Health and Safety Executive

Manufacturing Sector Work Plan 2021-22: Occupational Lung Disease (OLD) Caused by Asthmagens and Carcinogens, in theFabricated Metal Sector

Open Government Status: Open

Audience: FOD Inspectors, Visiting Officers, Occupational Hygienists, Occupational Health and Process Safety Inspectors

Contents

1. Inspection Programme

1.1. What are we inspecting and why?

We are targeting the fabricated metal sector where carcinogens and asthmagens are regularly used, produced or process generated. We will ensure the risks are adequately controlled and properly managed, to reduce the incidence of serious health effects from exposure to them and to make a real difference to worker's lives. We will deal with the underlying causes of poor risk control i.e. failures in health and safety management arrangements. These include the provision of adequate information, instruction, training and supervision; adequate monitoring arrangements to ensure preventive and control measures are effective; and adequate competent advice.

This is a long-term intervention aimed at delivering sustained improvements in the control and management of risk.

1.2. What is the extent of the problem?

Occupational Lung Disease (OLD) causes the death of 12,000 people in GB annually. There are 18,000 new cases of OLD per year that are caused or exacerbated by work and 400,000 working days are lost per year.

OLD causes premature death, significantly impacts the quality of peoples' lives and has a huge cost on the GB economy. Workers who develop asthma and/or lung disease through exposure to a substance at work often need to change career or fall-out of work all together.

Specific examples of OLD in the Fabricated Metal Manufacturing Sector include:

- Lung cancer and asthma from exposure to welding fume
- Asthma and Occupational Hypersensitivity Pneumonitis (OHP) which can lead to permanent debilitating lung damage from exposure to metalworking fluid mist

1.3 What must be covered at every inspection?

- The use of metalworking fluids and welding processes **through an assessment of the management arrangements for preventing and/or controlling** the risk of exposure
- Any Matters of Evident Concern (MEC's) see Appendix 5.2
- Any Matters of Potential Major Concern (MPMC) see Appendix 5.3

1.4 What sectors and topics are we inspecting and when?

Sector	Health topics	Starting
Fabricated metals	Welding fume, MWF	May 2021
Fabricated metals (evaluation)	Welding fume, MWF	October 2021

Further information on targeting of premises including SIC codes is contained in the *Targeting and Intelligence Guide*.

1.5. Application of the Enforcement Management Model (EMM)

If exposure to a carcinogen or asthmagen is not prevented or adequately controlled, then there is a risk of a **serious health effect** (see EMM application to health risks for more details).

The EMM and consideration of enforcement should also be applied to underlying management issues, particularly in circumstances where there is evidence of widespread poor control or failure to sustain compliance.

1.6. Impact evaluation inspections

A limited number of impact evaluation inspections to fabricated metal sites will be carried out, focussing on the same areas and controls as the HRS Inspections in this OG to find out if compliance has been sustained.

A separate Fabricated Metals Reporting Form will be issued to record the evaluation visits. These visits will be returning to sites inspected in 2020 or earlier and will be identified to operational support teams by Sector colleagues.

2. Guidance and Support Available

Specialist Support Type	**Relevant Specialist**
Control strategies and enforcement	Occupational Hygiene Inspectors
Health surveillance and diagnosis	Occupational Health Inspectors
Industry standards and enforcement	Manufacturing Sector
	Clare Owen x5084

Other Important Guidance for Inspections	Guidance Location
Fabricated Metals Vlog and all supporting materials,reporting form, instructions, guidance	Fabricated Metals Inspections - SharePoint Site
Health and Safety in Engineering Workshops	Health and Safety in Engineering Workshops - HSG129
Topic-specific self-learning presentations e.g. welding and MWF	Health PowerPoints
Enforcement Management Model (EMM): Application to Health Risks	HSE website
The Management of Health and Safety at WorkRegulations 1999 HSG65	HSG65

The above support and guidance are supplemented by new workplan briefings, in-year work briefings, webinars and targeted sector-specific training where required.

3. Recording the Inspections

Fabricated Metal HRS inspections **must** be recorded using the Fabricated Metals Reporting Form, available on the Fabricated Metals Inspections - SharePoint Site. This approach was successfully trialled during Q4 2020. You do not need to use COIN or DO-IT for the initial recording of the inspection.

