampling methods for certain substances (i.e. the designated substances) are the subject of mandatory codes. (See Reading List for other references.)

STEP 6

Determine Further Action Needed

Further control action to be taken will depend to some extent upon your air sampling results. If the airborne concentration of an individual contaminant in the workplace is above, at, or close to* the accepted safe exposure limit, you should:

- immediately look into engineering and/or other controls (See Section E).
- establish a periodic air sampling program to ensure that the controls you establish are functioning properly. Depending upon the toxicity of the substance, the nature and frequency of the operation and the actual contaminant levels in the workplace air, you may consider setting these at yearly, bi-annual or quarterly periods.
- set up a system for recording the results of your air sampling tests. This will enable you to detect any upward trends.
- ensure that the proper work practice controls are established and followed.

*As a rule of thumb, the variability of sampling results suggests that if initial results are over 50% of the recommended TLV, more extensive air sampling should be carried out to better determine workplace exposures and assess whether a problem does exist.

Depending upon the nature of the problem, you may find it necessary to call in a consultant to evaluate existing engineering controls and suggest necessary modifications. A consultant may also be needed in the following circumstances:

- where there is the possibility of two or more substances combining in the workplace air to form a toxic contaminant.
- employees complain of unusual symptoms, e.g. eye irritation, headaches, etc., even after you have taken all possible measures to control exposures.
- substances are being used which require sophisticated and complex sampling procedures.

APPENDIX D1

Job Hazard Analysis Procedure

During the job hazard analysis, you will be looking for possible exposures through all routes of entry as well as for possible direct contact (skin and eyes). Select the job to be analyzed, ask yourself a standard set of questions and tabulate the potential hazards as you identify them. Part 1 of Health Hazard Survey Table (Form # CH5 will be useful for this purpose.

PROCEDURE

Part 1 — Hazard Recognition

Ask yourself Questions 1 to 7 and if the answer to any of them is yes:

- Enter job title
- Make an entry against "Process/Activity" indicating if it is: a continuous (C) or intermittent (I) process, or a routine (R) or occasional (O) job.
- In the column headed "Substance" enter the name of the substance used.
- In the column headed "Agent", show the type of contaminant, e.g. dust, fumes, gas, vapour, mist, smoke or liquid.
- In the "Form of Exposure" column, enter:

  INHALATION: If the substance can get into the air and the employee can breathe it.

  INGESTION: If the substance can be transferred to the worker's mouth via the hands or some other means.

  DIRECT CONTACT: If the substance can get on to the skin or into the employee's eyes.

QUESTION #1 - DUST

Is the process capable of generating dust? Does it involve the agitation of loose, dry materials, such as mixing, conveying, sifting, screening, sieving, bolting? Is there a solid material being sawn, sanded, grooved, crushed? Is the material fibrous in nature? Is the process likely to break the fibres and release them into the air? Is there any evidence of dust around the work area, on the operator's clothes, on horizontal surfaces or on the floor? This is something for which you must check during your walk-through survey (Step 3).

QUESTION #2 - FUMES

Does the process generate fumes? Fumes may be generated by metals or other materials used in welding, brazing, smelting, galvanizing, soldering, etc.

QUESTION #3 - GAS

Does the process use or generate gas? It is fairly easy to tell if gases are being used in a process - they are usually in bottled form or are piped in from some other storage area.
It is not always easy to tell if gases are being generated by the process. Gases are formed during combustion, such as in welding, where the welding rod is consumed; and in internal combustion engines, where gasoline and a small quantity of oil are consumed. Gases can be formed by chemical action, such as mixing chemicals, electroplating, pickling, battery charging, etc. This is one area where additional investigation or special assistance or advice may be useful in detecting a hazard.

QUESTION #4 - VAPOUR

Does the process generate vapours? Vapour is the gaseous form of a material which is normally liquid at room temperature. Most industrial vapours result from the evaporation of volatile solvents. If a solvent or a material containing a solvent is used in a process, it will generate vapours to which the operator could be exposed.

