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# **Guide to the Safe Handling of PVC Resin Supplied by Australian Vinyls**



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## 1 Introduction

This note outlines the precautions that should be taken in the handling of polyvinyl chloride (PVC) resins, which are supplied in powder form by Australian Vinyls Corporation Limited, ABN 15 078 558 595. It does not include discussion on the suitability of grades for particular applications, nor any precautions that may be necessary during the use in service of any product made from the polymer.

Selected functional additives must be added to PVC resins to aid processing and to achieve the required properties and characteristics in the finished product. General advice on the choice of additive chemicals for different applications is contained in standard volumes on PVC Technology (Ref 1). However, the user must ask the additive supplier to provide information on the safe handling and use of each ingredient, including the relevant safety data sheet.

## 2 Potential hazards

### 2.1 Health

#### 2.1.1 General

The PVC resins supplied by Australian Vinyls (AVC) are chemically inert and are generally recognised as biologically safe by legislative authorities. They may contain trace residues of vinyl chloride monomer (VCM), which is gaseous and can be slowly released from the polymer to the surrounding atmosphere. The residual VCM level in all PVC resins supplied by AVC are guaranteed to be less than 1 ppm, well below the safe limits issued by Worksafe Australia.

PVC resins supplied by AVC are not classified as hazardous according to the criteria of Worksafe Australia. They are also not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code for transport by road or rail.

#### 2.1.2 Residual monomer inhalation

There is accepted evidence linking the inhalation of VCM over prolonged periods with carcinogenic effects and Worksafe Australia has recommended a maximum average exposure level of 5 ppm for workers (Ref 2). Whenever practicable, exposure should be brought as near as possible to zero concentration. Suitable analytical techniques to measure VCM levels may be found in a manual published by Chemical Industries Association Limited, Kings Buildings, Smith Square, London (Ref 3)

The release of VCM from the PVC resins supplied by AVC into processing plant atmospheres will only produce trace levels, very considerably lower than the Worksafe Australia levels in Ref 2. To avoid any risk of respiratory irritation, all areas where PVC resin supplied by AVC is stored, handled and processed should be well ventilated

#### 2.1.3 Ingestion

PVC resins supplied by AVC do contain very small quantities of unreacted monomer and, therefore, ingestion is undesirable. No adverse effects are expected as a result of ingestion, however large amounts may cause nausea and vomiting.

#### 2.1.4 Skin contact

PVC resins, being in the form of irregular fairly hard particles, may be irritating to the skin through abrasion. Attention is drawn to this fact because PVC resins are normally used with other chemicals, which may have an irritant effect on abraded skin.

#### 2.1.5 PVC dust

PVC dust is considered a "nuisance dust" (defined as producing no irreversible change in living tissues when exposures are kept under reasonable control, eg to a hygiene standard of 10 milligrams per cubic metre) (Ref 4). This classification has been supported by a number of surveys of workers who have had prolonged exposure to PVC dust.

It is considered prudent that steps should be taken by all PVC producers and users to maintain atmospheric levels of PVC dust as far below the nuisance dust threshold limit value defined by the relevant State Authority as is reasonably practicable.



The need for good industrial hygiene is emphasised. The exposure of operators to PVC dust should be minimised by the proper design of storage and handling facilities, by proper works practice, by good housekeeping and by the use of suitable clothing including face masks capable of excluding very fine particles (Ref 5). PVC dust can also be physically irritating to eyes and as for other fine inert powders can be difficult to remove. The use of suitable eye protection is recommended when handling PVC powder.

The use of efficient and appropriately sited ventilation and extraction systems will enable low atmospheric concentrations to be maintained (see Section 3.1 Health Considerations).

## 2.2 Fire

### 2.2.1 Ignition and burning characteristics

Under normal storage conditions, PVC resins and most compositions based on PVC are not flammable. They will burn, however, in the presence of an ignition source and an adequate supply of air. When stored in palletised bags, it must be recognised that the packages and pallets themselves can be a fire risk and are generally a much more likely route for rapid-fire spread.

#### Action in the event of fire involving PVC resins

See section 3.2, Safety Considerations.

### 2.2.2 Decomposition products

PVC burns to give dense, acrid fumes. The main gaseous products of combustion are carbon monoxide, carbon dioxide and hydrogen chloride (Ref 6). Carbon monoxide and hydrogen chloride are both highly toxic. Carbon monoxide acts as an asphyxiant while hydrogen chloride is highly irritant. In addition, hydrogen chloride is highly corrosive. The Threshold Limit Values are 50 ppm (TLV-TWA) for carbon monoxide and 5 ppm (TLV-C) for hydrogen chloride. Reference 10 should be consulted for further details of occupational exposure limits (OEL's), including their significance and application.

