SOLDER FUME
and you

INTRODUCTION

- This leaflet tells you about possible health hazards from solder fume when using flux materials containing rosin, sometimes known as colophony. It also explains what your employer has to do and the precautions you should take.

- It deals only with the risks arising from exposure to rosin-based or modified rosin-based solder fluxes.

WHAT IS ROSIN?

- Rosin is a naturally occurring, solid, resinous material obtained from pine trees. It is mainly a mixture of resin acids, but up to 10% may consist of other acids and neutral compounds.

- Rosin is insoluble in water, but soluble in many organic solvents. It may be obtained as gum rosin; wood rosin; or tall-oil. Gum or wood rosin and modified rosins are used for solder flux.

USE OF ROSIN IN SOLDERING

- Rosin is used mainly as a flux in the electrical and electronics industries where it is heated with the solder (usually tin/lead) to make electrical connections. It may also be used for soldering in plumbing and other pipe-fitting work.

- A flux helps the soldering process by:

    - cleaning the surfaces to be joined;

- increasing the flow of solder to make a good connection; and

- preventing oxidation which might affect the strength and quality of the joint.

- Other special activators and modifiers may be added to the flux to aid the soldering process. These can present additional health hazards.

WHAT ARE THE HEALTH HAZARDS?

Respiratory effects

- When heated, particularly to temperatures above 200°C, rosin-based solder fluxes form fumes containing a range of resin acid particulates and other components as gases. Lower temperatures can significantly reduce the amount of fume produced. Between 250°C and 400°C particulate fume levels can triple.

- When inhaled, rosin-based solder flux fume can lead to occupational asthma or make existing asthmatic conditions worse. The fume can also cause irritation to the eyes and upper respiratory tract.

- Rosin-based solder flux fume is now regarded as one of the most important causes of occupational asthma in Britain. When the asthmatic effects are fully developed they are permanent and irreversible. Continued exposure, even to very small amounts of fume, may cause asthma attacks and the person affected may be unable to do any soldering with rosin-based fluxes again.

- Typical early symptoms are watery and prickly eyes, runny or blocked nose, a sore throat, coughing, wheezing or breathing difficulties. These may start within minutes of exposure or be delayed for several hours, so that their link to work may not be immediately recognised. However, improvement at weekends and holidays often points to the symptoms being job related.

- The precise constituents of the fume causing occupational asthma and irritation are not known. From a review of scientific evidence it has not been possible to identify a safe level of exposure below which occupational asthma will not occur. Exposure to all rosin-based solder flux fumes should, therefore, be avoided or kept as low as is reasonably practicable.

Skin effects

- On contact with the skin, rosin-based solder flux and its fume can cause dermatitis. Both skin irritants and sensitisers are present in solder fluxes and their fume.

- Reactions have occurred from contact with liquid fluxes, flux residues and, to a lesser extent, the fume itself. Hands and forearms are mainly affected, possibly from contaminated workbenches or other surfaces. The fume may also affect the face and neck.

- Suitable precautions to avoid skin contact should therefore be taken.

HOW EXPOSURE OCCURS

- Without effective control, solder fume rises vertically and for manual operations is likely to enter the breathing zone of the solderer.

- Fume may drift and accumulate in the workroom, especially if the soldering work is widespread and intense, and general background ventilation is poor. Other people in the area who are not soldering can therefore be put at risk.

- People maintaining and cleaning soldering plant, equipment and control systems may also be at risk.

- Rosin-based fluxes may be integral with the solder or applied separately as in liquid fluxes. For solder wire, commonly used in hand soldering, the flux is often contained in a central core and is released on heating. In other cases, the flux may be within a solder paste applied by syringe, or by stencil and screen printing. Liquid fluxes may be applied from a bottle or by dipping into small jars or pots. On automated lines the flux may be sprayed as a liquid or foam before wave soldering.

- A large number of people including telecommunications engineers, ventilation and heating specialists, plumbers and those in technical research and further education do some soldering. Their intermittent soldering work may lead to high, short-term exposures, particularly if carried out in an enclosed space or at an awkward angle.

LEGAL REQUIREMENTS

- As exposure to rosin-based solder flux fumes may be hazardous to health, their use is subject to the Control of Substances Hazardous to Health Regulations (COSHH). A suitable assessment of the risks to health must be carried out. Where reasonably practicable, exposure should be prevented, or failing that, adequately controlled (see overleaf).

- The following Maximum Exposure Limits (MELs) have been set for rosin-based solder flux fumes:

  - 0.05 mg m^{-3} (over an eight-hour reference period); and

  - 0.15 mg m^{-3} (over a fifteen-minute reference period).

- Personal exposures to rosin-based solder flux fumes are assessed by a sampling method which measures resin acids and is described in MDHS83 *Resin acids in rosin (colophony) solder flux fume* HSE Books ISBN 0 7176 1363 1.

- To achieve adequate control, as required by the COSHH Regulations, exposures to rosin-based solder flux fumes should be reduced to as far below the MEL as is reasonably practicable, for example by the provision and use of a suitable local extraction ventilation system.