QUESTION #5 - MIST

Does the process generate mists? Does it involve spraying or atomizing a liquid, such as in spray painting or spraying of oil mists for cooling or lubrication? Does a foaming, splashing, effervescing of the material take place, such as in some electroplating or electro-cleaning processes?

QUESTION #6 - SMOKE

Does the process generate smoke? Smoke is the result of incomplete combustion and consists of particles of organic materials. (The tars that are formed from inorganic materials from incomplete combustion may be potentially carcinogenic.)

QUESTION #7 - LIQUID

Does the process involve the use of chemicals in liquid form which could come in contact with the skin or eyes (e.g. manual mixing, pouring, etc.)? Is there the possibility of splashing and spilling?

Part 2 - Hazard Evaluation

Use this section of Form #CH5 to summarize the results of your walk-through survey (Step #3 of your Workplace Survey) Show the recommended TWAEC or TLV/TWA of the substance in the appropriate column.

Part 3 - Recommended Control Action

After you have evaluated your hazards in the light of existing controls, you will be able to initiate some further control measures (Step #4 of your Workplace Survey). Any air sampling results should also be recorded so that they can be compared with the recommended TWAEC or TLV/TWA of the substance in order to help in determining whether any further controls are needed.

APPENDIX D2

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

(Reproduced from *Industrial Hazards and their Evaluation.* Worker's Compensation Board of British Columbia, Vancouver, B.C.)

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Abrasives (Manufacture)	Dust	aluminum oxide, silicon carbide, silica, emery, corundum
	Gas/Vapours	carbon monoxide, solvent vapours from adhesives, vapourized resins
Adhesives (Manufacture and Use)	Vapours	solvent vapours, resins
Asphalt Paving	Dust	silica, silicates, carbonates
	Vapours	polycyclic aromatic hydrocarbons, aromatic and aliphatic hydrocarbon solvents
Automotive (Repair and Maintenance)	Dust/Fibres	asbestos, metal and resin dust from grinding
	Fumes	metal oxides (welding)
	Gas/Vapours	petroleum solvents, gasoline, carbon monoxide, hydrogen, nitrogen oxides, styrene, acetone, isocyanates, organic peroxides
Bakeries	Dust	flour, other vegetable dust, yeast, molds
Battery Manufacture	Dust/Fume	lead, cadmium
	Gas	hydrogen, formaldehyde, vinyl chloride
	Mists	sulfuric acid, hydrochloric acid, alkali mists
Beverage and Soft Drink Manufacture	Gas	ammonia, carbon dioxide
	Mists	caustic mists
Blasting, Abrasive	Dust	silica, silicates, carbonates, lead, cadmium, zinc

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Boiler Making	Dust	silicates, fluorides, carbonates
	Fume	welding fumes, metal fumes
Brewing	Gas	refrigerant gases, carbon dioxide
	Mist	caustic mists
Brick and Tile Manufacture	Dust	silica, silicates, fluorides, carbonates
	Gas (Kilns)	carbon monoxide
Business Machines (Photocopying and Duplicating)	Gas	ammonia, ozone
	Vapours	methyl alcohol, chlorinated hydrocarbons, and petroleum solvents
Can Manufacturing	Fumes	metal fumes
	Vapours	solvent vapours
Cement Manufacture	Dust	silica, silicates, fluorides, carbonates, chromates
	Gas (Kilns)	carbon monoxide
Cement Products Industry	Dust	cement
	Fumes	welding fumes
	Gases/Vapours	gasoline, acetone, lacquer thinner, kerosene, fuel oil, Stoddard solvent
Charcoal Production	Gas	carbon monoxide, polycylic aromatic hyrdocarbons
Chemical Manufacture Acid Plants	Gas	sulfur dioxide, nitrogen oxides
	Mists	acid mists
Benzoic Acid	Dust	benzoic acid
Chlor-alkali Plant	Gas/Vapour	chlorine, mercury
	Mist	sodium hydroxide
Fertilizer	Dust	fluoride, phosphate, silicates carbonates, diatomaceous earth
	Gas	ammonia, hydrogen fluoride
	Mist	phosphoric acid
Solvents	Vapours	solvent vapours - alcohols, ketones, esters, aliphatic hydrocarbons, aromatic hydrocarbons, chlorinated hydrocarbons
Clay	Dust	mica, silicates, iron oxide, silica (quartz)
Coal Handling	Dust	coal dust, silica
	Gas	sulfur dioxide, carbon monoxide
Coke Handling	Dust	coke dust

