PAINTS

Part 1
physical hazards, organising, the law.

Twenty million tonnes of paint are used world-wide each year, about half on buildings and most of the rest on manufactured goods. Upwards of 100,000 people are employed as painters in the UK and a large number of people use paints in DIY. Painting as an occupation has been classified as carcinogenic by the World Health Organisation.

Part 1 of this two-part factsheet deals with physical hazards to the users of paint and with organising and using the law for protection.

Part 2 will cover chemical hazards.

Paint consists of finely divided pigment particles and a binder (resin) usually suspended in a volatile solvent but occasionally as a powder. Other materials may be added to impart special characteristics.

Fires and explosions

Using solvent-based paints releases vapours such as acetone, cyclohexane, ethyl acetate, hexane, methyl ethyl ketone (MEK) and white spirit. Between certain concentrations (the 'explosion limits') the solvent/air mixture is explosive: the explosion limits for toluene, for example, are 1.3% to 7%. The solvent also has to be above its flash point temperature: almost all solvent flash points are below room temperature, in fact many are below freezing point. Given these two conditions, flames, sparks, or hot surfaces can cause explosions. At a higher temperature (auto-ignition temperature) the vapour can catch fire spontaneously.

Effective ventilation is therefore essential. Ventilation should dilute or remove flammable vapour to a concentration of less than a quarter of the lower explosion limit. For electrical equipment, external surfaces must be kept below auto-ignition temperature, and sparks must be prevented or vapour kept out of the equipment.

Electrostatic wet paint spraying is a special fire hazard because it creates high electrical potentials. Spark discharges to earth may occur, igniting flammable materials. Electrostatic spraying should only take place in purpose-designed compartments with appropriate ventilation and anti-static floors. An automatic sprinkler system should be installed, supplemented by dry powder fire extinguishers. Conveyors, jigs, paint and solvent supply systems and the electrostatic generator should all be designed to prevent sparking. Conducting objects in the spraying compartment must be earthed. All workers, including those doing cleaning and maintenance, must be fully trained.

Storage

Large quantities of paints should be stored in metal tanks or drums. Both should be kept well clear of perimeter boundaries, process operations and buildings. Tanks should be situated in the open and their vent pipes fitted with flame arresters. They must have a valve beneath to allow complete drainage, and they must therefore always be supported far enough above ground to permit this. The supports should be of materials with a fire resistance of 2 hours. All metal parts should be earthed.

Drums should be stored in the open in a fenced-off area or in a detached non-combustible building. Stacks should be as small as possible with clear spaces on all sides. Flammable materials should not be stored with other goods. Easy access and suitable hydrants must be provided for the fire brigade, with virtually unlimited supplies of water. Smoking, naked flames and electrical appliances should be forbidden near the storage area and rubbish should not be allowed to accumulate. 'No Smoking' signs should be prominently displayed.

Smaller quantities of paint should be stored and carried in safety cans. The quantity in use should be kept to a minimum. Containers should be securely closed and kept in fire-resisting enclosures when not in use. Emptied containers should be closed and placed in a metal bin until disposal.

Application methods

Paint can be applied by brush, roller, dipping or various kinds of spraying. The main hazard of brushes and rollers is exposure to solvent fumes.

Spraying can be carried out by airless, compressed air or electrostatic methods. In addition to the fire risk, hazards arise from lack of ventilation, inadequate separation from other processes, injection of paint into the skin, and the use of especially toxic materials such as twin-pack isocyanate or epoxy-based paints.

Airless spraying requires the least solvent but effective ventilation is still necessary because toxic or flammable concentrations of vapour build up rapidly. Spraying should be conducted in booths or other enclosed spaces sealed to prevent the escape of fumes into other work areas. Booths should be provided with a water-wash system to trap paint and solvent fumes from the air being extracted. They should be sited against external walls to minimise the length of ducts to the atmosphere.

Workers required to enter tanks or confined spaces must be provided with breathing apparatus in addition to mechanical ventilation. An air-flow detector should be fitted to the inlet or exhaust and linked to an alarm.

