HEALTH AND SAFETY IN EMPLOYMENT ACT 1992

APPROVED CODE OF PRACTICE FOR SAFETY AND HEALTH IN THE

MANUFACTURE OF PAINT, PRINTING INKS AND RESINS

OCCUPATIONAL SAFETY & HEALTH SERVICE

DEPARTMENT OF
LABOUR
TE TARI MAHI

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NOTICE OF ISSUE

I have issued this *Approved Code of Practice for Safety and Health in the Manufacture of Paints, Printing Inks and Resins*, being a statement of preferred work practices or arrangements, for the purpose of ensuring the health and safety of persons to which this code applies and persons who may be affected by the activities covered by the code.

C J McKenzie
Secretary of Labour
June 1993

FOREWORD

I have approved this statement of preferred work practices, which is an approved code of practice for safety and health in the manufacture of paints, printing inks and resins under section 20 of the Health and Safety in Employment Act 1992. When a code is approved a court may have regard to it in relation to compliance with the relevant sections of the Health and Safety in Employment Act. This means that if an employer in an industry or using a process to which an approved code applies can show compliance with that code in all matters it covers, a court may consider this to be compliance with the provisions of the Act to which the code relates.

Maurice McTigue

Hon Maurice McTigue
Minister of Labour
June 1993

SUMMARY OF THE HEALTH AND SAFETY IN EMPLOYMENT ACT 1992

The principal object of the Health and Safety in Employment Act 1992 is to prevent harm to employees at work. To do this it imposes duties on, and promotes excellent health and safety management by, employers. It also provides for regulations and codes of practice that set more detailed minimum standards.

The following information is a brief outline of provisions of the HSE Act. Copies of the Act and associated regulations may he purchased from any government books shop or Occupational Safety and Health Service branch offices.

APPROVED CODES OF PRACTICE

The Act allows for the development and approval of statement of preferred work practice, known as “approved codes of practice”. These are recommended means of compliance with provisions of the Act, and may include procedures which could be taken into account when deciding on the practicable steps to be taken. Compliance with codes of practice will not he mandatory. However, they may be used as evidence of good practice in court.

EMPLOYERS

Employers have the most duties to perform to ensure the safety and health of employees.

If you are an employer, then you have a general duty to take all practicable steps to ensure the safety of employees while at work. (This is set out in section 6.) In particular, you are required to take all practicable steps to:

- Provide and maintain a safe working environment;
- Provide and maintain facilities for the safety and health of employees at work;
- Ensure that machinery and equipment in the place of work is designed, made, set up, and maintained to be safe for employees;
- Ensure that employees are not exposed to hazards in the course of their work; and
- Develop procedures for dealing with emergencies that may arise while employees are at work.

HAZARD MANAGEMENT

Employers must identify hazards in the place of work (previously existing, new and potential) and regularly review these to see whether these hazards are significant and require further action. Where an accident, serious harm or an event which in different circumstances might have caused harm to any person occurs, an employer must record it in a register of a prescribed form. The employer must also investigate whether it was caused by a significant hazard.

"Significant hazard" means a hazard that is an actual or potential cause or source of—

(a) Serious harm; or

(b) Harm (being more than trivial) the severity of whose effects on any person depend (entirely or among other things) on the extent or frequency of the person's exposure to the hazard; or

(c) Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

Where the hazard is significant, the Act sets out the steps an employer must take:

- Where practicable, the hazard must be *eliminated*;
- If elimination is not practicable, the hazard must be *isolated*;
- If it is impracticable to eliminate or isolate the hazard completely, then the employer must minimise the hazard to employees. In addition, the employer must, where appropriate:
  - Ensure that protective clothing and equipment is provided, accessible and used;
  - Monitor employees' exposure to the hazard;
  - Seek the consent of employees to monitor their health; and
  - With informed consent, monitor employees' health.

Employers must establish systems for this process of identifying and managing hazards. In situations where exposure to the hazard can only be minimised, the employer must ensure the systems put in place to protect the employee are used. Employers need to involve employees in the development of systems and emergency procedures to be used (section 14).

INFORMATION FOR EMPLOYEES

Before an employee begins work, their employer must inform them of:

- Emergency procedures;
- Hazards the employee may be exposed to while at work;
- Hazards the employee may create while at work which could harm other people;
- How to minimise the likelihood of these hazards becoming a source of harm to others; and
- The location of safety equipment.

The employer is also required to inform employees of the results of any health and safety monitoring. In doing so, the privacy of individual employees must be protected.

The employer must ensure employees are either sufficiently experienced to do their work safely or supervised by an experienced person. In addition, the employee must be adequately trained in the safe use of equipment in the place of work, including protective clothing and equipment (section 13).

An employer is also responsible for the health and safety of people who are not employees. An employer must take all practicable steps to ensure that an employee does not harm any other person while at work, including members of the public and other visitors (section 15).

EMPLOYEES

Effective safety management should involve everyone in a place of work. Employers have specific responsibilities but employees should look after themselves. If you are an employee, then the Act gives you responsibility for your own safety and health while at work. You must also ensure that your actions do not harm anyone else.

TERMS USED IN THIS CODE

Act Means the Health and Safety in Employment Act 1992.

Carcinogen Any agent that incites the development of a carcinoma (cancerous growth).

Exothermic A chemical reaction in which energy is released in the form of heat.

Flash point The lowest temperature at which a substance gives off sufficient vapour to produce a momentary flash when a small flame is applied in a prescribed manner.

Opacity The extent to which a medium is opaque (not allowing light to pass through). Numerically the reciprocal of transmittance.

OSH Occupational Safety and Health Service of the Department of Labour.

Pigment A coloured substance, generally insoluble.

Regulation The reference details of all regulations referred to in the code are given in appendix 2. These references were updated at the time of publication, however, as they are subject to change their current status should be checked.

Standard Means the current standard published by Standards New Zealand or an equivalent overseas organisation. A list of the relevant standards current at the time of publication is appendixed; however, as they are regularly updated their current status should be checked.

Toxicity The ability of a substance to cause harmful effects to the human body.

Viscosity The resistance of a fluid to flow.

WES Workplace Exposure Standards are guidelines for assessing the adequacy of the measures taken to limit exposure to airborne substances in the workplace. A WES booklet is updated and published regularly by OSH. It is obtainable from any OSH branch office.

Note: This publication gives the maximum levels workers should be exposed to. Wherever possible, the actual atmospheric concentrations of contaminants should be kept as far below the WES as practicable.

BEI Biological Exposure Indices as described in the WES booklet.

TWA Time-Weighted Average as described in the WES booklet.

STEL Short-Term Exposure Level as described in the WES booklet.

1. INTRODUCTION

1.1 The industrial processes by which paint, printing inks and resins are manufactured present a number of specific problems that must bc recognised and dealt with to promote health and safety in the workplace.

1.2 Many of the health and safety hazards present in the manufacture of paints are also present in the manufacture of printing inks and resins. It is therefore thought appropriate to deal with the three industries in the one document.

1.3 The main aim of this code is to identify the hazards associated with the various manufacturing processes present in these industries and the precautions that should be adopted to minimise the accompanying risk to employees' safety and health.

1.4 The objectives of the code are:

(a) To minimise the long- and short-term health risks to employees in the industry and to prevent accidents;

(b) To ensure a safe and healthy work environment, thereby benefiting not only employees but also the community and the environment; and

(c) To promote training, safe procedures, work methods and work practices, thereby not only minimising the risk of injury and accidents but also preventing financial losses to employers caused by fire and damage to stock and equipment.

1.5 The hazards in the industry are well known and essentially are:

(a) Exposure to solvent vapours;

(b) Exposure to other chemicals (e.g. pigment additives);

(c) Flammable liquids;

(d) Machinery hazards;

(e) Confined spaces.

1.6 The assistance of all who participated in the preparation of this code is gratefully acknowledged.

2. SCOPE AND TERM OF THE CODE

2.1 This code, which is made under the Act, shall apply to all manufacturers of paint, printing inks and resins and their employees.

2.2 This code takes effect from the date of approval, and will be subject to review.

2.3 This document was prepared by OSH, with assistance from the industry. Any enquiries regarding the practical application of this code should be referred to the local branch office of OSH.

2.4 This code is in three parts, as follows:

Part A Contains a description of the manufacturing processes, identifies specific hazards likely to arise in connection with the processes and sets out the specific precautions to be followed. This part contains information useful to technical staff.

Part B Covers special obligations. It sets out a summary of the main legal obligations of employers and employees and also lists additional key obligations and recommendations under this code. Also in this part is a section on provision of information, which contains requirements relating to access to information on hazardous substances, keeping of essential data and access to other information relating to health and safety generally and hazard measurements. The information in this part provides a framework for an employer to develop a safety policy and training programme.

Part C Deals with safety, health and welfare generally and covers such matters as:

- Housekeeping;
- Disaster plans;
- Assessment of hazard levels;
- Personal hygiene;
- Maintenance;
- Environmental surveillance;
- Health surveillance; and
- Records.

2.5 A number of technical terms appear throughout this code and the meaning of these are given in the glossary of terms at the beginning of this document.