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Coking	Gas	carbon monoxide, ammonia, hydrogen sulfide, sulfur dioxide, phenols, cyanides, naphthalene and other polycyclic aromatic hydrocarbons, benzene, pyridine, carbon disulfide
Dairy Processing Industry	Mist	alkali mists
Dental Industry	Vapour	mercury
Detergent Manufacture and Use	Dusts	proteolytic enzymes, sodium perborate, phosphates
	Mists	alkali mists
Distilleries	Vapour	alcohol (ethyl alcohol)
Drilling (Rock)	Dust	silica, silicates, carbonates, fluorides
Dry Cleaning	Vapour	perchloroethylene, trichloroethylene, petroleum solvents
Electrical Components Manufacturing Industry	Fumes	metal fumes (silver, lead, cadmium, tin)
	Vapours	solvent vapours, freon gases
Electroplating and Galvanizing		
Acid	Gas	hydrogen
	Mist	chromic acid, sulfuric acid, cyanide, sulfamate, hydrochloric acid, hydrofluoric acid
Alkaline	Gas	ammonia
	Mist	sodium stannate (tin salt)
Cyanide	Gas	ammonia, hydrogen cyanide
	Mist	cyanide, alkali
Electrodeless Plating	Gas	formaldehyde, ammonia
Electropolishing	Gas	hydrogen fluoride, hydrogen chloride
	Mist	sulfuric acid, hydrofluoric acid, phosphoric acid, hydrochloric acid, chromic acid, perchloric acid
Fluoroborate	Mist	fluoroborate mist
Galvanizing	Dust	metal oxides
	Fumes	lead, zinc
	Gas	ammonia, hydrogen chloride
	Mist	alkali, hydrochloric acid, sulfuric acid
Explosives	Gas	oxides of nitrogen, carbon monoxide, sulfur dioxide

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Fibreglassing (also see plastics)	Dust	asbestos, wood dust, glass fibres, resins, glycols, peroxides
	Vapours	acetone, styrene, amines, alcohols, phthalates, methyl ethyl ketone, toluene, phenol, isocyanates
Foundries, Furnaces and Forges		
Basic Oxygen Furnace Material Handling	Dust	iron oxide, graphite, limestone, ore, mill scale, fluorspar
Forging	Gas	sulfur dioxide, carbon monoxide, carbon dioxide
	Vapour	acrolein
Foundry Operations	Dust	silica, silicates, carbonates, fluoride, cyanides
	Fumes	metal oxides
	Gas	ammonia, carbon monoxide, sulfur dioxide, phosgene, chlorine, fluorine, nitrogen oxides
	Vapours	acrolein, aldehydes. phenols. isocyanates, polycyclic aromatic hydrocarbons
Furnace Operations (all types)	Dust/Fumes	iron oxide, other metal oxides, fluxing agents
	Gas	sulfur dioxide, carbon monoxide, other combustion products
Leaded Steel Making	Dust/Fumes	lead oxide, iron oxide
Sintering	Dust	iron oxide, silica, fluorides, carbonates, metal oxides
	Gas	sulfur dioxide, carbon monoxide
Tandem Mills	Mist	oil mists
Frozen Food Industry	Gas	ammonia, methyl chloride, freons
Gases - Compressed Manufacture and Filling	Gas	asphyxiating, corrosive or toxic gases, flammable or explosive gases
Glass Industry		
Etching	Gas	hydrogen fluoride
Fibreglassing (see fibreglassing)		
Manufacture	Dust/Fumes	silica, lead, soda ash, potash, vanadium, arsenic
	Fibres	asbestos
	Gas	sulfur dioxide, hydrogen fluoride
	Mist	oil mists