Regular cleaning of spray-spaces is essential to avoid the accumulation of residues. There must be an adequate work method for clearing blocked spray guns: workers have lost fingers as a result of paint injections.

Organising and using the law

Under the Health and Safety at Work Act 1974, employers have a duty to safeguard the health, safety and welfare of their employees. They are obliged to provide information on the hazards of the materials they use and on the safety measures required. Safety representatives of recognised unions are entitled to carry out inspections of the workplace and should do so at least every three months. The law is enforced by the Health and Safety Executive (HSE) or the local authority Environmental Health Department, depending on the type of premises.

Paints are covered by the Control of Substances Hazardous to Health (COSHH) Regulations 1988, except for lead-based paints, covered by the Control of Lead at Work Regulations 1980. The COSHH Regulations require employers to assess the hazards of materials and processes. For paints, this requires collection of toxicity data and air tests on processes. After the assessment, the employer is obliged first to substitute, or if this is not possible, to control, or if this is not possible, finally to protect against dangerous substances.

At present, there is a growing trend to substitute solvent-based by water-based paints. Control measures largely involve the provision of local or general ventilation. Protective equipment - goggles, gloves, boots, overalls, masks, breathing apparatus, etc. - must be sufficient to deal with the hazard, but should only be used when substitution or control measures are not possible. Safety measures must be introduced by consultation and negotiation with workers' representatives and not by unilateral decision of the employer.

Under the Lead Regulations, regular blood tests are required and workers with a blood lead level greater than 70 mg per 100 ml must be withdrawn from work with lead.

Storage of liquids with flash points below 32 oC, i.e. most paint solvents, is governed by the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972, which are enforced by the HSE. Storage, labelling and transport of petroleum spirit, a common ingredient of paints, is controlled by the Petroleum (Consolidation) Act 1928, which is enforced by local authorities.

Transport of dangerous substances in general comes under the Classification, Packaging and Labelling of Dangerous Substances Regulations 1984 and the Road Transport (Carriage of Dangerous Substances in Packages, etc.) Regulations 1986.

PAINTS

Part 2
chemicals and disease

Painters run a high risk of illness. The World Health Organisation's International Agency for Research on Cancer (IARC) reported in 1989 that painting as an occupation is carcinogenic. Painters suffer cancers at 20 per cent above the average and lung cancers at 40 per cent above the average. Their children too get cancer more often than is usual. Painters also suffer from dermatitis, bronchitis and asthma, and nervous system illness. There are effects on vital organs (liver, kidneys, heart, etc.) and on the blood. There are reproductive hazards to both men and women.

Painters are exposed by breathing vapour from solvents and other volatile components, mist from spray painting, and dust from powders. Skin exposure is also common.

Thousands of chemicals are used in paints as pigments and fillers, binders and resins, solvents or special-purpose additives. All are toxic and should be subjected to the COSHH procedure. The table lists the health hazards of some of the commonest or most toxic paint ingredients. But don't assume that materials not in the table are safe.

Paint Part 1, published in *Daily Hazard* No. 31, dealt with physical hazards, organising and the law.

Solvents

Most paint is carried in a liquid which is designed to evaporate. Most of the hydrocarbon solvents used for this can harm the central nervous system, causing headaches, tremors, loss of co-ordination and narcosis. Sufficient exposure can cause permanent brain damage: in Denmark, 'Painter's dementia' is an industrial disease recognised for compensation. In a recent survey by the construction union UCATT 186 out of 249 painters reported headaches. Particular solvents cause cancer, miscarriages, birth defects, allergy and dermatitis.

Objections to the use of organic solvents in paints have led to calls for the substitution of water-based for organic solvent-based paints. In Denmark, water-based paints already account for over 90% of all paints used.

The Paint Research Association, in a study funded by the HSE, reported in 1991 that water-based paints are a reliable alternative. A number of local authorities have agreed to change, and this should be extended to outside contractors. Painters should also watch for solvents in thinners and strippers.