- If personal protective equipment is necessary, it must be suitable and adequate for the purpose, meeting all relevant requirements of the Personal Protective Equipment at Work Regulations. It should only be used as a last resort when other controls are not feasible or adequate control is not achieved by other means.

- Adequate information on the hazards and proper precautions must be provided by the manufacturer or supplier of rosin-based solder fluxes for use at work. This is required by Section 6 of the Health and Safety at Work etc Act 1974 or the Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP), as amended.

- If employees are, or are liable to be, exposed to significant levels of rosin-based solder flux fumes, the COSHH Regulations require those employees to have suitable health checks (health surveillance).

- Medically confirmed cases of occupational asthma or dermatitis must be reported to HSE or another enforcing authority under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR).

WHAT SHOULD EMPLOYERS DO?

- Properly manage the risks to health and the precautions needed. Through suitable risk assessment employers must in particular:

  - check the workplace to find out if there is a problem; and

  - decide what to do to prevent harm.

  If appropriate they must then:

  - take action to control the risk; and

  - check that what has been done is effective.

  The assessment and precautions should be reviewed from time to time or if conditions change, and revised as necessary.

- Find out how much exposure to fume occurs, normally by means of a suitable monitoring programme.

- Ensure the proper use of any control measures provided such as local extraction ventilation.

- Properly maintain all control measures provided (including extraction ventilation systems and personal protective equipment) in efficient working order and monitor their effectiveness. In particular, extraction ventilation systems must be examined and tested at least every 14 months and should be regularly inspected by a responsible person on site for defects. Appropriate records should be kept.

- Where necessary, provide personal protective equipment which is suitable for use and appropriate to the job, but only as a last resort when prevention of exposure or adequate control by other means are not reasonably practicable. The reasons for such protective equipment, the jobs for which it is necessary and how it should be worn, stored, maintained and replaced should be explained to the user.

- Provide adequate washing facilities.

WHAT SHOULD EMPLOYEES DO?

- Follow instructions on safe working practices given by your employers, including the correct use and adjustment of control measures such as local extraction ventilation.

- When required, wear protective equipment such as respirators. Suitable gloves, protective clothing and eye protection may also be appropriate for certain work where splashing of fluxes etc can occur.

- Report defects in any enclosures, extraction equipment, protective equipment or other control measures to your employer.

- Avoid skin contact with rosin-based solder fluxes, but if this occurs, wash with soap and water as soon as possible. A simple skin conditioning cream may be used after washing and drying.

- Take part in health checks, which are part of the required health surveillance programmes. Report symptoms of respiratory or skin complaints to an occupational health doctor or nurse if there is one. If not, see your General Practitioner and tell them what work you do. Tell your supervisor or other member of management as well.

- If you have any concerns about working with rosin-based solder fluxes tell your occupational health doctor or nurse, if there is one, or a safety representative, supervisor or union representative so that your concerns may be taken up with your employer.

WHAT ABOUT HEALTH CHECKS?

- The need for health surveillance should be considered for all people working in processes where there is exposure to rosin-based solder fluxes. This will be determined by the risk assessment under COSHH.

- A programme of initial and regular health checks for both respiratory and skin problems may be required. You should co-operate with your employer and any occupational health doctor or nurse involved in carrying out these checks.

- The initial health check aims to pick out people who have a medical condition which could be made worse by exposure to rosin-based solder flux and its fumes. At the regular health checks you should report any respiratory or skin complaints and any other health problems which you think may be related to your work.

- If a respiratory or skin problem occurs, you should be seen by a doctor or nurse with a knowledge of occupational asthma or skin disease, as appropriate. When neglected, some health problems caused by exposure to rosin-based solder flux and its fume can be disabling and permanent, requiring a change in occupation.

- COSHH requires the employer to allow employees, who have first given reasonable notice, to see their health record.

WHAT OTHER INFORMATION IS AVAILABLE FROM HSE BOOKS?

Controlling health risks from rosin (colophony) based solder fluxes INDG249 (single copies free; ISBN 0 7176 1383 6 for priced packs of 10 copies)

General COSHH ACOP (Control of substances hazardous to health), and Carcinogens ACOP (Control of carcinogenic substances) and Biological agents ACOP (Control of biological agents). Control of Substances Hazardous to Health Regulations 1999. Approved Codes of Practice L5 ISBN 0 7176 1670 3

COSHH: A brief guide to the Regulations INDG136(rev1) (single copies free; ISBN 0 7176 2444 7 for priced packs of 10 copies)

Preventing asthma at work: How to control respiratory sensitisers L55 ISBN 0 7176 0661 9

Medical aspects of occupational asthma MS 25
ISBN 0 7176 1547 2

Medical aspects of occupational skin disease MS 24
ISBN 0 7176 1545 6

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

FURTHER INFORMATION

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995 Website: www.hsebooks.co.uk (HSE priced publications are also available from bookshops.)

For information about health and safety ring HSE's InfoLine Tel: 08701 545500 Fax: 02920 859260 e-mail: hseinformationservices@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG. You can also visit HSE's website: www.hse.gov.uk

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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