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Hair and Bristle Processing Industry	Dust	fibre dust, spores of animal diseases
	Gas/Vapours	sulfur dioxide, hypochlorite vapour
Hospitals	Gas	formaldehyde, anaesthetic gases, ethylene oxide
Insulation Manufacturing	Dust	mineral dust, cellulose dust, silica
	Fibres	asbestos, glass
	Vapours	isocyanates
Joineries, Cabinet Making and Furniture Manufacture	Dust	wood dust
	Vapours	solvents, glues, paints
Metal Cleaning and Surface Treatment Operations		
Abrasive Cleaners	Dust	silica, insoluble silicates, calcium carbonate, pumice, sodium carbonate, sodium silicate, di- and tri-sodium phosphate
Acid Cleaners dipping	Gas	oxides of nitrogen, hydrogen, hydrogen chloride
	Mist	nitric acid, sulfuric acid, chromic acid, hydrochloric acid
pickling	Gas	oxides of nitrogen, hydrogen fluoride, hydrogen chloride, hydrogen cyanide, hydrogen, arsine
Alkaline Cleaners	Mist	alkali mists
Case Hardening	Gas	carbon monoxide, oxygen deficiency, cyanides
Etching	Gas	hydrogen fluoride
	Mist	alkali mists
Degreasing	Vapours	trichloroethylene, perchloroethylene, petroleum and chlorinated hydrocarbon solvents
Strike Solutions	Gas	hydrogen chloride
	Mist	cyanide, chloride
Stripping Operations	Gas	hydrogen chloride, oxides of nitrogen
	Mist	hydrochloric acid, chromic acid, acetic acid, nitric acid, hydrofluoric acid, cyanide, alkali mists
Metal Spraying	Dust/Fumes	metals and oxides of metals (e.g. nickel, chromium, cobalt)
Paint Manufacture	Fumes	lead oxide, mercuric oxide resins
	Vapours	solvents, isocyanates, polyurethanes, insecticide

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Paperboard/Container Industry	Fumes	welding fumes
	Gas	formaldehyde, carbon monoxide
	Vapours	gasoline, acetone, lacquer thinner, kerosene, fuel oil, Stoddard solvent
Pest Control Fungicides, Herbicides, Pesticides, Rodenticides	Dust/Vapours	organophosphorus compounds, halogenated hydrocarbons, lead arsenate, carbonates, thiocarbonates, dinitrocresol, thallium and its compounds, coumarin, indane and derivatives, chloropicrin, mercury, creosote, dinitrophenol, solvents
Petroleum Refineries	Gas	hydrogen sulfide, mercaptans, liquified petroleum gases
	Vapours	solvent vapours
Photographic Industry	Dust	organic dyes
	Vapours	aminophenols, hydroquinone, acetic acid
Plastics and Resins	Gas	thermal decomposition products, (carbon monoxide, carbon dioxide, oxides of nitrogen), blowing agents
Plastics and Resins	Vapours	isocyanates, monomers (e.g. styrene, vinyl chloride)
Plumbing, Heating and Air Conditioning Contractors	Fibres	asbestos, glass
	Fumes	welding fumes
	Gas	carbon monoxide, refrigeration gases
	Mist	acid mists, caustic mists
	Vapours	solvents
Pottery and Porcelain Industry	Dust	clay, silica, silicates
	Fumes	lead
Power Stations (thermal)	Dust	vanadium oxide, nickel
	Gas	sulfur dioxide
	Mist	oil
Printing	Dust/Fumes	lead, chromium compounds, antimony, nickel salts
	Mist	chromic acid, alkalis
	Vapours	solvents (turpentine, benzene toluene, xylene, alcohols)