2.6 This code does not attempt to deal with the safeguarding of dangerous parts of machinery used in the industry. These requirements are laid down by regulation. Advice on machinery guarding standards can be obtained from OSH offices.

2.7 Wherever practicable, work processes should be so designed as to minimise the necessity for workers to wear personal protective clothing and equipment. The feasibility of replacing hazardous substances, the isolation of processes requiring the use of hazardous substances, and/or the provision of effective ventilation should be investigated before reliance is placed on personal protective devices.

3. RESPONSIBILITIES FOR HEALTH AND SAFETY

3.1 Both employers and employees have shared responsibilities for the safe operation of undertakings and both should play a role in promoting health and safety.

3.2 The Act requires employers to ensure all employees have the opportunity to be fully involved in developing procedures to identify, eliminate, isolate and minimise hazards, or in procedures to deal with emergencies or imminent dangers.

PART A

This part describes the manufacturing processes, the specific hazards likely to arise in the course of a process, and design and operational factors that must or should be employed to reduce the risk to employees from such hazards.

4. MANUFACTURING PROCESSES AND THEIR ASSOCIATED HAZARDS

4.1 PAINT MANUFACTURE

4.1.1 Paint may be defined as a liquid applied in layers to protect, decorate or finish a solid surface and which hardens to form a solid coating. The change to a solid state may result through solvent evaporation, by chemical reaction, or by a combination of these processes. Paints usually comprise a pigment to provide colour, opacity, or body; a binder (generally a resin); a solvent to regulate viscosity; and quite often one or more of a variety of additives to provide special characteristics.

4.1.2 The manufacture of paints involves the weighing and mixing of dry pigments and the grinding of these with the appropriate resin binder in a suitable mill which may be a ball mill, a roller mill or a continuous flow head mill. The shearing or crushing action of the mill ensures that each pigment particle is wetted by the resin. The milled pigment is transferred to a mixer where solvents and additives are introduced to adjust consistency, viscosity, colour and drying time. After mixing, the paint is sieved or filtered, packaged and labelled.

4.2 PRINTING INK MANUFACTURE

4.2.1 The majority of printing inks consist of three main components. These are additives consisting of dryers, waxes, and wetting aids, pigments with carbon black being by far the most common; and so-called varnishes, consisting of resins and solvents with various waxes and plasticisers, and which are vehicles used to carry and transfer pigment through the printing machines .and on to the print stock.

4.2.2 The manufacturing process is similar to that for paints. Pigments are weighed, mixed with the appropriate varnish, and the whole is milled to ensure that the pigment particles are thoroughly wetted by the dispersion vehicle. Additives are introduced and the finished material can then be packed.

4.3 RESINS

4.3.1 Resins, added as the binder or varnish to paint or printing ink formulations, are either purchased from outside suppliers or manufactured in a section of the paint or printing ink premises. The process typically employs a large (1,000 litres or more) heated vessel known as a kettle, which is effectively an enclosed pot fitted with a stirrer. The reactant materials are added to the kettle and continuous temperature measurement is used to monitor the reaction, which may be exothermic.

4.4 SOLVENTS

Liquid organic chemicals find a major use as solvents in both the paint and printing ink manufacturing industries. These solvents include a wide range of hydrocarbons, alcohols, esters and glycol ethers.

4. 4. 1 TOXICITY OF SOLVENTS

4.4.1.1 The major toxicity hazard arising from exposure to solvents used in these industries is inhalation of solvent vapours. The resulting acute effect on the body is usually a narcotic action, but other symptoms, and routes of absorption (e.g. via skin), may also be important.

4.4.1.2 Many of these solvents are effective at dissolving oil and grease and thus contact with the skin will lead to the removal of natural protective oils. This defatting action may result in dry and cracked skin, a condition known as dermatitis.

4.4.1.3 It is not possible to list each and every solvent used in these industries and to discuss the associated toxic hazards, but appendix 1 contains a list of 22 of the most commonly encountered solvents, together with some of their physical properties and their Workplace Exposure Standards (WESs).

4.5 PIGMENTS AND ADDITIVES

4.5.0.1 Pigments are added to paint and printing ink formulations primarily to provide colour to the product but also to give opacity and body. They arc usually light-stable and non-reactive with the medium.

4.5.0.2 It is important that the pigment is evenly dispersed throughout the dispersion vehicle so that uniform properties are obtained. This dispersion is achieved by “shearing” the pigment into the vehicle using machinery such as high-speed dispersers, ball mills or three-roll mills

4.5.0.3 Three-roll mills are mainly used for materials of high viscosity, while lower viscosity materials are prepared in ball mills, bead mills, etc.

4.5.1 TYPES OF PIGMENTS

4.5.1.1 Extender pigments are usually white or off-white in colour, but add little in colour or opacity when incorporated in coatings.

4.5.1.2 There is a large variety of other pigment materials which are both organic and inorganic in nature. Typical inorganic pigments include titanium dioxide, zinc oxide, lithopone, and antimony oxide (white); chromic oxide (green) ultramarine blue (a form of aluminium silicate); brown or yellow oxides of iron (known as ochres); ferric oxide (red); lead oxide (red); carbon black; cadmium compounds (yellows and oranges); and lead chromes which are complex lead chromate salts and which, depending on their exact formulation, give rise to a wide range of colours varying from lemon through yellow and orange to pink and scarlet.

4.5.1.3 Types of organic pigment materials include the highly stable phthalocyanines (blue and green); quinacridones (red); benzidine-based substances (yellow); lakes, of various colours, obtained by precipitation from dyestuffs, often by using a metallic hydroxide; and azo-based pigments, again of many different colours

4.5.2 TOXICITY OF PIGMENTS

4.5.2.1 Pigments are generally finely powdered solids. The principal routes of entry into the body are by ingestion (swallowing) of pigment dust from contaminated hands or food, and inhalation of line dust into the lungs.

4.5.2.2 For many pigment materials, particularly those which are organic-based, details of toxicity are unknown. Although it is sometimes possible to infer the approximate degree of toxicity from a knowledge of the toxic properties of the parent molecule, this does not make it safe to assume a low toxicity for all derivatives of a particular pigment class where the parent molecular unit is itself known to be of low toxicity. Where reliable information is not available on the toxicity of a pigment material, it must be assumed to be toxic and appropriate precautions as noted below observed.

4.5.2.3 Specific materials well known to present toxic hazards include lead-based pigments, and cadmium compounds.

4.5.2.4 Lead chromes and lead oxide may give rise to problems of excessive lead absorption in employees if handled incorrectly. The inhaled or ingested dust from these materials will be absorbed into the blood stream and contribute to an increased body burden of lead. If these levels become high, as measured by the quantity of lead in the red blood cells, the employee will begin to suffer the symptoms associated with lead poisoning. Lead chromate and related compounds are also under suspicion as possible cancer-causing agents. For provisions relating to personal hygiene when working with lead compounds, the regulations should be consulted.

4.5.2.5 Cadmium compounds used as pigments must be handled with caution as these substances can be very toxic. Exposure to ingested cadmium causes injuries to kidneys and livers and stomach upsets resembling food poisoning, while inhalation of the dust of cadmium compounds may result in chest pains, coughing and tightness in the chest, and eventually cadmium emphysema.

4.5.3 ADDITIVES TO PAINT AND PRINTING INKS

4.5.3.1 The basic raw materials of paint production are often supplemented by specialist additives which produce a final product with desirable properties. There are many examples of additives but some of the common ones are:

Aryl mercury compounds such as phenyl mercury acetate which are used as fungicides in some paints;

Aluminium or zinc compounds (e.g. zinc chromate) added to primer paint formulations as corrosion inhibitors;

Plasticizers such as tri-o-cresyl phosphate are added to specialist paints:

Dryers such as the metallic salts of organic acids.

4.5.3.2 In each of the above four categories, the additives present particular problems of toxicity and appropriate precautions must be taken.

4.5.3.3 Aryl mercury compounds are metabolised rapidly by the body and produce similar toxic effects to inorganic mercury. The major route of absorption is by ingestion, usually from contaminated hands. Absorption into the body can also occur by inhalation of dust and possibly skin absorption, since the compounds are fat-soluble. Mercury is a cumulative poison which concentrates in the brain, kidney, liver and other organs. Excretion occurs slowly and may take many months. The classic symptom of chronic mercury poisoning is mercury tremors which are fine trembling movements of the hands and may spread to the eyelids, tongue and legs. Other nonspecific symptoms include weakness, fatigue, weight loss and stomach upsets. Good personal hygiene, particularly before eating and smoking, and the provision of effective exhaust ventilation to maintain the airborne concentration below the WES at weighing and mixing points are required.

4.5.3.4 Zinc chromate, along with lead chromate and related chromate compounds of low solubility, have been implicated as carcinogens in laboratory animals. Precautions must be taken when handling zinc chromate to prevent inhalation or ingestion of this compound.