## 2.3 Explosion

As a dust explosion hazard, PVC powders are rated as a "lower order risk" as defined in the work carried out by the British Fire Research Station (Ref 7) (see section 3). However sensible precautions should be taken to avoid dust clouds and general dust build-up. In particular, ingress of dust into electrical switchgear and equipment should be prevented.

It is essential when PVC powder is pneumatically conveyed, that the system is efficiently earthed to avoid the possibility of a static discharge spark (see clause 3.2.3).

Before welding work on a silo or pipe system is started, it should be effectively purged and cleaned.

## 3 Recommended precautions for transportation, storage and handling

### 3.1 Health considerations

When required, tankers and bulk containers should be sampled by means of a long handled scoop to avoid possible exposure to levels of VCM above the recommended standard (Ref 2). Fall protection must be provided if accessing the tops of tankers and containers.

When it is necessary to enter a confined space of a bulk container, silo, etc, there is a risk of exposure to concentrations of VCM above the Worksafe Australia recommended levels (Ref 2). In such circumstances, all the requirements as stated in the standard AS/NZS 2865 – Safe Working in Confined Space – should be followed. Simple test equipment is available to check that the atmosphere is satisfactory for entry without breathing equipment. A method is contained in Ref 3.

All extraction systems, whether purge or venting facilities, should be positioned so that they exhaust away from the natural working environment. The exhaust air should be filtered so that fine PVC dust does not pass into the atmosphere. Suitable extraction and protective clothing should be available in all areas where a person is exposed to PVC dust during handling or processing. Persons continually



present in such areas should wear dustproof overalls and caps, made from cotton or cotton/polyester fabrics. Good quality dust masks capable of excluding fine powders, gloves and goggles should be used in unavoidably dusty conditions.

### 3.2 Safety considerations

#### 3.2.1 Fire fighting

All commonly available fire extinguishers are effective in fighting fires involving PVC, although due note should be taken of the particular situation (e.g. when live electrical equipment is nearby) which may restrict the use of some media. Advice should be sought from the local Fire Authority as to the most suitable types of extinguishers to be installed.

In the event of a small, localised fire, immediate action may be taken by personnel in the vicinity, removing the source and using available extinguishers. Care should be taken to avoid inhalation of decomposition fumes. When the fire has been extinguished, ventilation should be increased to clear the fumes as quickly as possible.

If a major outbreak of fire is discovered, the Fire Brigade should be called immediately and personnel should be evacuated from the area. It is important to advise the fire fighting personnel to wear acid-resistant, protective clothing and full face masks. Fire fighters who may be exposed to the products of combustion should wear suitable breathing equipment. Qualified medical aid should be sought if anything more than very temporary irritation to skin, eyes, throat, etc, is experienced by personnel who came into contact with PVC decomposition products.

#### 3.2.2 Corrosive fumes

Hydrogen chloride, which is given off during the combustion or degradation of PVC, has a highly corrosive effect on many materials. Equipment surfaces directly affected should be cleaned down to remove corrosive depositions as soon as possible after the fire has been extinguished (Ref 8).

#### 3.2.3 Static charge

In order to avoid the possibility of a static spark causing an explosion during the discharge of the contents of resin tankers and containers into silos, it is essential to ensure that there is strict adherence to earthing procedures for tankers and containers (Ref 9). Bulk storage systems should also be checked to ensure that earthing arrangements are fully effective.

Attention should be paid to controlling or eliminating likely sources of ignition, such as static charge build-up, naked flames, welding, etc.

Static charges sufficient to cause shocks can be induced on the outside of intermediate bulk containers during filling with PVC. To avoid this, metal containers must be earthed, and containers made of electrically insulating materials should have an earthed bare metal rod, reaching from top to bottom, inserted through the filling port while being filled.

#### 3.2.4 Storage and Handling

Every effort is made to ensure that PVC resins supplied by AVC arrive in good condition.

'Corvic' PVC resins and imported PVC resins supplied by AVC are packed and delivered in three forms,

- in 25kg paper or polymer bags on pallets
- in bulk bags on pallets
- in full bulk loads

Good material handling techniques should always be employed and staff should be trained in safe warehousing, lifting and handling procedures.

Under no circumstances should resin packed in bulk bags be stacked in a one on one arrangement.

