

CONTROLLING HAZARDS IN THE ELECTROPLATING INDUSTRY

What is electroplating?

Electroplating is the coating of a metal object with another metal, using an electrical current passed through a chemical solution.

Metals used in coatings include:

- zinc;
- copper;
- brass;
- chromium;
- nickel;
- gold;
- silver;
- cadmium; and
- lead.

Most electroplating in Western Australia is done in small factories and workshops. Risks are often more difficult to control in small workplaces because they have limited access to resources and technical advice.

What gets electroplated?

There are two main areas of electroplating business in WA. One provides heavy coatings of hard metal such as chromium to machine parts.

The other provides light coatings to personal and domestic items, such as jewellery, ornaments, hobby items, motor vehicle parts and electronic components. The items may be new or second hand.

A smaller and more specialised industry uses electroplating in the manufacture of electronic circuit boards.

What is the law?

The *Occupational Safety and Health Act 1984* says employers must provide and maintain a work environment in which employees are not exposed to hazards.

The *Occupational Safety and Health Regulations 1996* set down specific requirements for workplaces that use hazardous substances. These cover such things as:

- labelling of containers;
- Material Safety Data Sheets (MSDS);
- induction and safety training;
- record keeping;
- risk reduction; and
- health surveillance.

The *Regulations* say employers, main contractors and self employed persons must:

- identify hazardous substances;
- assess the risk of injury or harm; and
- reduce the risk by:
 1. preventing exposure to the hazardous substance ;
 2. means other than personal protective equipment; and
 3. where 1 and 2 are not practicable, by the use of personal protective equipment.

The *Act* says employees must take reasonable care of their own safety and health and avoid adversely affecting the safety and health of others. They must comply within reason with safety instructions, use personal protective equipment provided and report hazards or injuries.

Manufacturers of hazardous substances must prepare a material safety data sheet (MSDS).

Suppliers of hazardous substances must ensure containers are adequately labelled. They must provide a current MSDS to the workplace when first supplying a hazardous substance, and thereafter when requested.

Designers, manufacturers, importers and suppliers must ensure, as far as practicable, that people installing, maintaining or using their plant are not exposed to hazards.

Are you at risk?

Workers at electroplating workplaces may be exposed to hazardous substances.

These substances are mainly in the form of:

- fumes;
- vapours or mists; and
- metal dusts.

Other hazards in electroplating involve the use of:

- electricity;
- mechanical plant; and
- manual handling.

What are the risks?

Workers exposed to electroplating chemicals can develop:

- **short term** throat, lung, sinus, skin and eye irritation and burns; and
- **long term** health problems such as asthma, heart, lung and nerve disorders and, in some cases, cancer.

The risk of developing health effects depends on how much chemical is absorbed into the body.

In addition, electrolysis releases hydrogen bubbles which, unless safely contained or ventilated, can:

- **become explosive**; or
- **carry other chemicals** in a toxic mist.

What are the hazardous substances?

Hazardous substances in electroplating include:

- **solvents** such as methylene chloride, phenol, cresylic acid (a chemical similar to phenol);
- **gases** such as hydrogen cyanide;
- **acids** such as chromic acid, sulphuric acid and hydrochloric acid;
- **alkalis** such as sodium hydroxide (also known as caustic soda);
- **cyanides** such as sodium and potassium cyanide;
- **heavy metals** such as nickel, chromium, cadmium and lead; and
- **toxic wastes**.

These substances are commonly used or produced in the:

- preparation;
- coating; and
- polishing

of metal items.

When can chemical exposure occur?

People working in electroplating can be harmed when:

- containers leak or spill during transport, storage, decanting or disposal;
- explosive or toxic gas or fumes build up during storage in confined areas;
- operators are splashed by items entering or leaving plating tanks;
- excessive bubbling or fuming occurs in acids, caustic or other chemicals;
- dust is breathed in during buffing or grinding of plated items;
- excessive hydrogen or oxygen is emitted during electrolysis or anodising, causing an explosive or flammable atmosphere;
- local exhaust ventilation fails, or is inadequate to handle escaping gases, fumes and mists;
- overhead gantry cranes, hooks or slings fail when lowering or lifting items from dip tanks;
- residue liquid and sludge is removed from dip tanks;
- maintenance and repair work is done to tanks;
- chemical wastes are disposed of in sewers before being properly neutralised; and
- chemical wastes are disposed of at tipping sites without Department of Environmental Protection approval and procedures.

How can hazardous substances enter the body?