4.5.3.5 Tri-o-cresyl phosphate is a liquid which can enter the body by skin absorption. Inhalation is unlikely to occur unless it is heated. This compound causes a specific condition known as polyneuritis and many cases of this disease caused by occupational exposure to tri-o-cresyl phosphate have been reported world-wide. Most of the acute cases have occurred in workers manufacturing the material, but prolonged contact by users could result in similar serious effects. Polyneuritis is caused by the degeneration of nerve fibres, particularly in the arms and legs. The results are pains and tingling and numbness in the extremities and weakness in arm and leg muscles. Impervious gloves must be worn when handling tri-o-cresyl phosphate. Adequate ventilation is to be provided to remove any inhalation hazard.

4.5.3.6 Additives in printing inks account for only a small percentage of the total formulation but their inclusion is critical to the performance of many products. Thus:

(a) Dryers are added as oxidation catalysts for the drying of oil inks.

The most usual drier additives are cobalt naphthenate, lead acetate, and manganese linoleate.

(b) Slip compounds such as waxes are added to improve the scull resistance of inks, particularly those used in packaging.

(c) Wetting agents are added in very low concentrations, and they are generally detergent-related materials of low toxicity.

4.5.3.7 The hazard potential of most additives is low; however, cobalt naphthenate and lead acetate may each present certain problems.

4.5.3.8 Cobalt naphthenate is very easily ignited by an external source of ignition. Storage and handling of cobalt naphthenate must take due account of its highly combustible nature. Cobalt naphthenate is commonly used in solution in mineral turpentine. Regulations apply — refer to appendix 2.

4.5.3.9 Lead acetate can be inhaled or ingested into the body in the same manner as for any finely divided solid lead compound. Raised lead-in-blood levels will result, and if the absorption continues the symptoms of lead poisoning may become apparent (see 4.5.2.4). Control measures, such as those outlined in section 5.3.1, must be applied.

4.6 ISOCYANATES USED IN THE MANUFACTURE OF POLYURETHANE PAINTS AND LACQUERS

4.6.0.1 Some polyurethane paints contain isocyanates as a constituent. The special properties of these paints depend upon the reaction between the isocyanate and a substance providing hydroxyl groups or other reactive hydrogen atoms. This substance may, in general, be a polyalcohol or polyol, but in some cases atmospheric water vapour may be the second component.

4.6.0.2 As with all paints, precautions already discussed in this code have to be taken with solvents, pigments, and drying agents.

4.6.0.3 In brief, the major hazard from isocyanates arises when their vapours are inhaled because they are powerful respiratory irritants and respiratory sensitisers, that is they can cause a cough and asthma-like symptoms. A subsidiary hazard results in some people from the giving rise to skin irritation and sensitisation. Refer to the *Code of Practice for the Safe Use of Isocyanates* (see appendix 3).

4.6.0.4 The three isocyanates most commonly encountered as constituents in the manufacture of polyurethane coatings are:

Toluene diisocyanate (TDI);
Hexamethylene diisocyanate, (HDI); and
Diphenylmethane diisocyanate, (MDI).

4.6. 1 HAZARDS AND PRECAUTIONS

4.6.1.1 Because of their relatively high vapour pressure under normal conditions, the inhalation hazard of TDI and HDI is very much greater than that for MDI, which has a much lower volatility.

4.6.1.2 The isocyanates used in paint manufacture, in particular TDI and HDI, are modified by polymerisation to give isocyanate derivatives of higher molecular weight. This results in a corresponding decrease in volatility. However, there is still a toxic hazard associated with these modified materials.

4.6.1.3 Special precautions recommended to protect employees against the toxic effects of isocyanates during paint manufacture include:

(a) The handling of isocyanates in such a way as to keep the concentration of free isocyanate in the factory atmosphere as far below the WES as practicable.

(b) The use of extraction ventilation systems and, where necessary, personal respiratory protection to minimise employee exposure.

(c) The investigation of any respiratory ailment which develops while a employee is in contact with isocyanates. If a medical report discloses that the ailment is due to isocyanate sensitisation, then the person affected should be removed immediately from the risk of further exposure to isocyanates and placed on other work which cannot result in the inhalation of isocyanate in the air.

(d) The exclusion from this type of work on evidence of a medical report of any person with a history of allergy or respiratory disease (e.g. asthma).

4.6.1.4 The polyol constituent of a polyurethane paint makes a negligible contribution to the hazard inherent in manufacture.

4.6.1.5 From the above, it can be seen that the special hazards of polyurethane paint manufacture arise primarily from the isocyanate constituent. The extent of the hazard depends on the amount of original isocyanate still present in the prepolymerised ingredient supplied to the paint manufacturer.

4.7 MISCELLANEOUS PROVISIONS

4.7. 1 SAFE ENTRY INTO CONFINED SPACES

4.7.1.1 The paint, printing ink, and resin manufacturing industries utilise various vessels. Entry into such vessels exposes employees to many of the hazards associated with entry into confined spaces.

4.7.1.2 Working in any confined space can expose an employee to a variety of hazards with potentially lethal consequences, e.g. exposure to a localised concentration of a toxic gas or vapour, or an oxygen-deficient atmosphere. Precautions must be taken to ensure such work is carried out safely. For more detailed advice, refer to the OSH booklet *Safety in Confined Spaces*.

4.7.1.3 No entry into any confined space should be attempted without proper authorisation. This should be by means of a printed approval form to be signed by the responsible supervisor.

4. 7.2 CAUSTIC CLEANING OF VATS AND TANKS

4.7.2.1 Vessels which have been used for mixing of paint or ink formulations are often cleaned out by filling them with concentrated caustic solutions (sodium or potassium hydroxide), allowing the residues to be dissolved, and then emptying and hosing out the vessels. These solutions can cause serious eye damage if splashed into the eyes. Where caustic solutions are used for cleaning vessels, a sign shall be attached to the vessel advising employees that “CAUSTIC” is in the containers.

4.7.2.2 This procedure is generally only applied to portable vats and tanks, and fixed vessels may still require to be entered for cleaning purposes. In such circumstances, the procedures outlined earlier for confined space entry must he followed.

4.7.2.3 Caustic cleaning of tanks should be carried out in a part of the premises separated from other activities. Apart from the person or persons carrying out the cleaning work, other workers must he excluded from the area unless they are equipped with the protective clothing detailed in 4.7.2.5 below. This restriction on the presence of unauthorised personnel must be clearly and prominently signposted.

4.7.2.4 Where caustic is used to clean spillages of paints, resins, or printing inks from areas of flooring, equipment, or other parts of the structure, the protective measures detailed in 4.7.2.3 shall apply. In addition to these requirements, .areas treated with caustic soda should be cordoned off and signposted to prevent the accidental entry of workers not involved in the cleaning process.

4.7.2.5 Protective clothing shall be suitable to ensure that the concentrated caustic solutions used for cleaning cannot come into contact with any part of the operator’s body. Impervious gloves, aprons and boots are necessary and these shall be of PVC, neoprene, or other alkali-resistant material. Eye protection in the form of a face shield is essential; protective goggles alone do not offer sufficient protection.

4.7.2.6 A safety deluge shower, appropriately signposted and conspicuously painted, shall be installed in the caustic cleaning area so that accidental splashes of caustic solutions on the body can be rapidly washed off. The immediate vicinity of the shower must be kept free of any obstructions.

A step-on type operation safety shower should he installed in preference to lever action and pull chain types. Emergency showers shall he checked at regular intervals to ensure they are kept in proper working order.

5. DESIGN AND OPERATION OF THE MANUFACTURING PROCESS

This section discusses design and operational factors that either must or should, if relevant to a particular work site, be incorporated in the work process

5.1 VENTILATION OF WORKING AREAS

5.1.1 The primary aim of both general ventilation and specific local exhaust ventilation around process vessels is to ensure that the airborne concentrations of contaminants are maintained at the lowest practicable level. This level must be lower than the Workplace Exposure Standard (WES) for the particular contaminant (or mixture of contaminants).

5.1.2 Atmospheric contaminants in the workplace often derive from a number of sources, rather than one point source. The preferred solution in these circumstances, after minimising the emissions from each source is to provide sufficient general dilution ventilation throughout the area. This can be achieved by natural or mechanical ventilation, as long as clean air is supplied in sufficient quantity, and well distributed throughout the process area.

5.1.3 Where specific process vessels in an area are the prime contributors to atmospheric contaminants in the workplace, these sources are best controlled by local exhaust or extraction ventilation. Process vessels should be enclosed as far as practicable, and be provided with adequate mechanical exhaust ventilation.

5.1.4 Professional expertise in ventilation should be consulted for advice in these matters, particularly where local exhaust ventilation systems need to be designed.

5.2 PLANT LAYOUT AND WORK METHODS IN RELATION TO SAFETY WITH SOLVENTS

5.2.1 Some paint and printing ink premises have installed bulk storage tanks, either below or above ground, to hold large quantities of commonly used solvents such as toluene and isopropanol. There are many advantages in providing bulk storage facilities but such storage also introduces additional hazards. Dangerous Goods Class 3 Regulations apply: refer appendix 2.

5.2.2 In brief, these regulations cover the types of storage depots which are permissible, materials of construction, siting and isolation distances for depots, fire fighting equipment, and many miscellaneous matters. Dangerous Goods Class 3 Regulations apply, see appendix 2.

