

MC4

COSHH essentials for the Microelectronics Industry



This information will help employers comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH), as amended, to control exposure and protect workers' health.

It is also useful for trade union and safety representatives.

This sheet applies to work involving molecular beam epitaxy processing to add extra layers of gallium, arsenic, aluminium, phosphorous, indium and silicon to gallium arsenide wafers.

The main hazards are toxic metals. Liquid nitrogen is used to maintain the vacuum.

This sheet describes good practice using containment, with extraction for product removal, and covers the points you need to follow to reduce exposure to an adequate level.

It covers daily and weekly routine tasks of operation and maintenance. It does not cover major maintenance tasks or decommissioning of used equipment.

It is important to follow all the points on the sheet, or use equally effective measures.

Check the supplier's safety data sheet.

Plan and practise what you will do in an emergency.

For environmental guidelines see MC0.

Molecular beam epitaxy

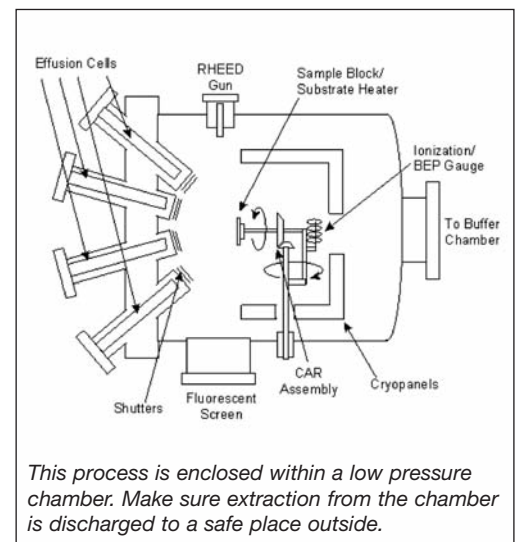
Control approach 3 Containment

Access and premises

- ✓ Restrict access to authorised staff.
- ✓ Keep the workplace exit routes clear.
- ✓ Label the work area, pipework and equipment clearly.

Equipment

- ✓ A very low pressure chamber encloses wafers. Materials for deposition are held at controlled high temperatures. These migrate to the wafer surface and build up to the required thickness.
- ✓ Follow the manufacturer's guidance for use.
- ✓ Don't store chemicals beneath the bench.
- ✓ Provide good lighting which should be suitable for the chemicals and tasks eg, flameproof for solvent benches.
- ✓ Provide a manometer or pressure gauge to check the extraction is working and has cleared the enclosure before opening the chamber. Link this to a visual or audible warning alarm.
- ✓ Keep extraction ducts short and simple. Avoid long sections of flexible ductwork.
- ✓ Ductwork must be compatible with the chemicals being used.
- ✓ Discharge cleaned, extracted air to a safe place outside, away from windows, doors and air inlets.
- ✓ Dispose of used process chemicals via suitable drainage systems for solvents and non-solvents. Can you use dump valves or aspirators to avoid contact with the chemical?
- ✓ Can you use less hazardous products, or eliminate the process?



Maintenance, examination and testing of controls

- ✓ Employ a competent engineer to maintain your equipment in effective and efficient working order, in accordance with the manufacturer's instructions. It will save you money in the long run.
- ✓ Use extraction and wear respiratory protective equipment (RPE) for maintenance.

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- ✓ Use a written system of work for maintenance and define what personal protective equipment (PPE) you need.
 - ✓ It is vitally important to maintain RPE in effective and efficient working order.
 - ✓ Look for signs of damage every time you use the equipment; repair immediately.
 - ✓ At least once a week, check that the extraction system is working properly and check any manometer systems or alarms. Record any adverse findings.
 - ✓ You need to know the design performance to know if extraction is working properly. The supplier's literature must give this information.
 - ✓ Noisy or vibrating fans can indicate a problem.
 - ✓ A competent ventilation engineer should examine the system and test its performance at least once every 14 months (see HSE publication HSG54). Keep records of all examinations and tests for at least five years. Some systems may continuously monitor the performance of the extraction.

Cleaning and Housekeeping

- ✓ Ensure the workplace remains clean. Clean plant and equipment in accordance with manufacturers' schedule and procedures.

Personal Protective Equipment (PPE)

