

MC4

COSHH essentials for the
microelectronics industry

Epitaxial deposition

Control approach 3 Containment

The Control of Substances Hazardous to Health Regulations 2002 (COSHH) require employers to ensure that exposure is prevented or, where this is not reasonably practicable, adequately controlled. This guidance gives practical advice on how this can be achieved by applying the principles of good practice for the control of exposure to substances hazardous to health, as required by COSHH.

It is aimed at people whose responsibilities include the management of substances hazardous to health at work (eg occupational health specialists, anyone undertaking COSHH assessments, supervisors and is also useful for trade union and employee safety representatives). It will help you carry out COSHH assessments, review existing assessments, deliver training and supervise activities involving substances hazardous to health.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, 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.

See Essential information near the end of the sheet.

What this sheet covers

This sheet describes good control practice for epitaxial deposition in microelectronics. It covers routine operations for the task, not major maintenance or decommissioning.

It covers the key points you need to follow to reduce exposure to an adequate level.

Follow all the points, or use equally effective measures.

The sheet does not cover fire and explosion risks or risks from radiation (x-ray, UV) but these risks will need to be considered when putting your control measures in place.

Hazards

Epitaxial deposition is achieved using of a range of gases and vapours that may be hazardous. Check safety data sheets for a full list of the hazardous properties of the substances used. Hazardous waste gases and by-products may also be produced in the reaction chamber.

In general:

- ✓ Skin and eye contact with acids (eg hydrofluoric (HF), hydrochloric) can cause severe burns. Exposure to HF is of particular concern; if it comes into contact with the skin, pain may not be felt at once.
- ✓ Breathing in mists and fumes from acids and irritant gases (eg silane, phosphine, diborane) can cause irritation of the airways and lungs.
- ✓ Frequent skin contact with irritants can cause dermatitis.
- ✓ Some of the substances can pass through the skin and respiratory system and cause harm elsewhere in the body (eg to the kidneys, cardiovascular system or central nervous system)(eg phosphine). Some may cause cancer.
- ✓ Some of the gases, such as silane, may be pyrophoric (may ignite spontaneously on exposure to air) and can cause burns to the skin.
- ✓ Asphyxiant gases such as nitrogen will become a danger when their concentration in air is sufficient to cause a reduction in oxygen levels.

Access to work area

- ✓ Allow access to authorised and appropriately trained people only.
- ✓ Label the work area, pipework and equipment clearly.
- ✓ Keep the work area exit routes clear.

Equipment and procedures

- ✓ If reasonably practicable, eliminate the process, or use less harmful substances. Automation/part automation may also minimise exposure. Operate epitaxial processing in a closed system with extraction.
- ✓ Contact suppliers of the specialised equipment for further information on the types of containment available.

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- ✓ Use equipment manufactured from materials that are compatible with the chemicals being used.
 - ✓ Where reasonably practicable, decontaminate items before removal from any enclosure.
 - ✓ Follow the manufacturer's guidance for use.
 - ✓ Provide extraction around all potential leak points such as valves and fittings.
 - ✓ Provide a manometer or pressure gauge to check the extraction 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.
 - ✓ Discharge extracted air to a safe place away from doors, windows and air inlets.

Respiratory protective equipment (RPE)

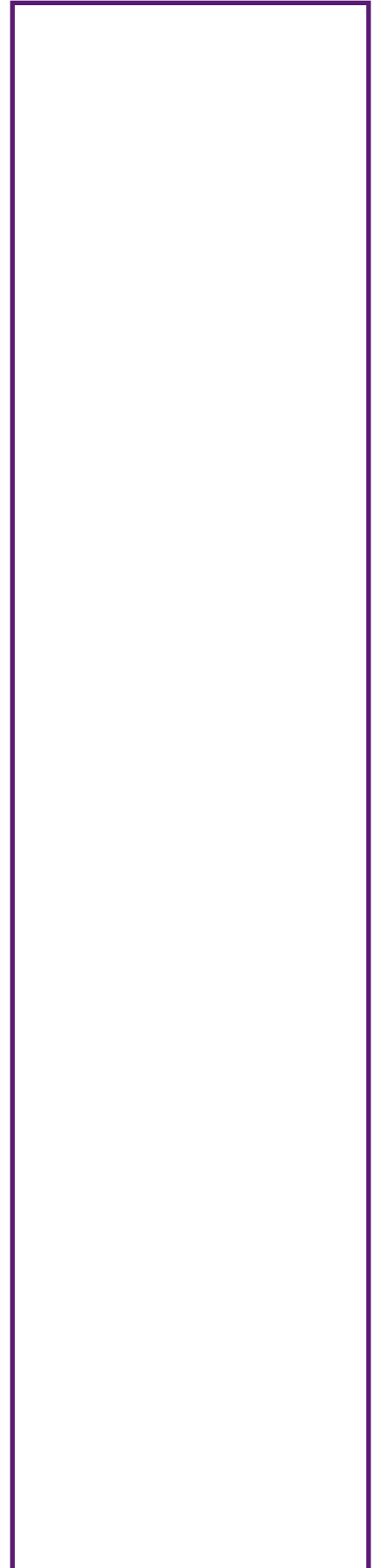
- ✓ Provide positive-pressure breathing apparatus for gas bottle changes.
- ✓ RPE may be needed for cleaning and maintenance, in which case provide RPE with an assigned protection factor (APF) of at least 200.
- ✓ Fit testing is required for RPE with a tight fitting face seal.
Workers wearing tight fitting RPE must be clean shaven and trained how to fit it properly and look after it.
- ✓ Examine and test non-disposable RPE thoroughly at least once every month and record this.
- ✓ Tell workers to check RPE is working properly before every use and record this.
- ✓ Make suitable arrangements for maintenance, storage and replacement of RPE.