5.2.3 Smaller quantities of commonly used solvents are dispensed as required from drums. Some firms have found it convenient to place these drums on racks in the open air; this means that spillage and/or drips of solvents can readily evaporate in safety, and access to individual drums is easy. Dangerous Goods Class 3 Regulations apply, see appendix 2.

5.2.4 The positioning of vats, tanks, and processing steps within the factory layout should be such that maximum use can be made of natural ventilation. Dangerous Goods Class 3 Regulations apply, see appendix 2.

5.2.5 All chemical and service pipelines should be clearly colour coded in accordance with NZS 5807, see appendix 3.

5.3 DUST CONTROL MEASURES

5.3.1 The basic measures for controlling exposure to pigment dust shall include:

(a) Altering processes and raw material forms, as far as is practicable, to ensure that the minimum amount of dust is produced, for example using wet processing instead of dry.

(h) The provision of adequate and suitable enclosure and local exhaust ventilation at raw material batching points and where bag opening operations occur.

(c) When powder raw materials are added directly to processing vessels, adequate local exhaust ventilation should be provided to that vessel.

(d) If the above measures are not practicable, personal protective equipment, in particular respiratory protection, must be supplied, and good personal hygiene encouraged. Refer publications list appendix 5.

5.3.2 Pigments in pelletised or other dust-suppressed forms (e.g. polymer-bound) may be available in certain cases and these will greatly reduce dust formation.

5.3.3 The work area where pigments are weighed, mixed, etc. shall be kept clean and tidy at all times. Cleaning shall be carried out by vacuuming or wet sweeping.

5.4 FLAMMABILITY HAZARDS

5.4.0.1 Many of the organic solvents used in paint or printing ink manufacture are highly flammable. Typical examples are hydrocarbon solvents, alcohols, esters, ketones, glycol ethers.

5.4.0.2 A flammable solvent is classified depending on its flash point. Dangerous Goods Class 3 Regulations apply, see appendix 2. The flash points for solvents commonly used are given in appendix 1.

5.4.0.3 Such classification in turn determines the specific safety measures which must be taken with regard to storage and handling..

5.4.1 CELLULOSE NITRATE (NITROCELLULOSE)

5.4.1.1 Cellulose nitrate is a highly flammable chemical used in the manufacture of nitrocellulose lacquers and some printing inks.

5.4.1.2 Cellulose nitrate is usually wetted with a solvent, e.g. methanol, to reduce the explosion hazard. Only “wetted” cellulose nitrate is to he used in the manufacture of nitrocellulose lacquers and printing inks.

5.4.1.3 Employers must ensure that drums containing cellulose nitrate are handled carefully, and handling systems designed to minimise the risk of drums being dropped. Cellulose nitrate must be stored in closed containers. Before storing, make sure that the drums’ closures are tight to prevent loss of the wetting agent. Cellulose nitrate must be stored in such a manner that the stock can be rotated to ensure that the oldest material is used first.

5.4.1.4 The number of drums permitted in the operating area must he kept to a minimum. Not more than one day’s supply shall be present in the work area.

5.4.2 ORGANIC PEROXIDES

5.4.2.1 Organic peroxides such as tertiary butyl perbenzoate are used as initiators or catalysts in the production of acrylic resins.

5.4.2.2 Organic peroxides are a class of strong oxidising agents which burn vigorously when ignited. All organic peroxides are unstable to a greater or lesser extent and may decompose slowly at room temperatures. Decomposition, which is accelerated by heat and some contaminants, may produce flammable gases and vapours. Most organic peroxides will explode when involved in a fire.

5.4.2.3 Organic peroxides are classified by Dangerous Goods Class 4 and Regulations, see appendix 2.

5.4.2.4 Only the minimum quantity of organic peroxides necessary shall be brought from the store into a working area; normally one day’s supply.

5.4.2.5 Organic peroxides may be a severe health hazard if splashed on the skin or in the eyes. Where it is not practicable to protect workers by other means such as elimination, substitution or isolation of the substances, then protective clothing, including gloves, face shield and apron shall be provided and worn when transferring or mixing organic peroxides.

5.4.2.6 Always keep organic peroxides sealed in original containers to prevent accidental contamination.

5.4.2.7 Never return unused peroxides to the original container. Either dispose of them by an approved method, or chemically decompose by covering with 10-20% caustic soda equivalent to 10 times the weight of the peroxicle and leave to weather for 2-3 days.

5.4.3 CONTROL MEASURES TO PREVENT FIRES AND EXPLOSIONS

5.4.3.1 The first means of control must be the elimination of all possible sources of ignition in areas where flammable substances are handled and/or stored, or where vapours of these substances might be present.

5.4.3.2 In these areas, the following shall apply:

(a) Smoking must be prohibited in such areas and it is general practice to ban cigarettes, matches and cigarette lighters.

(b) Other naked flames and equipment producing sparks or hot surfaces must be prohibited.

(c) Electrical equipment including motors and switch gear must be of the flameproof type or other approved alternative.

(d) Where an area is designated as a “hazardous area” as detailed in NZS 6101, see appendix 3, all electrical installations must be suitable for use in that area.

(e) Specific steps must be taken to prevent the accumulation of static electricity in processes involving flammable solvents (see 5.5 below for a detailed discussion). Also refer appendix 5.

5.4.3.3 The vapours of flammable liquids will only ignite if their concentration in the air is above a particular level for that substance. This is known as the lower flammable limit. This limit varies from liquid to liquid but is generally much higher than the relevant WES.

5.4.3.4 Thus, if ventilation is provided to reduce airborne concentrations of contaminants to below the WES, then this will ensure that the concentration is considerably below the lower flammable limit. Consideration must be given, however, to the possibility of an abnormal situation developing.

5.4.3.5 The storage of flammable liquids either in above- or below-ground bulk storage tanks, or in drum form in compounded areas, is covered by regulations, refer appendix 2.

5.4.3.6 The storage of cellulose nitrate and organic peroxides is covered by regulations, refer appendix 2.

5.5 STATIC ELECTRICITY AS AN IGNITION SOURCE

5.5.0.1 Static charges are generated within liquids and powders when movement occurs in such operations as the passage of liquids through pipes, mixing, pumping, agitation filtering or by pouring from one container to another.

5.5.0.2 In general, the greater the velocity of the liquid, the greater the charge which is generated. Constrictions such as valves and filters also increase the rate of charge generation, and the free fall of liquids into vessels results in the liquid acquiring a quite considerable charge.

5.5.0.3 In all of these instances of static charge generation, a serious hazard of ignition exists if the liquid or powder is flammable and air or oxygen is present. This is the case with many of the liquid solvents used in the manufacture of paint and printing inks.

5.5.0.4 The degree of this hazard depends on many factors including the static generating ability of the substance, the amount of time available for the build-up of charge, and the resistivity. This last quantity is a measure of the ability of the substance to hold an acquired charge; the higher the resistivity (the lower the conductivity) the greater the hazard.

5.5.1 MINIMISING STATIC ELECTRICITY HAZARDS

Precautions which must be taken to reduce the potential hazard of static electricity include the following:

5.5.1.1 Tanks and pipework used for the storage of flammable liquids must be bonded and earthed, preferably with an insulated wire braid which is easily inspected for mechanical damage. The integrity of bonding wires should be checked regularly, and especially after any maintenance or plant modifications. The bonding wire resistance should be 10 ohms or less. All higher resistances should be investigated to ensure that contacts have not become corroded, or damaged.

5.5.1.2 Systems used for transferring, storing, or processing liquids and powders must be bonded and earthed to the current standard, AS 1020, see appendix 3.

5.5.1.3 Earthing clips must be fixed in place before the transfer hose is connected and they must not be removed until after the hose has been disconnected.

5.5.1.4 Transfer pipes should be inserted all the way to the bottom when filling tanks, or alternatively a subsurface inlet should be used. Wherever possible, tanks should:

(a) Be filled under a liquid and vapour tight seal;
(b) If vented, be covered with an approved gauze, e.g. 500 micron nominal aperture size, secured in such a manner as to allow removal for inspection and cleaning; and
(c) Be protected against hydraulic shock.

5.5.1.5 The velocity of liquids flowing in pipes should be restricted, where practicable, to 6 m/see maximum, particularly if the resistivity of the liquid is high. A velocity of 6 m/see is equivalent to:

(a) 175 l/min in 25 mm pipe
(b) 450 l/min in 40 mm pipe
(c) 700 l/min in 50 mm pipe
(d) 1800 l/min in 80 mm pipe.

Special precautions, outside the scope of this document, are required for higher flow rates. Advice should be sought from suppliers or from OSH.

5.5.2 STATIC ELECTRICITY AND THE USE OF PLASTICS

The use of plastic linings and containers has increased the dangers of static build-up.