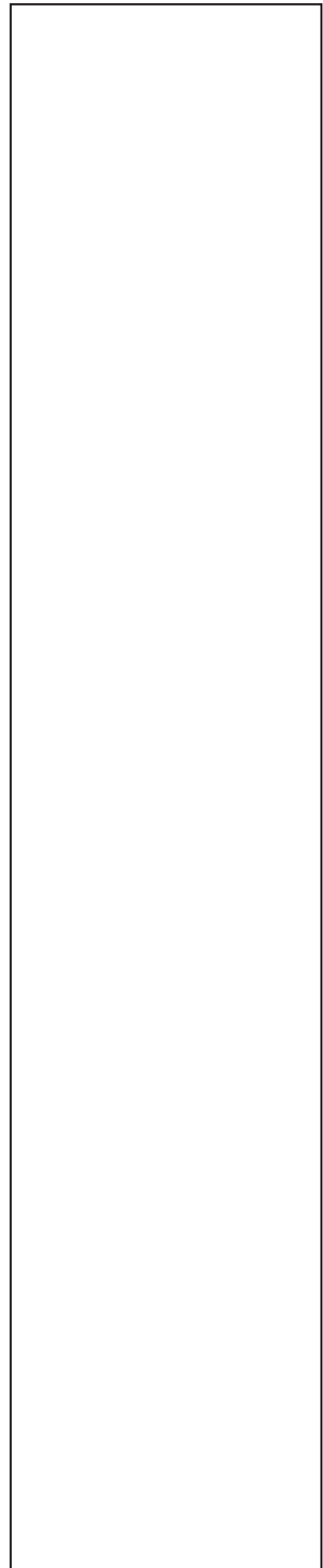
- ✓ Workers need:
 - eye protection;
 - protective goggles;
 - impervious aprons; and
 - protective footwear.
- ✓ Provide storage for PPE to prevent damage or contamination when not in use.
- ✓ Skin creams help in washing contamination from the skin. After-work creams help to replace skin oils.
- ✓ Also see sheet MC0.

Additional Guidance

- ✓ If skin problems appear consult an occupational health professional.
- ✓ You may decide to have air monitoring done to make sure the controls are adequate. See COSHH essentials sheet G409 - see 'Further information'.
- ✓ Review your risk assessment on a regular basis and when any changes take place.
- ✓ For general information on training, PPE, cleaning, housekeeping and maintenance, please see sheet MC0.

Further information

- *An introduction to local exhaust ventilation HSG37* (Second edition) HSE Books 1993 ISBN 978 0 7176 1001 3
- *Respiratory protective equipment at work: A practical guide HSG53* (Third edition) HSE Books 2005 ISBN 978 0 7176 2904 6



- *Maintenance, examination and testing of local exhaust ventilation* HSG54 (Second edition) HSE Books 1998 ISBN 978 0 7176 1485 1
- *COSHH a brief guide to the Regulations: What you need to know about the Control of Substances Hazardous to Health Regulations 2002 (COSHH)* Leaflet INDG136(rev3) HSE Books 2005 www.hse.gov.uk/pubns/indg136.pdf
- *General ventilation in the workplace: Guidance for employers* HSG202 HSE Books 2000 ISBN 978 0 7176 1793 7
- *Working safely with solvents: A guide to safe working practices* Leaflet INDG273 HSE Books 1998 (single copy free) www.hse.gov.uk/pubns/indg273.pdf
- *Hydrofluoric acid poisoning: Recommendations on first aid procedures* Leaflet INDG307 HSE Books 1999 (single copy free or priced packs of 25 ISBN 978 0 7176 1751 7) www.hse.gov.uk/pubns/indg307.pdf
- Other useful COSHH essentials sheets, available on www.hse.gov.uk/pubns/guidance/index.htm):
 - G409 *Exposure measurement: Air sampling*
 - G300 *Containment*
- The COSHH essentials risk assessment on www.coshh-essentials.org.uk/
- *Code of Practice: Safety Features of Chemical Workstations Issue 1* Semiconductor Safety Association (Europe) on behalf of the Microelectronics Semiconductor Manufacturing Joint Working Group 1994 ISBN 978 1 872780 02 3 Web version available at www.plade.com/editorial/code.html
- *Environmental, Health, and Safety Guidelines for Semiconductor Manufacturing Equipment* SEMI S2-0706b and *Safety Guidelines for Heated Chemical Baths* SEMI S3-91 Semiconductor Equipment and Materials International (SEMI). Both available to download from <http://dom.semi.org/downloads.nsf/standards?openview> or go to http://wps2a.semi.org/wps/portal/_pagr/103/_pa.103/210 and select the 'search semi standards' link

Useful links

- HSE priced and free publications are available from HSE Books Tel: 01787 881165 Website: www.hsebooks.co.uk.
- For information about health and safety ring HSE's Infoline Tel: 0845 345 0055 Textphone: 0845 408 9577 e-mail: hse.infoline@natbrit.com.
- Contact the British Occupational Hygiene Society (BOHS) on 01332 298101 or at www.bohs.org for lists of qualified hygienists who can help you.
- Look in the Yellow Pages under 'Health and safety consultants' and 'Health authorities and services' for 'occupational health'.
- Also see www.nhsplus.nhs.uk.

Employee checklist

- Are the engineering controls and extraction systems working properly?
- Is the equipment in good condition and working properly?
- Make sure you know what to do if there is a leak or spill.
- Make sure you have the right PPE for the job you are doing, that it's in good condition and that you use and store it properly.
- Do not use gloves that are punctured, split, cracked or otherwise damaged.
- If you find a problem, tell your supervisor. Don't just carry on working.
- Don't smoke in the work area.
- Wash your hands before and after eating, drinking, smoking and using the lavatory.
- Check your skin regularly for dryness or soreness – tell your supervisor if these appear.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.