Personal protective equipment (PPE)

- ✓ Take note of any specific advice on material safety data sheets on PPE. However, in general provide:
 - splash protection glasses for use in clean rooms;
 - chemical resistant face visors for use when handling processing substances;
 - overalls and chemical resistant aprons;
 - suitable protective gloves; and
 - protective footwear.
- ✓ Ensure that all items of PPE are compatible and resistant to the contaminants.
- ✓ Provide PPE that meets current British Standards.
- ✓ Ensure PPE is checked before use (including for pin holes in gloves) and do not use if there are any problems.
- ✓ Make sure contaminated gloves are removed correctly.
- ✓ Make suitable arrangements for maintenance, storage and replacement of PPE.

Personal decontamination and skin care

- ✓ Provide warm water, mild skin cleansers, and soft paper or fabric towels for drying. Avoid abrasive cleansers.
- ✓ Provide pre-work skin creams, which will make it easier to wash dirt from the skin.



- ✓ Provide after-work creams to replenish skin oils.

Caution: 'Barrier creams' are not 'liquid gloves' and do not provide a full barrier.

Maintenance examination and testing

- ✓ Keep all equipment used for the task in effective working order. Maintain it as advised by the supplier or installer.
- ✓ Follow any special procedures before any systems are opened or entered, eg purging or cleaning. Don't forget you may need RPE as well as PPE for some maintenance tasks.
- ✓ Check for signs of damage to control equipment before starting work. Remember to check any flexible ducting.
- ✓ Have equipment thoroughly examined and tested against its performance standard, at suitable intervals.
- ✓ For local exhaust ventilation (LEV) a user manual or log book is helpful in setting out the frequency of checking, maintenance or parts replacement.
- ✓ For LEV with no user manual or log book, you may need the help of a competent person. They can determine the performance needed for adequate control.
- ✓ Keep records of all examinations for at least 5 years.
- ✓ LEV systems require a statutory 'thorough examination and test' (TExT), this includes constantly monitored and alarmed systems.
- ✓ Get a competent person to perform the TExT at least once every 14 months.
- ✓ Carry out all actions arising from the TExT.
- ✓ HSG258 provides more detailed information on LEV systems and legal and competence requirements.
- ✓ Several measures are available to check effectiveness of controls. These range from simple qualitative (use of smoke tubes, de-ionised water foggers or other airflow visualisation techniques) to complex quantitative techniques (eg air sampling) usually for higher risk scenarios.

Cleaning and housekeeping

- ✓ Conduct risk assessments in preparation for accidents (including spills) and other incidents by taking appropriate action to minimise the risk. Ensure the necessary equipment, PPE and trained personnel are available to deal with any such events promptly.
- ✓ Deal with spills immediately using suitable protective gloves. You may also need RPE. Use the precautions, equipment and trained people specified in your emergency plan.
- ✓ Ensure the workplace is suitably clean. Follow the manufacturer's or company schedule and procedures.
- ✓ Ensure that incompatible wastes are not mixed.
- ✓ Ensure that waste containers are labelled and have lids.

Health surveillance

- ✓ Provide health surveillance for dermatitis where there is a reasonable likelihood that dermatitis may occur in your workplace. See G403.

Training and supervision

- ✓ Provide supervision – ensure that safe work procedures are followed.
- ✓ Tell workers about the hazards associated with their work and how to recognise early signs of dermatitis.
- ✓ Provide workers with training on:
 - working safely with hazardous substances;
 - when and how to use controls;
 - how to check they are working;
 - how the LEV system works;
 - how to use the LEV to get the best out of it;
 - how to check that the LEV is working; and
 - what to do if something goes wrong.
- ✓ Training records are helpful to demonstrate training has taken place.
- ✓ Changes to the work process and LEV means that staff may need retraining.
- ✓ Involve managers and supervisors in health and safety training.

Essential information

- MC0 - Advice for managers
- S100 - General advice
- S102 - Selection of personal protective equipment
- G403 - Health surveillance for occupational contact dermatitis (OCD)
- G406 - New and existing engineering controls
- G409 - Exposure measurement: Air sampling

Further information

You can find the full COSHH essentials series at www.hse.gov.uk/coshh/index.htm

Occupational Safety and Health Consultants Register www.oshcr.org/

Controlling airborne contaminants at work: A guide to local exhaust ventilation (LEV) HSG258 HSE Books 2011 ISBN 978071766613 3
www.hse.gov.uk/pubns/books/hsg258.htm

Health surveillance <http://www.hse.gov.uk/health-surveillance/index.htm>

National Poisons Information Service page for HF
<https://www.npis.org/Download/HFguidance.pdf>

For information about health and safety visit <https://books.hse.gov.uk> or <http://www.hse.gov.uk>.

You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

To report inconsistencies or inaccuracies in this guidance email: commissioning@wlt.com.

Employee checklist

- Make sure you have had suitable training.
- Is the extraction switched on and working properly? Check the gauge.
- Look for signs of leaks, wear and damage before every job.
- If you find any problems, tell your supervisor. Don't just carry on working.
- Co-operate with health surveillance.
- If you develop any symptoms that may be related to work, inform your line manager.
- Use, maintain and store your PPE in accordance with instructions.
- Do not use gloves that are punctured split cracked or damaged in any way.
- Wash hands before eating, drinking, smoking, using the lavatory and after work.