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Pulp and Paper Industry		
Bleaching	Gas	chlorine, chlorine dioxide, sulfur dioxide
Chlorine Dioxide Generation	Gas	sulfur dioxide, chlorine dioxide, chlorine
	Mist	sulfuric acid mist
Digesting	Gas	methyl mercaptan, dimethyl sulfide, dimethyl disulfide, hydrogen sulfide
Lime Kiln	Dust	calcium oxide, calcium carbonate, sodium oxide
	Gas	carbon dioxide
	Mist	alkali mist
Recovery Furnaces	Dust	sodium sulfate
	Gas	carbon dioxide, sulfur dioxide, hydrogen sulfide, mercaptans
Refrigeration Plants	Gas	ammonia, hydrogen chloride, ethane, chlorine, methyl chloride, phosgene, sulfur dioxide, ethyl chloride, propane, butane, ethylene, freons
Rock Crushing and Drilling	Dust	silica, silicates, carbonates, fluorides
	Gas	internal combustion engine exhaust gases - oxides of nitrogen, sulfur dioxide, carbon monoxide, aldehydes
Roofing Industry	Dust/Fibres	asbestos, cement dust
	Fumes	metal oxides
	Vapours	solvents, asphalt
Rubber Industry		
Synthetic	Mist	acetic acid, sulfuric acid
	Vapours	acrylonitrile, benzene, butadiene, chloro-butadiene, isocyanates, styrene, ethyl benzene, isoprene, dichloroethane
Vulcanizing	Gas	sulfur dioxide
	Vapour	organic solvents
Sawmilling and Planing		
Filing Room	Dust/Fumes	cadmium, metals, metal oxide, mineral dust, welding fumes
	Fibres	asbestos
Wood Rooms	Dust	wood dust
	Mist	oil mist

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Scrap Metal Processors	Fumes	lead, cadmium, mercury, zinc, welding fumes
	Gas	fluorine
	Vapours	solvents
Sewage Disposal and Treatment	Gas	methane, carbon dioxide, hydrogen sulfide, mercaptans
Sewers	Gas	oxygen deficiency, methane, carbon monoxide, hydrogen sulfide, carbon dioxide, liquified petroleum gases
	Vapours	gasoline, petroleum solvents
Shipbuilding	Dust/Fibres	asbestos, metal oxides
	Fumes	lead, organotin and organomercurial anti-fouling paints, welding fumes
	Gas	combustion products (carbon monoxide, oxides of nitrogen)
Sign and Advertising Display Manufacturers	Fibres	asbestos
	Fumes	welding fumes
	Vapours	methylene chloride, methyl ethyl ketone, methanol, xylene, mercury
Silos	Gas	oxygen deficiency, oxides of nitrogen
Slaughtering Plants (Digesters and Rendering)	Dust	sodium hydroxide, sodium carbonate
	Gas	chlorine, refrigerant gases
	Mist	sulfuric acid, phosphoric acid, acetic acid
	Vapours	formaldehyde, phenol or cresol based sanitizers
Smelting and Refining	Dust/Fumes	metal oxides, selenium, tellurium, cadmium, arsenic, lead, bismuty, indium, silver, gold, fluoride, metal fumes and dusts
	Gas	arsine, sulfur dioxide, carbon monoxide, hydrogen selenide, hydrogen fluoride
	Mist	sulfuric acid, fluorosilicic acid
Soldering	Fumes	metal fumes (silver, cadmium, lead, tin)
	Vapours	formaldehyde, acrolein, aldehydes
Sterilization Processes	Gas	ozone, ethylene oxide, halogenated hydrocarbons

AIR CONTAMINANTS FROM INDUSTRIAL PROCESSES

PROCESS TYPE	CONTAMINANT TYPE	EXAMPLES OF CHEMICAL CONTAMINANTS
Tunnelling (underground)	Dust	silica, silicates, fluorides, carbonates
	Gas	internal combustion engine exhaust gases, oxygen deficiency, oxides of nitrogen, carbon monoxide, natural gases (methane), sulfur dioxide, aldehydes, explosive by-products
Water Supply and Treatment	Gas	chlorine, ammonia, hydrogen chloride, ozone
	Mist	hydrochloric acid, sodium hydroxide, calcium hydroxide
Welding and Thermal Cutting	Dust/Fumes	metal oxides, welding fumes, silicates, carbonates, fluorspar, metal fumes, fluoride
	Gas	oxides of nitrogen, ozone, phosgene, carbon monoxide, hydrogen fluoride
Wineries	Gas	carbon dioxide, refrigerant gases, sulfur dioxide
	Vapour	ethyl alcohol
Wood Processing and Treatment		
Wood Treatment	Dust	arsenic and copper compounds
	Vapours	pentachlorophenol, tetrachlorophenol
Plywood and Veneer Mills		
Filing Room	Dust/Fibres	metal dust (cadmium, tin, antimony, copper, lead), asbestos
Maintenance Shops	Fumes	welding fumes
	Gas	carbon monoxide, nitrogen oxides
Paint and Stains	Vapours	organic solvents, pigments (compounds of titanium, iron, lead, cadmium, chromium)
Sawing and Sanding	Dust	wood dust, wood preservatives
Veneer Drying Glueing and Patching	Dust	resins, catalysts
	Gas	ammonia, formaldehyde
	Vapours	isocyanates, methylene chloride, urea, phenol, terpenes, alcohols, aldehydes, esters, ketones