5.5.2.1 Bags or kegs with plastic liners should not be used for finely powdered organic material. Where they are, the removal of raw materials from plastic or plastic-lined containers and bags must, as far as is reasonably practicable, be undertaken outside areas where highly flammable liquids are being used. The contents must be transferred to paper bags or metal containers before bringing into production areas in which highly flammable liquids or vapours are likely to be present. The generation of powder clouds in solvent vapour/air mixtures has led to a number of explosions and fatalities and must be avoided as far as is reasonably practicable.

5.5.2.2 The supplier's recommendations on the pouring of solvent-damped or plasticiser-damped nitrocellulose from plastic-lined containers are to be followed.

5.5.2.3 The use of plastic materials for stretch and shrink wrapping on bags of raw materials and empty containers can increase the risk of static generation. The wrappings must be removed before the materials or containers are transferred into production areas or stored where flammable vapours may be present.

5.5.2.4 Where plastic liners are used in mobile mixing vessels, these are to be removed from the vessel outside areas where highly flammable liquids are being used.

PART B

This part sets out a summary of the main legal obligations of employers and employees and also lists additional key obligations and recommendations under this code.

6. SPECIFIC OBLIGATIONS

6.0.1 The Act requires employers to take “all practical steps” for the safety and health of employees and persons lawfully on the premises. This and other legislation which contains similar obligations is listed in appendix 2.

6.0.2 The three sections in this part cover:

1. Obligations and recommendations to employers and employees;
2. Training and supervision; and
3. Provision of information.

6.1 OBLIGATIONS OF EMPLOYERS

6.1 .1 SUMMARY OF MAIN LEGAL OBLIGATIONS

Employers must ensure that:

1. All practical steps are taken to safeguard employees and anyone legally on the premises
2. All employees are properly trained and when under supervision, are properly supervised by a competent person;
3. Employees are provided with personal protective equipment and clothing when necessary and that these are used:
4. Employees are safeguarded against dangerous machinery, hazardous processes, noise, dust; and
5. Employees are provided with a safe and healthy work environment and with suitable facilities and amenities.

6.1.2 ADDITIONAL REQUIREMENTS AND RECOMMENDATIONS UNDER THE CODE

6.1.2.1 (a) The company should have a written safety policy covering all aspects of its operation.

(b) The safety policy should embody a statement of commitment to the provision of a safe and healthy work environment.

6.1.2.2 Every employer shall ensure that all employees have the opportunity to be fully involved in the development of procedures developed for the purpose of identifying, eliminating, isolating and minimising significant hazards, or dealing with or reacting to emergencies or imminent dangers.

6.1.2.3 Proper control measures should be adopted to ensure that health and safety considerations are accounted for in the following situations:

(a) Planning for the establishment of an undertaking;

(b) Before the introduction into the workplace of all hazardous and potentially hazardous substances;

(c) The establishment of production procedures.

6.1.2.4 In adopting efficient control measures, a system for identifying hazards and assessing risks should be adopted (see appendix 4).

6.1.2.5 No substances shall be introduced into a work premises without information pertaining to:

(a) What the substance is;

(b) What hazards are likely to arise from its use;

(c) What safety precautions are necessary; and

(d) What treatment or action is necessary in the event of an emergency.

The use of Material Safety Data Sheets is recommended.

6.1.2.6 A central register in an appropriate form and under the control of a designated person should be maintained, containing the information under (6.1.2.5) above and that this register also contain information as to:

(a) The supplier, importer, manufacturer or wholesaler of the product;

(b) The product's trade name and scientific name; and

(c) Any other details considered relevant.

6.1.2.7 In addition to the right of access conferred by other pieces of legislation, the following persons should be permitted access to the central register at any reasonable time on request and at any time in the event of an emergency:

(a) Any employee;

(b) A first aider, or a member of a rescue/evacuation team;

(c) A health and safety representative or committee member;

(d) Such other person as may be agreed upon by the employer and employees;

(e) An officer of OSH, the Department of Health or Crown Health Enterprise, or an officer authorised under dangerous goods legislation;

(f) A fire safety officer of the New Zealand Fire Service.

6.1.2.8 All employees shall be made aware of this code, and have access to a copy in the workplace.

6.1.2.9 Suitable persons shall be appointed and trained to act in fire, first aid, rescue/evacuation, and emergencies. Such persons shall be kept abreast of new substances introduced and new technology.

6.1.2.10 No person in a position of authority shall require a employee to carry out any work that is likely to endanger that employee or others because of:

(a) Lack of training;

(b) Lack of supervision

(c) Lack of information as to hazards;

(d) Absence of back-up;
(c) Lack of protective equipment/clothing;
(f) Presence of hazards;
(g) Any other matter that may cause injury to the employee or may result in injury to others.

6.1.2.11 All safety equipment shall be properly maintained and stored, safe to use, suitable for the operation, and should be checked regularly by a competent person.

6.1.2.12 A regular, efficient maintenance programme should be adopted.

6.1.2.13 Procedures should be adopted for the purpose of maintaining a regular surveillance of:
(a) The health of all employees exposed to the manufacturing process,
(b) The work environment.

6.1.2.14 Employers shall be informed of changes to procedures, substances used, and receive appropriate training in the safety precautions necessary

6.2 OBLIGATIONS OF EMPLOYEES

6.2. 1 SUMMARY OF MAIN LEGAL OBLIGATIONS

All employees shall ensure:
(a) They do not do anything likely to endanger themselves or others;
(b) That they use protective clothing and/or equipment provided for them; and
(c) That they do not misuse protective clothing and/or equipment provided for them.

6.2.2 ADDITIONAL REQUIREMENTS AND RECOMMENDATIONS UNDER THIS CODE

All employees should:
(a) Familiarise themselves with the company‘s health and safety policy and shall follow authorised work practices;
(b) Report any defect, incident or accident immediately to the supervisor, or person in charge:
(c) Sound the alert in the case of an emergency or serious accident, and not attempt any unauthorised rescue (especially into any confined space);
(d) Obey the rescue/evacuation procedures, and if requested, obey the directions of the emergency/rescue personnel; and
(e) Practice good personal hygiene prior to commencing work, and prior to taking meal breaks or leaving work.

6.3.1 Employers have a legal obligation to train employees.

6.3.2 Training must be conducted by a competent person.

6.3.3 Training shall be carried out at the earliest possible opportunity and shall include not only matters relevant to an employee's immediate work or environment, but also such general issues as:

(a) The employer's safety policy;
(b) Emergency procedures;
(c) The contents of this code; and
(d) The recognition of workplace hazards.

6.3.4 An employer's obligation regarding the training of employees should not be regarded as having been adequately discharged by the fact that information has been given. The obligation can only be fulfilled when it can be demonstrated to the employer, either orally or in writing, that an employee has learned and understood the information provided.

6.3.5 Retraining shall be carried out where it is apparent to the employer that an employee's knowledge of the above points is inadequate, or before changes are made to work processes, procedures and methods.

6.3.6 Assistance to develop training programmes is available from OSH, as well as from private consultants.

6.4 SUPERVISION

6.4.1 Supervisors have a key role in any organisation and should be properly prepared for their role and have adequate authority.

6.4.2 Employers must ensure that supervisors:

(a) Have been trained in accordance with this code;
(b) Are persons with a sufficient knowledge and experience of the work;
(c) Clearly understand their role in implementing and carrying out the employer's safety policies; and
(d) Have adequate authority to deal immediately with safety matters arising in their area.

6.5 PROVISION OF INFORMATION

6.5.0.1 Employers shall recognise an employee's need for information on the hazardous substances in the workplace and also the precautionary measures to be adopted

6.5.1 INFORMATION ON HAZARDOUS SUBSTANCES

6.5.1.1 Employers should take steps to:

- (a) Provide information essential to an employee (as outlined in section 6.1.2.5) without the inclusion of complex technical chemical data;
- (b) Ensure such information is readily accessible to employees (6.1.2.6).

6.5.2 RESULTS OF HAZARD MEASUREMENTS

6.5.2.1 Records shall be kept of all hazard monitoring carried out. Access to these records shall be available to those groups outlined in section 6.1.2.7.

6.5.2.2 Employers shall ensure that employees are:

- (a) Informed of the findings of any tests carried out;
- (b) Informed of the action that is being taken to address any hazards disclosed.

6.5.3 GENERAL INFORMATION ON HEALTH AND SAFETY

6.5.3.1 Employers should endeavour to inform employees of:

- (a) New developments in safety technology;
- (b) New legislation;
- (c) New safety codes and standards.

PART C

This part deals with general health, safety and welfare.

7. GENERAL SAFETY, HEALTH AND WELFARE

7. 1 HOUSEKEEPING

7.1.1 Employers shall adopt and encourage good housekeeping practices. For example, all areas should be kept free of unnecessary items, all materials and product should be properly stored, and all waste and spillage promptly removed.

7.1.2 Where the packaging of raw materials becomes damaged, the packaging should either be repaired, or the product repackaged. Residual spilt materials should be cleaned up immediately. Weighing and batching areas should also be cleaned regularly to ensure that extraneous raw materials inadvertently spilt during work do not remain in the area to provide a possible toxic hazard, or to contaminate subsequent raw material batches.

7.1.3 Attention to good housekeeping practices in storage areas must include safe storage of both raw materials and products in a manner which complies with relevant legislation and which protects against inadvertent breakages or falls of stored items.