A separate Fabricated Metals Reporting Form will be issued for Q3 to record the evaluation visits.

Capturing this information is essential to enable us to effectively analyse the inspection outcomes and determine the impact.

4. Your Health and Safety

HSE health and safety information for visits to engineering premises is available. Inspectors should follow the company's procedures when visiting, where appropriate. General health & safety information for visiting staff is on the intranet.

Appendix 5. Industry Specific Information, Initial Enforcement Expectation (IEE) Tables, Examples of Matters of Potential Major Concern (MPMC) and Safety Priorities

Appendix 5.1.1. Metalworking fluids

Introduction

Metalworking fluids (MWF), often referred to as coolant, are used to cool and lubricate during machining processes. **This inspection programme is focusing on water-mix fluids only.**

The health risks for workers are respiratory disease and skin disease:

- Occupational Hypersensitivity Pneumonitis (OHP) (a serious lung condition previously known as Extrinsic Allergic Alveolitis) and Occupational Asthma (OA) from inhaling water-mix MWF mist.
- The exact causal agent(s) are not fully understood, so we focus on the probable causes: the ingredients in the fluid concentrate, microbial contaminants, substances deliberately added (e.g. biocides) and/or substances contaminating the fluid (e.g. metal fines).
- Dermatitis caused by wet work, contact with hazardous substances in MWF concentrate, biocides, additives and contaminants present in fluid (e.g. metal fines, dissolved metals and tramp oil).

Coolant can stay in the machine for long periods (typically many months), and subsequently its composition will change through degradation and contamination. The on-going maintenance of fluid quality **and** cleanliness of the fluid delivery system are a key part of risk control and suitable arrangements must be in place to ensure this is effectively monitored and managed.

Exposure to MWF mist should be controlled to as low as is reasonably practicable (ALARP). This is because there is strong evidence that there is a risk of OA from exposure to MWF mist.

There is no WEL or guidance value for water-mix MWF. The guidance value was withdrawn by HSE in 2005 following the Powertrain outbreak, where workers were diagnosed with occupational asthma despite exposures below levels intended to protect worker health.

Health and Safety

The risk of respiratory ill-health depends on the concentration of mist from water-mix MWF and the duration and frequency of exposure. The risk of dermatitis depends on skin contact. In the course of typical regulatory interventions, inspectors and visiting officers will experience very low levels of exposure to MWFs and the risk to health is very low.

Inspectors and Visiting Officers should take simple steps during interventions to minimise exposure by inhalation and skin contact, including:

- Keep away from activities with potentially high concentrations of mist e.g. leaning into CNC enclosures.
- Wash your hands if you come into contact with MWF.
- Take account of the company's procedures when visiting.

You should ensure appropriate PPE for the premises is worn where required e.g. safety footwear, eye protection (BS EN 166), hearing protection. If you are concerned about particular premises or exposure beyond the low levels expected, please discuss with your PI.

Inspection

First establish that water-mix MWF is in use (typically made up from a concentrate solution mixed with water).

Follow protocol under '1.3. What must be covered at the inspections' and examine the necessary exposure controls expected by consideration of:

- Are there processes where exposure to mist is highly likely?
  - CNC machines?
  - Use of compressed air to clean fluid from components and internal machine surfaces?
- Is effective LEV in place to control mist?
  - Is LEV present to remove mist that builds up inside the CNC enclosure?
  - Are CNC machines fully enclosed, if not, can they be enclosed further?
  - Is a delay observed on completion of machining, to allow mist to be extracted, so when the operator opens the doors, no mist is present in their breathing zone?
  - How was this determined e.g. smoke, visually with backlighting **and** how is this implemented e.g. programmed interlocks, timer?
  - LEV regularly cleaned and inspected, and records kept?
  - LEV passed TExT.
  - Where the extracted air is re-circulated back into the workshop, does this incorporate a mist filtration system?