Resins and Binders

The most hazardous resins are the 'two-pack' epoxy and urethane materials. They require the mixing on site of epoxy and isocyanate derivatives with a curing agent, often an amine. Epoxys and isocyanates are highly toxic and are also sensitisers, so that subsequent exposure to very small quantities of chemical can trigger severe symptoms.

The most commonly used resins, alkyds and acrylics, are preformed rather than two-pack. They can still cause skin irritation. Also, they may contain small quantities of precursor chemicals left over from manufacture.

Pigments and fillers.

A huge number of metals and metal derivatives are used as paint pigments. Titanium dioxide is now the almost universal white pigment and accounts for about 60 per cent of all pigments in current use. Formerly thought to be relatively safe, it is now known to be a respiratory and skin irritant and is being investigated as a possible carcinogen. Lead-based paint is now rarely used but precautions are required in removing it from older buildings. Organic dyes are often carcinogens as well as causing dermatitis and respiratory illness. Fillers, such as talc, can result in lung disease.

Additives

Paint additives are used to confer special properties such as mould-resistance. They do not form more than one to two per cent of the product. But such highly toxic chemicals as formaldehyde or the pesticide tributyltin oxide may be used.

Health Effects of Common and Especially Toxic Paint Ingredients

Ingredient	Health Effects
Solvents	
White Spirit[1]	Central nervous system (CNS) depressant,i.e. causes headaches, nausea, giddiness, drowsiness, unconsciousness, behavioural disorders, encephalopathy, dementia. Nose and respiratory irritant. Dermatitis. Co-carcinogen leading to skin cancers. Miscarriages.
Toluene	CNS depressant. Causes dermatitis. Reproductive hazard: teratogenic (birth defects), embryotoxic (miscarriages).
Xylene	CNS depressant. Causes vomiting,cough, catarrh. Skin and eye irritation. Embryotoxic.
Benzene[2]	CNS depressant. Causes anaemia,leukaemia and multiple myeloma. Skin and pulmonary irritant. Reproductive effects.
Methyl Ethyl Ketone (MEK)	CNS depressant. Nausea and vomiting. Eye, skin and respiratory tract irritant. Sensitiser.
Glycol Ethers & Glycol Ether Esters	CNS depressant. Nausea, vomiting, abdominal pains. Lung, liver and kidney damage. Anaemia and depression of bone marrow. Embryotoxic, teratogenic.
Resins and binders	
Isocyanates eg Toluene di-isocyanate	Severe respiratory irritant. Sensitiser producing severe asthma. Skin and eye irritant.
Epichlorohydrin (an epoxy monomer)	Severe eye and respiratory tract irritation. Skin burns leading to sensitisation. CNS depressant. Damage to nose,throat, lungs, liver and blood. Suspected carcinogen.
Glycidyl Ethers (types of epoxy monomer)	Skin and eye irritants. Sensitisers. CNS depressant.
Vinyl resins eg polyvinyl acetate	Skin irritant. Damages lungs, liver and blood. Possible carcinogen.
Pigments and Fillers	
Titanium Dioxide	Skin irritant. Respiratory illness.
Chrome and Chromates	Lung and nasal cancer. Perforation of nasal septum. Skin ulcers and dermatitis.
Iron Oxide	Respiratory illness. Suspected carcinogen.
Lead and Lead Compounds	Fatigue, headaches, muscle pain, CNS depressant. Vital organ damage. Reproductive effects for men and women. Children specially vulnerable.
Aluminium Powder	Lung disease. Possible brain damage.
Talc	Fibrogenic: chronic obstruction of the lungs.

1. A mixture of aliphatic hydrocarbons. The composition varies but the components all have similar properties. Called Stoddard Solvent in the USA.
2. Usually found as an impurity in other solvents such as white spirit, toluene or xylene.

The COSHH Regulations

The law says: Employers must assess the hazard of all workplace chemicals and then, in strict order of priority:
1 substitute a safer process or substance,
2 or control it by enclosure or ventilation,
3 or, only if other steps fail, provide protective clothing.

● There are factsheets on COSHH in LHC's *Basic health and Safety*, and *Factpack*