'Corvic' PVC resin packed in 25kg paper bags is designed to be double stacked provided safe warehouse practices are followed. All imported resins supplied by AVC in 25kg bags should not be double stacked in a one on one arrangement.



If unsure of the safe stacking of PVC resin supplied by AVC, advice should be sought in writing, from AVC.

Stacked products should be inspected regularly in store to check that stacks are stable and safe.

Pallets are designed for movement by forklift trucks. Care should be taken to ensure that the forks are longer than the depth/width of the pallet to be lifted (ie: forks protrude through).

Overwrapping of pallets is designed to improve the stability of the load and not to provide protection against weather ingress. PVC resin should therefore be stored internally.

#### 3.2.5 Spillage

Vacuum cleaning is preferable, but if polymer is swept up, it should be moistened first. Employees should wear appropriate protective clothing (see Section 3.1). The polymer may be disposed of by landfill, according to local regulations (see Section 7), but dust generation on the way to and at the tip should be avoided, for example by the use of covers and/or moistening.

## 4 Recommended precautions for compounding, processing and fabrication

### 4.1 Temperature limits

PVC resins are stable at ambient temperatures, but will decompose at elevated temperatures, liberating traces of unreacted monomer, oxides of carbon and free hydrogen chloride, which is both corrosive and toxic. As a general rule, unstabilised PVC resin will show signs of decomposition within one hour at 100°C and within two minutes at 180°C. Decomposition may normally be recognised by a brown discolouration of the PVC, accompanied by the emission of an acrid odour and fumes. These fumes are both corrosive and toxic and users should avoid where possible any practices which may result in the decomposition of PVC. (See section 2.2.2)

### 4.2 Ventilation and extraction

Good ventilation should be provided in any working area where PVC resins are handled and processed.

### 4.3 High speed mixing

Where high speed mixers are used for the preparation of PVC powder blends, it is particularly important to maintain adequate ventilation and here 10 - 15 air changes per hour are recommended for the work area in the vicinity of the mixer.

### 4.3 Other processing equipment

While the build up of explosive monomer/air mixture is most likely to occur in high speed mixers, it can conceivably happen in other compounding, handling and processing equipment. All equipment should be considered carefully on this count, the remedy in every case being adequate ventilation, exhausting right away from the work environment.

### 4.4 Fire

The recommended precautions under this heading are as in Section 3.2.

## 5 Hygiene

After contact with PVC polymers, ordinary precautions for personal hygiene should be observed, including normal washing with soap and water. Barrier creams may be applied to the skin before starting work, but they are not essential.

The use of solvent or compressed air, either for cleaning the skin or clothing while it is being worn, should not be allowed.



Although no special hazard exists, it is recommended that in accordance with normal practice for handling industrial materials, no smoking, eating or drinking should be allowed in areas where PVC polymers are handled. Employees handling PVC should be encouraged to wash and to change their outer clothing before eating.

When a PVC composition is known to contain a toxic ingredient, the following personal hygiene precautions are necessary in handling and processing:

1. Suitable protective clothing (e.g. gloves, goggles and dust respirators) should be worn when there is a risk of exposure. Such protective clothing should be laundered/cleaned/replaced regularly, as appropriate.
2. All exposed areas of skin should be washed (normally soap and water are adequate but organic solvents should not be used) after work and before eating, drinking or smoking. Barrier creams may be used but are not essential.

Some restrictions may be appropriate in the interests of good hygiene, even when the presence of toxic ingredients is not indicated.

## **6 Recommended First Aid treatment**

### **6.1 Inhalation of noxious fumes**

The patient should be removed as rapidly as possible into fresh air. Artificial respiration should be applied if necessary. Expert medical attention should be obtained immediately.

### **6.2 Eye Injuries**

PVC powder and powder compositions should be flushed from the eye with water. Medical attention should be sought immediately.

### **6.3 Ingestion of PVC resin**

Although ingestion is obviously undesirable, no special medical treatment is required should it occur.

### **6.4 General**

It is important when summoning medical attention that the doctor or hospital is fully advised of the nature of the products being handled and the circumstances surrounding the accident.

## **7 Waste disposal**

The statutory authorities in each State or regional area control disposal of waste. Before disposing of contaminated or waste PVC materials, it is recommended that advice be sought from the local authority or authorities concerned.

Wherever possible, PVC waste should be recycled. If further information or assistance in this area is required, contact Australian Vinyls (03 9368 4800) or PACIA (03 9429 0670).

## **8 Additional information**

The material safety data sheet for the PVC resins supplied by AVC should be consulted for further information on transportation, storage and handling of PVC resins.



## Appendix 1. References

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