APPENDIX D3

Guidelines For Use in Conjunction With Action Step 3 (Walk-through Survey) and Step 4 (Immediate Action to be Initiated)

HAZARDS TO LOOK FOR/CONTROLS TO CHECK (STEP 3)	RECOMMENDED CORRECTIVE MEASURES (STEP 4)
AIRBORNE CONTAMINANTS • Traces of dust, smoke and fumes • Odours Make a record of these as they are an indication that contaminants are getting into the breathing air. (As a note of caution, however, do not assume that just because the air is clear, there are no contaminants. At some of the very low concentrations permitted for some substances, e.g. asbestos, 0.5 to 1 fibre/cm^3, the air will appear to be clear even if these concentrations are in the air)	
VENTILATION • Type of ventilation provided: General Local None • Is the system functioning properly? • Does it require cleaning or maintenance? Much of the equipment involved in hazardous dusty operations has built-in ventilation controls to capture the dust (local ventilation). If you find traces of dust, this is an indication that the system is not functioning properly and must be checked (see Appendix D4 for a suggested method of checking ventilation systems).	Correct any ventilation systems which are not functioning properly. This should be considered before any air sampling is carried out.

HAZARD TO LOOK FOR/CONTROLS TO CHECK (STEP 3)	RECOMMENDED CORRECTIVE MEASURES (STEP 4)
PERSONAL PROTECTIVE EQUIPMENT	
• Kind and type of personal protective equipment provided for the job?	Check any regulated codes and the supplier's data sheet to see if the equipment is of the correct type and take appropriate action, as needed.
• Is it of the correct type?	
• Are there any complaints about fit?	It is important to check this and make adjustments, as needed. Not only does ill-fitting equipment deter an employee from using it, it can also be a hazard in itself while not providing the required protection. (See next item regarding maintenance of personal protective equipment).
• Is there a procedure for routine cleaning and maintenance (repair and replacement) of personal protective equipment?	If not, establish procedure. For example goggles, respirators, etc., must be kept clean. Any equipment worn next to the skin must be cleaned and disinfected before being worn by another person. Employees should not be allowed to repair or make adjustments to their own equipment.
• Are proper storage facilities provided?	Proper storage of personal protective equipment is vital. Respirators should never be left on the work-bench when not in use - ideally, there should be a closed cupboard with a good inflow of clean air. Gloves, boots, aprons and overalls should have a separate storage area in the locker-room/washroom and *never* be taken out of the plant area by employees.
• Is the personal protective equipment being worn?	Provide training in and enforce use of personal protective equipment. Post signs in areas where personal protective equipment is required to be worn.