7.1.4 Accumulation of dust and refuse must be removed daily from floors, benches, stairways and passages. Attention must also be given to regular removal of dust from ledges, pipes, overhead fittings and other places where it may collect.

Dust removal should be by vacuuming or wet cleaning methods.

The industries covered by this code should be aware of the inherent fire risk associated with the careless disposal of cotton-waste cleaning rags and similar materials that have been in contact with vegetable and fish oils. Such materials may undergo spontaneous combustion and must therefore be disposed of safely. For example, by placing them in metal containers with close-fitting lids, or similar. Refer appendix 5.

7.2 DISASTER PLANS

7.2.1 FIRE FIGHTING

7.2.1.1 The first essential is the provision of fire extinguishers, fire hoses, etc., and the maintenance of these in good condition. A close liaison with the Fire Service should also be maintained. It is recommended that site inspections be done every three months.

7.2.1.2 Full inventories of chemicals stored and handled on site and the nature of finished products should all be readily available at all times and kept up-to-date. Emergency services should be informed as to the location of inventories.

7.2.1.3 While plant personnel at all levels should be given basic fire fighting training on a regular basis, they must also be instructed always to leave the area in case of fire, and to follow the directions of the Fire Service.

7.2.1.4 Evacuation procedures must be carefully and clearly laid down, and they must also be the subject of regular practices (e.g. every three months) for the entire site staff. Evacuation procedures should be lodged and .approved by the Fire Service.

7.2.1.5 Premises employing more than 20 workers per shift should establish a rescue squad that is fully trained and suitably equipped to deal with any emergency likely to arise.

7.2.1.6 All premises should display the HAZCHEM Code at site entrances and at each storage site.

7.3 ASSESSMENT OF HAZARD LEVELS

7.3.1 A systematic assessment of workplace hazards and the risks they present should play a vital role in the operation of any undertaking, large or small. The activities, processes and machinery used in industry all have the potential to be hazardous to the employees and to the local community. Management should put in place a hazard assessment system to assist in the prevention of accidents and incidents.

7.3.2 A good hazard assessment system should contain the following elements:

(a) The identification and evaluation of potential accident, incident, or hazards.

(b) The development of effective preventive measures, including safety procedures, management practices and audits, and covering training, plant layout, operating procedures, maintenance, and provision of safety equipment and protective clothing..

(c) The preparation of emergency procedures to deal with and minimise the consequences of any accident or incident involving the undertaking and the surrounding community.

7.3.3 An example of a simple hazard assessment sheet is set out in appendix 4.

7.3.4 The complexity of any hazard assessment system would depend on the size of the undertaking, but even small undertakings employing one or two employees will find such a system a useful tool for operating safely and effectively.

7.3.5 All employees should be involved in the system, and the information gathered should be included in a comprehensive data base available and open to them. The information can be used to train new employees and encourage employees to report defects or potential hazards, as well as suggesting solutions for overcoming or removing the hazard.

7.3.6 Where a potential hazard exists which would affect the local community or environment, it is essential that the advice and involvement of local emergency services and other relevant authorities, e.g. drainage hoards and water boards, be sought and used.

7.3.7 Any hazard assessment system should be updated, revised or amended on a regular basis and especially when new activities, processes or machinery is introduced.

7.4 PERSONAL PROTECTIVE EQUIPMENT

7.4. 1 INTRODUCTION

7.4.1.1 As previously stated, wherever practicable work processes should be so designed as to minimise the necessity for employees to wear personal protective clothing and equipment. The feasibility of replacing hazardous substances, the isolation of processes requiring hazardous substances, and/ or the provision of effective ventilation, should be investigated before reliance is placed on personal protective devices.

7.4.1.2 Personal protective equipment includes such items as respiratory protective devices (masks and breathing apparatus), protective clothing' and protection for the eyes, face, head, limbs, body and hearing.

7.4.1.3 In order to assess what protective equipment is required, the nature of the chemical in question and the particular circumstances of an employee's tasks must be considered.

7.4.1.4 Employers must ensure that personal protective equipment and clothing are:

(a) Suitable and sufficient for use with the process for which they are intended. Where appropriate, they shall be of a type recommended or approved by a recognised authority;
(b) Properly maintained, cleaned and stored by a trained and competent person;
(c) Not used by employees unless employees have firstly been trained in their correct use;
(d) Issued and fitted to employees on an individual basis;
(e) Checked regularly to ensure they are effective;
(f) The time limit for usage as stipulated by the manufacturer is not exceeded.

7.4.2 EYE AND FACE PROTECTION

7.4.2.1 Suitable safety glasses, goggles and face visors must be worn where there is a risk of injury from flying particles, or chemical splashes. Personal protective equipment covering both the head and face should be worn when drums are opened or chemicals mixed.

7.4.2.2 Safety showers and eye washing facilities shall be provided in the areas where solvent handling and mixing is carried out. These should be conspicuously marked, access to them kept clear of obstructions, and must be kept clean. Safety showers should be tested regularly to ensure proper functioning.

7.4.3 RESPIRATORY PROTECTION

7.4.3.1 The airborne concentration of solvent vapours must be maintained below the WES in working areas by providing adequate ventilation. Respiratory protection should only be required during some "one-off" jobs and in some emergency situations, e.g. spillages. Refer appendix 5.

7.4.3.2 When respirators are used, the training programme shall provide information on:

(a) The choice of the correct respirators for the job hazards and the employee.

(b) The correct use and fitting of respirators.

(c) The importance of proper maintenance of respirators. For example, at the end of each day they should be taken apart, washed, dried and have defective parts replaced.

(d) That respirators should be used by only one person unless cleaned and disinfected between use.

(e) The replacement of filters when the respirator has been used tor the cartridge's specified lifetime, if an employee can smell vapours in mask, or if breathing becomes difficult. Canisters and cartridges, once opened, must be stored in an airtight container when not in use.

7.4.4 HAND, ARM AND FOOT PROTECTION

7.4.4.1 Impervious gloves are essential for employees handling solvents in any quantity. Not all materials from which gloves are made offer effective protection against solvents, and some materials are chemically attacked by certain solvents. Gloves of PVC or neoprene are resistant to most types of solvents. Gloves should comply with the standard, refer appendix 3.

7.4.4.2 Rubber, PVC, or neoprene aprons are appropriate items of protective clothing if solvents are to be handled regularly.

7.4.4.3 Solvent-resistant footwear may be considered advisable in some circumstances, particularly where bulk handling of solvents is carried out.

7.4.5 BODY PROTECTION

7.4.5.1 Overalls should be worn. These should be resistant to penetration by liquids and dusts and be manufactured of non-static producing materials. Food or cigarettes should not be carried in overall pockets. Overalls should be cleaned regularly, preferably by dry cleaning, before they become heavily soiled. Impervious overalls should be worn in high-risk situations.

7.4.5.2 A waterproof bib-type apron which extends below the knees should also be worn if splashes are likely.

7.4.6 CLEANING AND STORAGE FOR PROTECTIVE CLOTHING AND EQUIPMENT

7.4.6.1 To work efficiently, protective equipment must be constantly looked after. This includes storage in a clean, dust-free area. Wash, clean and disinfect respiratory equipment after use. If possible, have separate clothing storage areas for women and men. Lockers should comply with the Standard, refer appendices 3 and 5.

7.4.7 RESPIRATOR CLEANING

7.4.7.1 The following steps are to be taken:

(a) Remove any filter, cartridges or canisters.

(b) Wash facepiece and breathing tube in cleaner-disinfectant solution. Use a hand brush for removing dirt.

(c) Rinse well in clean, warm water.

(d) Air dry in a clean area.

(e) Clean other respirator parts as recommended by the manufacturer.

(f) Inspect valves, head straps, etc., and replace with new parts if defective.

(g) Insert new filters, cartridges or canisters, make sure seal is tight.

(h) Store in a plastic bag or some other container.

(i) Store respirators, protective clothing and other equipment safely, away from contaminating dust.

(j) Also follow manufacturer's instructions provided. For further information refer appendix 5.

7.5 PERSONAL HYGIENE

7.5.1 EATING, DRINKING AND SMOKING

Employees must not eat, drink or smoke in the work area, nor should food or drink be taken into the process area. Chemicals will often get onto clothing, hands, food and cigarettes and residues can then be swallowed.

7.5.2 EMPLOYEE RESPONSIBILITIES

7.5.2.1 Workers should take the following steps to reduce the risk of exposure to workplace contaminants:

(a) Before work—

- (i) Take off normal outdoor clothing in the washroom and put on overalls and working boots or shoes.
- (ii) Check that there are hand cleaners and towels in the washroom ready for later use.
- (iii) Make sure gloves, helmet visor and respirator are clean and in good condition.

(b) During work—

- (i) Don't eat, drink or smoke in the work area.
- (ii) Don't carry food, drink or tobacco into the work area.
- (iii) Don't rub eyes or face with dirty hands or sleeves.
- (iv) Stop chemicals splashing or dripping onto clothes.
- (v) Apply appropriate first aid measures to protect all wounds from contamination.

