Feb 1999

1:7 Health and safety precautions (part 3)

The notes listed below are designed to provide help and guidance when modern Protective Coatings are being used in different environments. These notes are not intended to be a complete treatise on the subject of safety during painting but are designed to make one aware of some of the dangers involved. Further information may be made available if required by contacting our local representatives. The two notes presented cover: (1) The interior painting of tanks, (2) Exterior painting.

Tank painting
A high proportion of tank coatings applied throughout the world contain flammable organic solvents, which can form explosive mixtures with air. Refer to AS/NZS 2865:2001 Safe Working in a Confined Space for safety precautions to be taken while applying these coatings. Attention must be given to the following points:

a. Danger of explosion or fire.
b. Provision of a suitable breathing environment
c. Prevention of skin irritation problems.

Danger of explosion or fire
The key factors in preventing explosion or fire are:

1. Adequate ventilation, 2. Elimination of naked flames, sparks and any ignition sources.

Any organic based coating could, merely by the normal process of drying, give off sufficient solvent vapour to produce an explosive mixture in a tank when the vapour concentration reaches or exceeds 1% by volume in air. However, at 1% these solvents produce an intolerably unpleasant odour, often with irritating skin effects and smarting of the eyes. These symptoms should be taken as a warning sign that better ventilation is needed. 0.2% solvent vapour in air is normally recommended to give a five-fold safety margin and at this concentration NO EXPLOSION CAN OCCUR.

Ventilation
Both air blowing and extraction methods of ventilation have been suggested but experience has shown that of the two methods, blowing is more efficient. Extraction tends to produce channelling with smooth air flow and dangerous pockets of solvent vapour. Blowing causes turbulence, which disperses solvent pockets.

For individual tanks the blowing air is trunked into the coaming down to a depth of 2.5-3 metres in a 12 metre tank. This prevents the blowing air immediately returning through the coaming without sweeping the tank. The geometry and size of tanks makes each one a separate problem and it is essential to check that the ventilation arrangement, fan output, etc. is suitable before painting commences.

FORE AND AFT PEAKS AND DOUBLE BOTTOMS of ship tanks require special attention. Because of their construction, adequate ventilation is difficult, resulting in a rapid build up of solvent vapours to toxic and explosive concentrations. It is necessary to have a responsible standby man at the tank opening to keep a "head count" of painters and other workers and to ensure no interruption of essential services, i.e. air supplies and electricity.

Elimination of ignition sources

1. Welding, cutting or grinding in the tank must be forbidden until paint fumes are totally dispersed. This also applies to all areas within a 15 metre radius of the tank and trunking outlet.
2. Coamings must be simply covered to prevent spark entry where welding is being carried out on superstructure.
3. Lights, including hand torches, must be certified as flash proof.
4. Smoking must be prohibited in or near tanks or extraction systems.
5. No electrical junction boxes should be allowed in tanks.
6. Airless spray equipment must be earthed (static electricity danger).

Solvent vapour and paint mists - Protection of painting personnel
No ventilation system can reduce solvent vapour levels to below the Threshold Limit Values for solvents in tank coating procedures. Painters must therefore wear air fed hoods or pressure fed masks with additional eye protection. Normal protective clothing must be worn, e.g. overalls, gloves and non-spark footwear.

Skin irritation
If proper protective clothing has been worn, e.g. overalls, gloves, airline hood etc., no difficulty should be experienced from skin irritation. Any small areas not protected by clothing, such as wrists or neck can be treated with a non-greasy barrier cream. Petroleum jelly is not recommended. Areas of skin accidentally contaminated with paint should be cleaned with a proprietary industrial skin cleaner then thoroughly washed with soap and water. Skin conditioners designed to replace the natural oils in the skin can be used with advantage.

Summary of precautions to be taken
1. Provide adequate ventilation.
2. Ensure that the tanks and surrounding areas are flame and spark free.
3. Provide painters with full respiratory protection.
4. Ensure that suitable protective clothing is worn.
5. Do not smoke while stirring, handling and applying compositions.
6. Always wash hands before smoking or eating.
7. In case of splashing, wash skin immediately with soap and water.
8. If splashes get into the eye, flood copiously with water at once and obtain medical attention.
9. Rescue equipment with independent air supply (air cylinder) to be available for use in emergencies.
10. Operate a "head count" of men working in the tank and ensure no interruption of essential services.

Appendix
It is believed that the foregoing notes will provide a practical basis for the safe painting of tanks. There are however a number of technical terms and principles, which provide the scientific basis of these notes and which are often quoted (or misquoted) in practice. The following simple definitions should help clear up any misconceptions.

Flashpoint
The lowest temperature at which a liquid gives off vapour sufficient to form an inflammable mixture in contact with air. It is a rather rough yet quick way of measuring the relative combustibility of volatile liquids and, in turn, determines the appropriate temperature below which combustibles may be stored and used without creating explosive atmospheres. The flashpoint is always determined in a standard apparatus.

Explosion limits
- **Lower** - The lowest concentration of vapour in air, which can be ignited (exploded).
- **Upper** - The highest concentration of vapour in air, which can be ignited (exploded).

Flashpoint and lower explosive limit are interconnected. The flashpoint is the temperature at which a liquid gives off sufficient vapour into a fixed volume of air so that when a naked flame is applied the mixture will ignite. The quantity (%) of vapour in the mixture when ignition occurs is the lower explosive limit for that particular solvent. This means that at all temperatures below the flashpoint of a solvent the quantity of vapour it can give off into the atmosphere must be less than the lower explosive limit. This simple guide to the volatility of solvents is, however, complicated by the presence of paint spray and solvent mist (liquid particles) in tank atmospheres. If particulate spray is present it will also have a lower explosive limit, which is not dependent on the flashpoint of any solvent mixture present.

Threshold limit value (TLV) or Maximum allowable concentration (MAC)
Threshold limit values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. The TLV is expressed in milligrams per cubic metre (mg/M^3) of air and in parts per million; that is parts of gas per million parts of air. The TLV's for paint solvents are very much lower than safe explosion limit concentrations and in ship tanks it is totally impractical to attempt to ventilate to below the TLV for a solvent mixture. Painters must be provided with suitable breathing apparatus.