Hazardous substance can enter the body through:

- the skin or eyes, following contact with liquids or droplets;
- the lungs and nasal passages, when fumes, droplets, gases or dusts are inhaled; or
- the mouth, when eating or smoking with contaminated hands.

How can hazards be identified?

Workplace hazards can be identified through:

- checking packaging or container labels and material safety data sheets;
- regular communication between workers, supervisors and employers about likely hazards;
- regular inspection of workplaces, plant and equipment;
- regular review of tasks and procedures; and
- checking of previous incident and injury records for recurring situations.

How can risk be assessed?

General hazards:

The risk of injury or harm from general workplace hazards can be assessed by:

- assessing the likelihood of the hazard causing injury or harm, eg. very likely or remotely possible;
- assessing the likely severity of injury or harm, eg. serious or minor injury;
- checking records of previous incidents and injuries where hazards have caused injury or harm; and
- checking plant and equipment to make sure hazards are properly controlled, for example, whether it is guarded in accordance with the manufacturer's specifications or Australian Standards.

Hazardous substances:

In addition, the risk of injury or harm from hazardous substances can be assessed by:

- obtaining information about the hazards (eg. MSDS, labels, operating manuals, Australian Standards etc.);
- checking work processes to make sure hazards are adequately controlled, for example, whether chemicals are used in accordance with the manufacturer's MSDS;
- conducting atmospheric monitoring to determine levels of exposure to chemicals such as chromic acid; and
- conducting health surveillance to detect any adverse health effects from chemicals at an early stage. There are specific health surveillance requirements for chromium.

How can risk be reduced?

Risk can be reduced by using control methods, in the following order of priority:

1. Eliminate or remove the hazard – eg. do not use a chemical or item of plant if it is not required.
2. Substitute or replace it with safer plant, equipment or substance.
3. Isolate it from workers – eg. enclosed systems for chemicals, relocation of employees or physical barriers.
4. Introduce engineering controls – eg. guarding or exhaust ventilation.
5. Administrative controls – eg. limiting workers' time spent near the hazard.
6. Personal protective equipment – eg. safety goggles and respirators. While essential for some work procedures, these should be last in the list of priorities.

What information and training is required?

- All workers must be informed of hazards from exposure to harmful substances.
- They must be given information, instruction, training and supervision in safe procedures, including personal protective equipment.
- Workers should know how to identify hazards, and to report them to a supervisor.
- Training on hazardous substances must include potential health effects of the substances used, control measures, correct use of protective equipment and the need for and details of health surveillance.
- Workers from non-English speaking backgrounds may have special needs and should be provided with information in their first language.
- Training should be ongoing, with regular revision of safe procedures.

What first aid facilities?

First aid facilities should be appropriate for the hazards in the workplace and should comply with the WorkSafe Western Australia Codes of Practice for *First Aid, Workplace Amenities and Personal Protective Equipment* .

What storage safety controls?

General principles should involve:

- storing hazardous substances in a cool, lockable, enclosed area with adequate ventilation;
- storing incompatible substances separately, eg. cyanides away from acids, and avoiding risk of mixing or cross contamination;
- ensuring all labels remain intact on containers and packaging;
- limiting access to chemical storage areas to authorised people only;
- ensuring flammable, explosive or toxic substances are stored away from possible sources of electrical spark, heat or flame;
- checking all containers against leakage or seepage – keeping lids and caps tightly sealed;
- ensuring forklift and other mobile plant operators are formally trained in safe procedures for chemical containers;
- appropriate fire fighting and emergency equipment; and
- monitoring atmospheric contamination and temperature levels in storage areas.

Chemicals that can be classed as dangerous goods must be stored in accordance with the *Storage of Dangerous Goods Regulations* administered by the Department of Minerals and Energy.

Controlling plating tank hazards

- Substitute hazardous substances with less hazardous ones.
- Where possible, pump chemicals into plating tanks rather than pouring manually from containers.
- Pumps need to be cleaned before use with a different chemical.
- Use local exhaust ventilation along one or more sides of the tank to remove mists and vapours.
- Use a suppressant to minimise the amount of mist generated during electroplating.
- Minimise risk of items accidentally dropping into tanks, splashing operators.
- Ensure overhead cranes, hooks and slings are regularly maintained.

Controlling cyanide hazards

Acids and cyanides are an explosive combination, and should be clearly labelled and stored in locked, dry places, well away from each other.

Articles treated in acid baths should be thoroughly rinsed with water before being placed in plating tanks.

Drainage should be designed so there is separation of acid spillage from cyanide spillage or effluent.