- How are wet components/internal machine surfaces cleaned and what measures are in place when using compressed air guns?
  - Have alternatives to compressed air been considered – e.g. vacuum guns etc.?
  - Can exposure to mist be reduced by using compressed air guns inside enclosures with LEV and at reduced pressure?
- Were there adequate measures to prevent or minimise skin contact including:
  - Automatic mixing devices or equipment to handle neat concentrate.
  - Tools e.g. swarf hooks, shovels, vacuum systems to remove swarf/chips from machine surfaces and components.
  - Suitable protective gloves (single use nitrile) provided for machine operatives?
  - Clothing that covers exposed skin e.g. forearms.
- Are the arrangements for monitoring and managing fluid quality adequate?
  - Dipslide tests (to estimate levels of living bacteria) undertaken and reviewed?
  - pH tested? (Note: pH is not considered an alternative to dipslides as the results do not alter significantly until high levels of bacteria are present and can be affected by other variables).
  - Fluid concentration maintained as specified by fluid supplier (typically between 4-6% and measured using a refractometer)?
  - Sumps inspected to check levels of tramp oil, biofilm and for unusual odours (sulphurous/rancid).
- Have employees been provided with adequate information, instruction and training in relation to the potential health risks associated with exposure to MWF's and the controls in place to prevent or reduce exposure in their work area?
- Is health surveillance (skin and respiratory) provided where required?
- Have they had any reports of ill-health (skin or respiratory)?

Priorities

- Processes where high levels of MWF mist is generated e.g. CNC machining with absent or ineffective LEV.
- Use of compressed air with no or ineffective controls.
- Poor management of MWF quality (absent or inadequate monitoring and/or review of test results, timely corrective action not taken).

Safety Priorities

The Manufacturing Sector Plan details HSEs' safety priorities for the Sector. These safety issues are the most common causes of safety-related deaths and serious injuries in the Sector. They are:

- The movement and storage of heavy loads e.g. moving or relocating machinery
- Maintenance activities: including issues of access (fall from height) and machinery intervention

Although these safety priorities are not a specific focus of this inspection programme, visiting staff should be aware these issues may well manifest as MECs.

Guidance

Health PowerPoint on MWFs plus IEE table overleaf.

UKLA Good Practice Guide for the Safe Handling and Disposal of Metalworking Fluids (updated in 2021 but only minor changes from 2018 version).
COSHH Essentials Metalworking Fluid Sheets
MW0: Advice for managers
MW1: CNC Machining
MW2: Control of skin risks during machining
MW3: Sump cleaning: water-mix fluids
MW4: Sump cleaning: neat oils
MW5: Managing fluid quality
HSE MWF web pages
INDG365 (2011) Working safely with Metalworking Fluids

Contacts

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Task	Situation (giving rise to risk)	IEE	Comment
Operating CNC machines	Workers are exposed to mist by: - using CNC machines without LEV - insufficient time delay	IN	**LEV should be fitted to CNC Machines** unless the exceptions below apply or the dutyholder can demonstrate from the specific circumstances that workers are not exposed to mist. LEV should be designed and maintained to keep the mist inside the enclosure during machining (i.e. under negative pressure) and to effectively extract mist. Design considerations should include volume flow rate, location of the extraction point, volume and dimensions of the enclosure and the level of mist generated from machining. Where the extracted air is re-circulated back into the workshop, a mist filtration system should be fitted. **Enclosures** are designed as machine guards and not for mist control. Some enclosures e.g. vertical milling machines will be open at the top. It may be possible to retrofit additional panels to enclose further. Mist levels will be highest during and immediately after machining. There should be a **delay** that is long enough for the LEV to extract the mist, so when the operator opens the doors, no mist is present in their breathing zone (the space within 20-30 cm of the nose and mouth).The time delay can be **established** by filling the enclosure with smoke or using a dust lamp to observe fine mist. It can be **implemented** by incorporating a time delay into the machine program or using a timer. In order to prioritise the installation of control measures, dutyholders should establish which machines and work practices expose operators to mist e.g. using a high-intensity inspection lamp (spot beam) to look for the presence of mist in and around machines where operators are working, (see MDHS82/2 The Dust Lamp: A simple tool for observing the presence of airborne particles). Direct reading aerosol monitors can also be used. Large CNC machines e.g. gantry or bridge Operator exposure will depend on their position during the machine cycle, tool changing methods and levels of mist generated. Unlike other CNCs the guarding options may mean these machines are open. Retrofitting of enclosures and/or LEV may be practicable. Seek SG Occupational Hygiene/Sector advice where necessary. Tool room CNC machines An alternative to installing LEV is to allow mist to settle out prior to opening the CNC enclosure door. The machine would need to be fully enclosed and mist must not escape from the enclosure during machining, such that operators are exposed. As anecdotal information indicates the time taken for mist to settle is between 10 to 30 minutes, this is unlikely to be practicable in a production environment.