HAZARDS TO LOOK FOR/CONTROLS TO CHECK (STEP 3)	RECOMMENDED CORRECTIVE MEASURES (STEP 4)
WORK PROCEDURES/PRACTICES	
• Are there safe work procedures in respect of each job/activity involving the use of chemicals or the generation of chemical contaminants?	If not, take immediate steps to institute adequate procedures for all activities, including the disposal of toxic wastes. These must be supported by an on-going training program and a system of communicating hazards to employees. (See Section F for information and guidance in setting up a communications system.)
• Are there procedures for disposing of toxic or dangerous wastes?	
• Are they followed? (List deviations observed, including the non-use or improper use of personal protective equipment, e.g. handling chemicals with bare hands).	Draw these to the attention of the supervisor for immediate corrective action. In setting up such a procedure, refer to the supplier's disposal instructions or contact an authorized disposal authority. Cleaning staff must be made aware of the hazards and should not be expected to handle highlly toxic or dangerous materials.
• Is there smoking or eating in an area where there are ingestion hazards, e.g. where exposure to lead is a hazard?	Enforce "No Smoking" and "No Eating" Rules for designated areas. Post signs, as needed.
Are there separate eating facilities?	Provide as needed.
Are there adequate washing and toilet facilities?	Provide as needed. Encourage good personal hygiene habits and practices. Washrooms are best located near lunch rooms to encourage workers to wash before handling food.
• Is compressed air used to blow dust from employees' clothing or from equipment?	This should never be permitted. Toxic dusts could be blown into the air.
• Are proper containers provided for dispensing chemicals? Are they used?	Provide as needed. Enforce use.

HAZARDS TO LOOK FOR/CONTROLS TO CHECK (STEP 3)	RECOMMENDED CORRECTIVE MEASURES (STEP 4)
HOUSEKEEPING	
• Is there a sufficient number of disposal containers? Do they have lids? Are they being used?	Encourage good housekeeping practices by correcting any deficiencies noted and reinforce the need for following these practices through on-going training.
• Do workers keep their work areas clean?	
• Are there any chemical spills on floors?	Arrange for immediate cleaning up of these and all future spills in accordance with supplier's instruction.
• Look for hoses or other evidence of wetting down work areas for dusty operations. Is the wetting appropriate? Is it not being used where it should be?	Wetting down dusty areas will prevent dust dispersion. All dusty equipment should be cleaned before any maintenance work is carried out.
• Check cleaning equipment/methods, e.g. dry sweeping of powdered chemicals - are vacuum cleaners of the appropriate type - do they capture all particles or can small ones be blown out?	Take action, as needed.

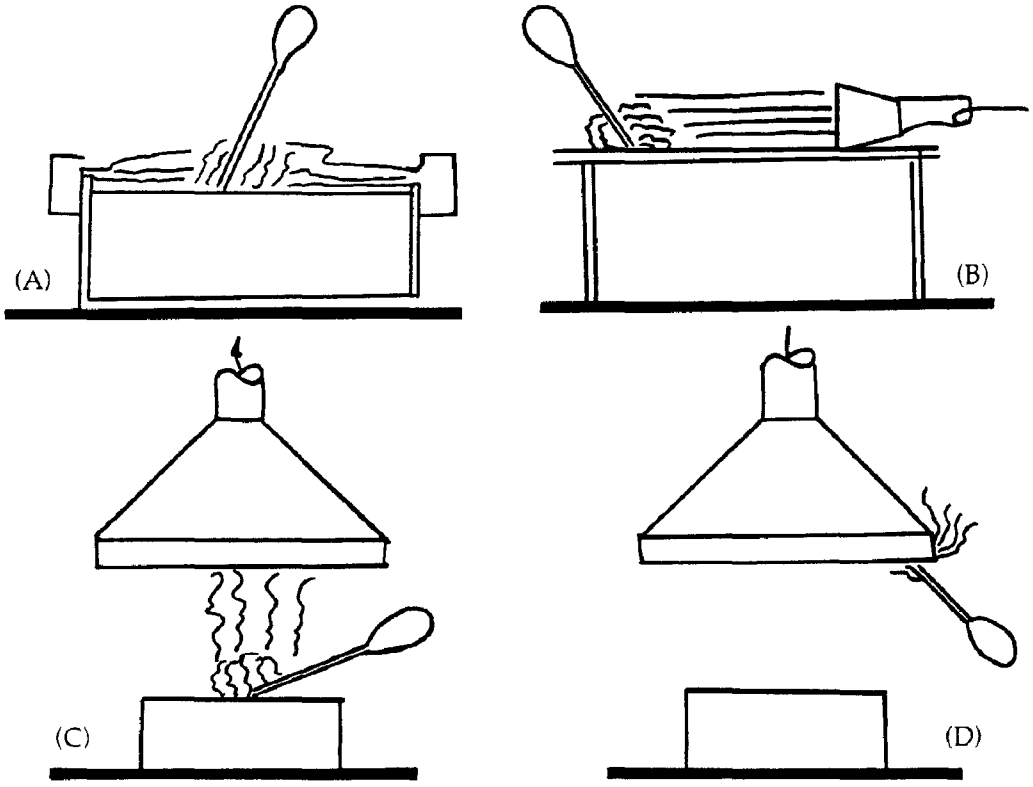
HAZARDS TO LOOK FOR/CONTROLS TO CHECK (STEP 3)	RECOMMENDED CORRECTIVE MEASURES (STEP 4)
STORAGE	
• Are all containers clearly labelled?	Containers should be labelled as soon as they are received from the supplier (see Labelling, page 3 F).
• Do storage conditions conform to supplier's recommendations?	Check the supplier's data sheet and make the necessary provisions.
• Are potentially reactive chemicals stored together?	
• Is any mixing, pouring or other handling of chemicals done in the storage area?	If yes, local exhaust ventilation must be provided. In any case, even a general storage room or area should have some form of ventilation.
Is there local exhaust ventilation?	
Is there general ventilation?	
FIRST AID/EMERGENCY PROCEDURES	
• Is your first-aider trained to provide the specific first-aid treatment needed?	Refer to the supplier's Material Health & Safety Data Sheet for information on first-aid treatment.
• Are emergency facilities adequate (showers, eyewash, stretcher)?	Correct as required.
• Are fire extinguishers of the right kind? Are they regularly checked? Have they expired? Are they labelled and located conveniently?	
• Are fire exits accessible?	Post the telephone number of the person/department to be called in case of an emergency. This could be the Chemical Control Co-ordinator, chemist or whoever is most knowledgeable in emergency procedures.