Buffing, grinding and polishing

Newly electroplated surfaces on heavy machinery parts are usually finished with portable or fixed grinding machines.

Finer finishes on personal, hobby or household items are achieved with buffing and polishing wheels, containing various polishes and waxes.

These processes generate large amounts of metal dusts, some of which are hazardous if inhaled.

Local exhaust ventilation should be fitted to grinding and buffing machines to remove dust as it is generated.

Where substances that are known to be carcinogenic are used, exposure levels should be kept as low as possible and respiratory protection must be worn in accordance with *AS/NZS 1716:1994 Respiratory Protective Devices*.

Controlling waste disposal hazards

Electroplating produces substantial amounts of chemical waste such as metal salts, acids, alkalis and cyanides.

Unless safely disposed of, these can cause health risks to people at the workplace or to others, eg. workers doing sewer maintenance. They can also harm the environment and interfere with sewerage treatment.

Care should be taken to neutralise chemicals such as acids, alkalis and acids before disposal, and metal residues must be settled out.

Waste disposal into sewers must be in accordance with Water Corporation requirements. Advice can be obtained from the Industrial Waste Section.

Solid chemical waste is disposed of at landfill sites. This must be done in accordance with requirements of the Department of Environmental Protection.

Disposal of toxic liquid wastes into storm water drains is illegal.

Controlling electricity hazards

A combination of electricity, water, and damp, corrosive conditions increases the risk from electrical hazards in electroplating.

Conductive and corrosive fluids may be spilled on floors. People may have to work close to electrical systems and exposed conductors.

Injury from electric shock, electric burn, electrical arcing, fire or explosion caused by electrical energy may occur unless adequate controls are in place.

Electrical hazards in electroplating may be associated with:

- pumps;
- filters;
- blowers;
- centrifuges;
- heaters;
- grinding and buffing machines; and
- hand held electrical tools.

The design and maintenance of electrical systems are critical. The system and items such as transformers and heaters should be checked regularly for problems such as:

- damaged insulation;
- exposed live high voltage conductors; and
- corrosion of system parts.

Portable electrical tools must be RCD protected to minimise the risk of shock.

Controlling machinery hazards

Machinery used in electroplating workshops includes forklifts, overhead travelling cranes, hoists, buffing and grinding machines and portable tools such as angle grinders.

To reduce risk of injury employers need to ensure:

- plant has been properly designed;
- plant is used in accordance with manufacturers' instructions;
- employees are trained in safe use of the plant;
- plant is properly maintained; and
- moving or hazardous parts are adequately guarded.

Where practicable:

- moving parts such as gears, pulleys and belts should be guarded in accordance with Australian Standard 4024.1 of 1996;
- forklifts must be operated in accordance with Australian Standard 2359.2 of 1985; and
- cranes must be designed in accordance with Australian Standard 1418.1 of 1994 and operated in accordance with Australian and New Zealand Standard 2550.1 of 1993.

Controlling manual handling hazards

Manual handling hazards in electroplating may include pushing, pulling, lifting or carrying heavy chemical containers, plant and items being electroplated.

They may also involve prolonged or awkward holding of heavy objects during grinding, or use of portable power tools such as angle grinders. Buffing and grinding on fixed machines may require excessively repetitive movement.

These activities can result in strain injuries, and wet floors can increase the risk of strain injuries from slipping.

Controlling manual handling hazards involves:

- identifying all hazards associated with manual handling;
- assessing the risk arising from the hazards; and
- deciding on and using appropriate control measures.

Control measures may include using:

- smaller containers;
- trolleys;
- cranes;
- safe manual handling procedures; and
- safety training in manual handling tasks.

Further information

Further information may be obtained on the matters covered in this publication from:

Division of Explosives and Dangerous Goods
Department of Minerals and Energy
"Mineral House"
100 Plain Street
EAST PERTH 6004
Tel: 9222 3413

Department of Environmental Protection
"Westralia Square Building"
141 St George's Terrace
PERTH WA 6000
Tel: 9222 7000

Water Corporation
"John Tonkin Water Centre"
629 Newcastle Street
LEEDERVILLE WA 6007
Tel: 9420 2420
Email: cust_centre@watercorporation.com.au

Health Department of Western Australia (Environmental Health)
"Grace Vaughan House"
227 Stubbs Terrace
SHENTON PARK WA 6008
Tel: 9388 4999

WorkSafe Western Australia
1260 Hay Street
WEST PERTH WA 6005
Tel: 9327 8777
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Chamber of Commerce and Industry
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