Task	Situation (giving rise to risk)	IEE	Comment
Cleaning wet components and/or machine surfaces (CNC and manual machines)	Workers are exposed to mist by cleaning using compressed air guns	IN	Alternatives to cleaning down parts with compressed air guns during machining should be considered, for example vacuum guns, absorbent materials, low pressure coolant guns, spindle mounted fans or automatic compressed air hoses (operated with CNC enclosure doors shut). These have been successfully introduced by a number of companies. Finished components can be cleaned in washing/degreasing machines. Where there is no reasonably practicable alternative to using compressed air guns: • Reduce the exit pressure of the compressed air to as low a level as practicable (as a guide some countries have set a maximum level of 30psi/2.1bar). Different nozzle designs allow guns to be operated at a lower pressure. • Blow down components inside the CNC machine with the LEV on. • Consider using compressed air guns with longer lances (e.g.30 cm). These measures will also reduce other risks to workers particularly noise and ejected swarf. The cleaning of machine surfaces using compressed air should be avoided. Suitable swarf vacuums should be used to remove wet swarf/chips from machine surfaces.
Handling of neat concentrated fluid, water-mix MWF and wet components/swarf when cleaning etc. (CNC and manual machines)	Repeated and/or prolonged exposure of skin from: - Use of compressed air guns - Poor fluid handling (mixing, decanting, topping up sumps) - Sump/machine cleaning - Incorrect removal and replacement of protective gloves	IN	Check SDS for Hazard Statements e.g. H315 Causes skin irritation, H317 May cause an allergic skin reaction. Should explore substitution for less hazardous alternatives. **Note:** Higher than recommended fluid or biocide concentration increases the risk of skin disease. To prevent/reduce skin contact: • Use automatic mixing and dispensing devices. • Reduce pressure and use longer lances on compressed air guns. • Enclose machine as much as possible. If not fully enclosed provide properly designed splashguards. • Use suitable tools e.g. brushes, swarf hooks, vacuums to remove swarf/chips from components, machine surfaces and sumps. • Provide suitable PPE, single use nitrile gloves for general machining and thicker chemical resistant gloves for cleaning and maintenance. Skin covered and clothing not heavily contaminated.

Task	Situation (giving rise to risk)	IEE	Comment
Maintaining fluid quality (CNC and manual machines) **inhalation and skin risks**	Routine testing not undertaken e.g. dipslides	IN MHSW Reg 5	Recommended checks and frequencies where there is mist generated either in the machining process and/or through the use of compressed air: • Weekly dipslide, pH, concentration and tramp oil. • Daily checks of odour and appearance. Dipslide frequency can be reduced if dutyholder can demonstrate controls are consistently effective, which would include dipslide, concentration and pH test records. **Note:** Check whether the fluid is Bioconcept fluid (naturally populated with bacteria and so routine dipslides not required) and refer to the advice on the Bioconcept webpage. Seek SG Occupational Hygiene/Sector advice where necessary.
	No or ineffective action following test results	IN MHSW Reg 5	Examine a representative sample of records e.g. last 3 months looking for: • Dipslides **consistently at or above 10^4 cfu/ml** indicate bacteria growth. **Dutyholder action required**: Check and review measures to maintain fluid quality e.g. fluid concentration, pH, tramp oil content, metal contamination, temperature, agitation/flow. Only after this should additional biocide be added and as agreed with fluid supplier. • Dipslides **consistently at or above 10^6 cfu/ml** indicate heavy bacterial contamination and poor control. **Immediate dutyholder action is required.** This normally means draining and disposal of the MWF and a complete system clean or taking other equally effective measures. • Fluid concentration should be maintained within the limits set by the fluid supplier e.g. 4-6% to reduce risk of ill health (too high will increase the concentration of irritant and/or sensitising substances, too weak can increase bacteria levels). Plotting results on a graph/chart will make it easier for dutyholders to monitor trends. Dutyholders should contact their fluid supplier for advice where necessary.
Maintaining fluid quality (manual machines) **skin risks only**	Routine testing not undertaken or no or ineffective action taken following monitoring results	IN MHSW Reg 5	Recommended checks and frequencies where there is **no** mist generated from either the machining process or from compressed air use, but skin exposure is present: • Weekly pH, concentration Fluid concentration and pH should be maintained within the limits set by the fluid supplier (other checks will be required to ensure fluid quality but are less critical to preventing dermatitis).
Ensuring LEV performance	No or ineffective routine inspection and cleaning of LEV e.g. swarf blocking extract inlets, damaged ductwork, no filter inspection.	IN	MWF, chips and swarf can significantly reduce LEV performance over a short period of time. Regular checks, maintenance and cleaning should be in place. There should be an easy way of checking the LEV is working e.g. airflow indicator or equivalent.
	No current thorough examination and test.	IN	TExT is absent, out of date or inadequate (required every 14 months). If TExT has been undertaken, then check that any critical defects have been remedied.