APPENDIX D4

Method for Checking Ventilation Systems

A good method for checking any ventilation system is shown in Figure 4.
The method involves use of a smoke tube and squeeze bulb. Smoke tubes are available from companies selling safety equipment and supplies.
When the bulb is squeezed, air passes through the tube producing a puff of smoke. If this is directed at the point where the contaminant is being generated and observed, it should naturally be drawn towards the ventilation duct which is intended to extract the contaminant before it gets to the worker's breathing zone. *If the smoke by-passes the duct, then the contaminant is also.* Again the system too should be checked, it may be possible to modify the duct inlet to improve its capability.

USE OF SMOKE TUBES AROUND EXHAUST HOODS



A – Smoke ejected midway between exhaust slots of a tank

B – Smoke released at point of contaminant generation (generally at that point on the work bench most remote from the hood)

C – For canopy hood above a cold process, smoke is released at the source

D – Smoke at the lip of a canopy hood above a hot process indicates spillage of contaminanted hot air

FIGURE 4

APPENDIX D5

Air Sampling Services — Sources of Information

The following organizations may be able to provide you with information as to available air sampling services:

Canadian Centre for Occupational Health & Safety
150 Main Street West, Room 435
Hamilton, Ontario L8P 1H8
Tel: (416) 523-2981

Ontario Ministry of Labour
Occupational Health Branch
400 University Avenue, 7th Floor
Toronto, Ontario
Tel: (416) 965-3211

Ontario Ministry of the Environment
Air Resources Branch
880 Bay Street, 4th Floor
Toronto, Ontario
Tel: (416) 965-6343

Centre for Occupational Health & Safety
University of Western Ontario
London, Ontario
N6A 5B9
Tel: (519) 679-3913

Occupational Health & Safety Resource Centre
Queen's University
25 Union Street
Kingston, Ontario
K7L 2N6
Tel: (613) 547-5749

Centre for Occupational Health & Safety
Lakehead University
Oliver Road
Thunder Bay, Ontario
P4B 5E1
Tel: (807) 345-2121

Centre for Occupational Health & Safety
University of Waterloo
Waterloo, Ontario
N2L 3G1
Tel: (519) 885-1211 - Ext. 2581

Industrial Accident Prevention Association
Technical Services Department
2 Bloor Street East, 23rd Floor
Toronto, Ontario
M4W 3C2
Tel: (416) 965-8888