(c) During work breaks—

During work breaks, before eating, drinking or smoking, follow this order:

- (i) Go to the washroom.
- (ii) Take off gloves and apron.
- (iii) Rinse hands, arms and face with running water.
- (iv) Wash hands, arms and face with soap.

(d) After work—

- (i) Wash outside of gloves, turn inside out, wash inside, then leave to dry.
- (ii) Take off all work clothes.
- (iii) Wash well before putting on outdoor clothing to go home.
- (iv) Shower after the end of each day's work, at work, if there is one available, or as soon as returning home.
- (v) Arrange for work clothes to be washed.

(Employers should, where necessary, provide shower facilities tor employees and laundry facilities for contaminated clothing.)

7.6 MAINTENANCE

7.6. 1 NORMAL MAINTENANCE PROCEDURES

Maintenance procedures should be tailored to suit each work situation, but the following points must be taken into account.

7. 6.2 MAINTENANCE OF PROTECTIVE CONTROL MEASURES AND FACILITIES

All control measures and facilities that are provided to protect employees against exposure to workplace contaminants require regular maintenance, e.g.:

(a) Process control measures:
(b) Protective clothing and respiratory protective equipment;
(c) Drinking and eating facilities; and
(d) Washing facilities.

7.6.3 CARRYING OUT MAINTENANCE

7.6.3.1 Maintenance should be carried out in a systematic way. All components of the protective control measures, from ventilation system components to personal protective equipment, need proper maintenance. All maintenance carried out should be recorded in a maintenance log book.

7.6.4 MAINTENANCE TIMING

7.6.4.1 The intervals between visual checks and thorough examinations will vary, but:

(a) Carry out a weekly general visual check.
(b) Check respiratory protective equipment each day before use; (carefully check facepieces, harnesses, inlets and exhaust valves, filter canisters, cartridges, hoses and airlines. Self-contained and airline breathing apparatus shall be thoroughly examined and tested monthly).
(c) Ventilation equipment should be thoroughly examined and tested yearly.

7.6.5 CORRECTING DEFECTS

7.6.5.1 There should be a procedure for replacement and repair. Time limits should range from immediate action to action within a few weeks or months, depending on the equipment concerned.

7.6.6 RESPONSIBILITY FOR MAINTENANCE

7.6.6.1 Visual checks should be carried out by employees and supervisors as part of their daily work routines. These should look for obvious defects such as damaged protective clothing and leakages from enclosures.

7.6.6.2 Persons with the appropriate specialist skills should be responsible for the thorough operation and testing of breathing apparatus and ventilation systems.

7.6.7 THE VENTILATION SYSTEM

7.6.7.1 A thorough, yearly examination of contaminant control ventilation systems should include:

(a) A thorough examination, both internally and externally. Check all parts: openings, collection hoods or other suction points duct work, dust collection and filtration units, fans or air movers.

(b) Measurements of static pressure in the duct immediately behind each opening, collection hood or suction point; (do this when the equipment is simultaneously extracting from each place served).

(c) Measurement of air velocity at the face of openings to enclosures, collection hoods, or other suction points for which standard speeds have been specified.

(d) An assessment of whether the dust, fumes or vapour are being controlled at each opening, collection hood or suction point.

(e) Measured dust or vapour concentrations to make sure the system is keeping the concentration below the control limit.

7.7 WORKPLACE ENVIRONMENTAL MONITORING

7. 7. 1 PURPOSE

7.7.1.1 The purpose of environmental monitoring is to:

(a) Decide whether plant and process control measures are working efficiently;

(b) Measure the amount of exposure of employees to possible health hazards.

7.7.2 METHOD

7.7.2.1 Workplace environmental monitoring is usually carried out in one of two ways: either by using a direct reading instrument to give an immediate measure of the concentration of a substance present in the workplace, or by taking a sample which must be sent to a laboratory for analysis.

7.7.2.2 Where a sample is taken, this can either be obtained from a fixed point, or a “personal” sample from equipment attached to an employee. The advantage of personal sampling is that it reflects more accurately the concentrations of hazardous substances to which the employee has been exposed.

7.7.2.3 The following points need to be considered when environmental monitoring is undertaken:

(a) The type of hazard;

(b) Who and where to sample;

(c) When to sample;

(d) For how long to sample;

(e) The number of samples; and

(f) The sampling period.

7.7.2.4 The correct sampling instruments, methods and correct analytical procedures need to be identified. Advice on this is available from offices of OSH or the appropriate crown research institute.

7.7.2.5 Repeat monitoring should be carried out if there is a change in materials, plant or process controls. The first assessment will give valuable information for comparison when re-assessments are carried out.

7.7.2.6 After the first assessment, an air monitoring programme should be considered, taking into account:

(a) The substance which may be present in the air and which need to be measured;
(b) The work practices that may produce these substances;
(c) The period of exposure to the substances;
(d) The best practical means of measuring such substances; and
(e) How often monitoring takes place.

7.7.2.7 Sampling should be done during normal work. Personal samples should be taken from within the breathing zone if this is possible, to ensure that the results obtained accurately reflect worker exposure. Further advice can be obtained from OSH, or the CRI.

7.8 HEALTH MONITORING

7.8. 1 INTRODUCTION

7.8.1.1 It is essential that in an undertaking where chemicals or dust may be hazardous to the health of employees, the health of exposed employees be monitored, with their agreement, by a qualified person (a doctor or nurse).

7.8.2 PURPOSE OF HEALTH MONITORING

7.8.2.1 The aim of health monitoring (checking employee's health) is to ensure, as far as possible, the fitness of employees to do their work, and to protect and maintain their health.

7.8.2.2 It should ensure that:

(a) The employee has no relevant disability (health problem) which will prevent them from safely performing the work.
(b) Health is not likely to be affected by the work process.
(c) Health education is given about the possible hazards of the job and the importance of taking appropriate safety and health precautions. (Employees should be encouraged to discuss any worries about their health with the nurse or doctor, especially if they might be caused by the working environment).
(d) All baseline health information should be recorded. Any health details obtained subsequently can then be compared. In addition,
(e) Any notifiable diseases must be reported.

7.8.3 INITIAL HEALTH CHECK

7.8.3.1 Employers should ensure employees undergo an initial health check in order to obtain information about the employee's health. It should include details of all significant, previous ill health which may have a bearing on the employee's ability to do the intended work. It may also identify employees more at risk from the health hazards of the workplace.

7.8.3.2 The check should be carried out by a suitable trained nurse and/or doctor and should include:

- (a) Previous work history, including possible exposure to physical and chemical hazards;
- (b) A history of health problems, particularly conditions likely to be affected by the hazards present in the industry;
- (c) Consideration of other physical hazards such as noise and physical ability to do the job;
- (d) Reference to the eyes, ears, nose, throat and respiratory system and the skin (which are most likely to be affected by chemicals and dust). However, the gastro-intestinal, neurological and cardiovascular systems should be included. Any metabolic disorders, such as thyroid dysfunction, diabetes or liver disease should be noted; and
- (e) A record of drinking and smoking habits, as well as any use of medication.

7.8.4 PERIODIC HEALTH CHECK

7.8.4.1 At the initial health check it should be decided which employees need further health surveillance. This will depend upon the health of the individual employee and on the potential health hazards posed by the job.

7.8.4.2 Where health questionnaires are to be completed by the employees, it is suggested that they be given enough time to complete them at their own pace. Details can be checked later at the time of the medical assessment.

7.9 RECORDS

7.9.1 KEEPING RECORDS

7.9.1.1 Records should be kept of all health surveillance and environmental monitoring carried out in an undertaking. Such records should be concise and available to parties as detailed below.

7.9.2 INDIVIDUAL MEDICAL RECORDS

7.9.2.1 The following information should be recorded for each employee:

(a) Job classification.

(b) Health problems, especially those which may be work-related.

(c) Biological monitoring results (e.g. blood or urine levels of toxic chemicals).

7.9.2.2 Employee health data, other than the results of routine biological monitoring, are confidential and remain the property of the doctor or nurse to whom the information is given. The results of any monitoring of an employee undertaken by or on behalf of an employer or a state department shall be given to the employee. No information shall be divulged to any other person (employer or employee) without the written consent of the employee involved. The only exception to this shall be the transfer of records from one doctor or nurse to their successor. Where no successor is appointed, all records shall then be regarded belonging to the employees from whom they were obtained. Medical records should be kept for 30 years.

7.9.3 WORKPLACE ENVIRONMENTAL MONITORING RECORDS

7.9.3.1 These records should clearly show:

(a) Clear identification of the work being monitored:

(b) The results of first and subsequent measurement of workplace contaminants;

(c) Details of corrective action taken where results in excess of the Workplace Exposure Standard are found;

(d) Any significant change to:

   (i) Processes;

   (ii) Materials used;

   (iii) Environmental control equipment;

   (iv) Name, status and dated signature of person doing the monitoring.

7.9.3.2 These records should be available to those persons as listed in the section on provision of information (6.1.2.7).

WARNING: The following references, standards and associated information has been updated at the time of publication, however, it is subject to change without notice at any time.

APPENDIX 1: NOTES ON THE TOXICITY OF SOLVENTS

In industry the main toxicological hazards arising from exposure to solvents are normally due to inhalation of the vapour or prolonged skin contact. Ingestion is not normally a problem and is not considered here.

All organic solvents are capable of causing dermatitis due to the defatting action of the solvent on the skin. All organic solvents are also capable of causing central nervous system depression with effects such as drowsiness, uncoordination, inattention and impaired balance, which are clearly safety risks in the industrial setting. The solvents listed below have the following significant additional toxicology hazards.

n-butanol:

Prolonged exposure to high concentrations of the vapour may damage the eyes. However, because of its low vapour pressure, concentrations below the WES should be easily maintained.

ethoxyethanol and methoxyethanol:

Both of these solvents (and their acetates, which may also be used in the paint and printing industry) have been implicated in causing adverse reproductive effects in animals. While such effects have not been reported in humans, special care should be taken with these solvents. It should be noted that they will readily pass through the skin.

2 -nitropropane:

Care should be taken when handling this solvent as it can not be detected by smell up to about 80 ppm (cf WES-TWA of 10 ppm). There is evidence that this solvent is an animal carcinogen.

1,1,1-trichloroethane and trichloroethylene:

Exposure to high concentrations of the solvents in conjunction with vigorous physical activity or excitement may cause sudden ventricular fibrillation, causing cardiac arrest.

APPENDIX 1(A): PROPERTIES OF COMMON SOLVENTS

SOLVENT	CHEMICAL SYNONYMS	WES		BOILING POINT	VAPOUR PRESSURE	FLASH POINT	AUTO IGNITION TEMP
		TWA	STEL	(°C)	(mmHG @125°C)	(°C)	(°C)
Acetone	2-propanone dimethyl ketone	750	1000	56	226	-18	461
N-butanol	butyl alcohol		50[2]$_{\text{ceiling}}$	82	7	52	365
Butoxyethanol’	ethylene glycol monobutyl ether	25[2]	75	172	1		75
Ethanol	ethyl alcohol	1000	•	78	50	13	423
Ethyl acetate	acetic ether	400	•	77	100	-4	427
Ethoxyethanol[1]	ethylene glycol monobutyl ether	5[2]	•	135	5	44	235
Ethylene glycol	ethanediol		50$_{\text{ceiling}}$	156	0.005 @20^{0}C	56	380
Isopropanol	isopropyl alcohol	400	500	83	44	12	456
Isopropyl acetate		250	310	89	73	2	460
Methanol	methyl alcohol	200	250	65	125	12	470
Methoxyethanol[1]	ethylene glycol monomethyl ether	52	•	124	10	46	285
Methyl ethyl ketone	2-butanone	200	300	80	100	-6	516
Methyl n-propyl Ketone	2 pentanone	200	250	102	16	7	505
2-nitropropane		10		120	13 @ 20°C	39	428
1-propanol	n-propyl alcohol	200	250	97	21	25	440
N-propyl acetate		200	250	102	35	14	450
Propylene glycol	1, 2-propanediol	•	•	188	0 13	99	371
Toluene	toluol, methyl benzene	100	150	110	29	4	480
1,1,1-trichloroethane	methyl chloroform	350	450	74	127	NF[3]	NF[3]
Trichloroethylene	numerous	50	87	77	NF[3]	NF[3]	
White spirits	Stoddard solvent	100	200	150-210	•	35-43	232$_{\text{approx}}$
Xylene	Xylol, dimethyl benzene	100	150	138	10 @28°C	17-25	530

1. These are glycol ether compounds and have a number of commonly used proprietary names such as Cellosolves, Dowanols, Oxitols.

2. These WESs gave skin notation.

3. Non-flammable.

NOTE: Chlorinated hydrocarbons produce toxic gases when involved in a fire.

APPENDIX 2: LIST OF LEGISLATION APPLICABLE TO THE INDUSTRY AND THE OPERATION OF THIS CODE

GENERAL LEGISLATION ADMINISTERED BY OSH INSPECTORS

Health and Safety in Employment Act 1992

The Factories and Commercial Premises (First Aid) Regulations 1985

The Lead Process Regulations 1950

DETAILED LEGISLATION ADMINISTERED BY OSH (DANGEROUS GOODS) INSPECTORS OR REGIONAL AUTHORITIES.

Cobalt naphthenate is designated as a Class 4.1C flammable solid in terms of the Dangerous Goods Order 1983. Cobalt naphthenate is commonly used in solution in mineral turpentine with a dangerous goods classification 3b.

The Dangerous Goods (Class 3: Flammable Liquids) Regulations 1985 give extensive details of all aspects of above- and below-ground storage requirements for flammable liquids in bulk.

The provision and construction of depots and approved storage areas for the storage of dangerous goods of Class 3 is covered in detail in the Dangerous Goods (Class 3) Regulations. In brief, these regulations cover the types of storage depots which are permissible, materials of construction, siting and isolation distances for depots, fire fighting equipment, and many miscellaneous matters.

Smaller quantities of commonly used solvents are dispensed as required from drums. Such storage must comply with the Dangerous Goods (Class 3: Flammable Liquids) Regulations 1985.

The positioning of vats, tanks, and processing steps within the factory layout should be such that maximum use can be made of natural ventilation. Reference must be made to the Dangerous Goods (Class 3: Flammable Liquids) Regulations 1985, Regulations 128-170.

REFERENCES IN THIS CODE

5.4.0.2 A flammable solvent is classified depending on its flash point as Class 3(a) or 3(b) dangerous goods under the Dangerous Goods Order 1983. If the flash point is below 23°C the material is considered to be in Class 3(a), and if the flash point is 23°C and above, but below 61°C, the designation is Class 3(b). The flash points for solvents commonly used are given in appendix 1.

5.4.0.3 Such classification in turn determines the specific safety measures which must be taken with regard to storage and handling. The Dangerous Goods Act 1974 and, in particular, the Dangerous Goods (Class 3: Flammable Liquids) Regulations 1985 should be consulted for precise requirements.

5.4.1.2 "Wetted" cellulose nitrate is scheduled Class 4.1, Category B, under the Dangerous Goods Order 1983.

5.4.2.3 Organic peroxides are scheduled Class 5(b) under the Dangerous Goods Order 1983 and Dangerous Goods (Class 4 Flammable Solids or Substances and Class 5 Oxidising Substances) Regulations 1985.

5.4.3.5 The storage of flammable liquids either in above- or below-ground bulk storage tanks, or in drum form in compounded areas, is covered by the Dangerous Goods (Class 3—Flammable Liquids) Regulations.

5.4.3.6 The storage of cellulose nitrate and organic peroxides is covered by the Dangerous Goods (Class 4: Flammable Solids or Substances and Class 5: Oxidising Substances) Regulations 1985.

OTHER LEGISLATION

7.8.2.2(e) Any diseases as specified in the Health Act 1956 and the Health Amendment Act 1982 as notifiable diseases must be reported — administered by Crown Health Enterprises.

Electrical Wiring Regulations 1976 — administered by local power authorities.

APPENDIX 3: OTHER CODES OF PRACTICE AND STANDARDS WHICH SHOULD BE READ IN CONJUNCTION WITH THIS CODE

Name	**Available from**
Code of Practice for the Safe Use of Isocyanates	All branches of OSH
Code of Practice for Health and Safety Representatives and Health and Safety Committees	All branches of OSH
NZS 5807: *Code of practice for industrial identification by colour wording or other coding*	All branches of OSH
NZS 6101*: Part 3—Classification of hazardous areas*	Standards New Zealand
AS 1020: 1984 *The control of undesirable static electricity*	Standards New Zealand
NZS 5812: 1982 *Specifications for industrial gloves*	Standards New Zealand
NZS 1187:1969 *Lockers*	Standards New Zealand

APPENDIX 4: A SIMPLE EXAMPLE OF PART OF A HAZARD ASSESSMENT

Identified hazard—
Possible effects
Source of hazard—
Number of employees exposed—
Degree of employee exposure—
Methods to eliminate or reduce risk to workers from hazard—

APPENDIX 5: LIST OF PUBLICATIONS RELEVANT TO THE INDUSTRY AND TO THE OPERATION OF THIS CODE

Available from any branch office of the Occupational Safety and Health Service, Department of Labour:

Safety in Confined Spaces

Guidelines for the Control of Static Electricity in Industry

Guidance Notes for Completion of a Material Safety Data Sheet

A Guide to Respirators and Breathing Apparatus

Planning the Workplace

Safety with Corrosive Chemicals

Good Housekeeping in Industry

A Brief Guide to the Training of Machine Operators

Safety at Work—What Every Employee Should Know

Hot Work on Drums and Tanks

Safe Access

Workplace Exposure Standards and Biological Indices for New Zealand

Practical Guidelines for the Safe Use of Organic Solvents

Available from the Chemical Industry Council:

Guidelines for Waste Management Practice in New Zealand

Emergency Response Procedures

Warning Signs for Premises Storing Hazardous Substances

Hazardous Material Labelling