Task	Situation (giving rise to risk)	IEE	Comment
Health surveillance (CNC and manual machines)	No health surveillance programme in place where there is a reasonable likelihood that dermatitis or asthma may occur.	IN	Dermatitis health surveillance will be required if there is frequent 'wet work', glove use or risk of contact with MWF that can cause dermatitis (irritant or allergic). Respiratory health surveillance will be required where there is exposure to MWF mist as there is a risk of inhalation and developing lung disease. The duty holder should seek competent advice to identify and implement suitable health surveillance, under the supervision of a competent person, i.e. occupational health provider. A suitable health surveillance programme is likely to include a regular respiratory questionnaire, lung function test and skin checks, at frequencies determined by the competent person. Discuss with SG Occupational Health where necessary.
Information, Instruction, training (CNC and manual machines)	No information, instruction and training provided to employees who may be at risk from exposure.	IN	Employees should be aware of the health risks/symptoms associated with exposure to MWFs **and** the controls in place to prevent or reduce exposure. They should know to report any suspected symptoms as soon as possible.

5.1.2. Welding fume (fabricated metal, shipbuilding and repair)

Introduction

Inspectors will need to consider the overall risk to health from exposure to all types of 'welding fume', including mild steel, stainless steel, high chromium steel, armour steel and super alloys made from exotic metals. Inspector's applying the EMM will identify the health outcome following exposure to any type of welding fume as having a 'serious' health effect.

Control will be judged by observing any visible fume as a pragmatic way of assessing the effectiveness of the controls provided. This may also be supported by relevant duty holder exposure monitoring data.

Welding fume must be 'adequately controlled' to prevent exposure in accordance with Regulation 7 of COSHH 2002. Control is only adequate if the principles of control in Schedule 2A to COSHH are applied and the controls ensure exposures are below any WELs for substances within the fume (e.g. manganese). There is no one control solution and the control measure(s) will be proportionate to the health risk and dependent on the task. The principle exposure controls required will be:

- The provision of suitable engineering controls (e.g. LEV) for visible welding fume indoors; and, where LEV is not reasonably practicable, the provision of suitable RPE.
- Where visible fume is not captured by the LEV, suitable RPE must also be provided.
- The provision of suitable RPE for welding outdoors.

Exposure should be negligible and at a level unlikely to cause harm when all of the following are considered:

- Controls follow methods recommended by HSE COSHH Essentials WL series: http://www.hse.gov.uk/coshh/essentials/direct-advice/welding.htm or the Breathe Freely Welding Fume Control Selector Tool: http://www.breathefreely.org.uk/wst/
- RPE is also used where LEV alone is not adequate or reliable.
- The RPE selected offers both adequate protection from the welding fumes and is suitable for the wearer. Powered RPE is required when respiratory protection is worn for more than 1 hour.
- Effective general ventilation is provided.
- Workers use controls effectively.
- Appropriate management arrangements are in place to ensure workers understand the health risks and appropriate use of LEV/RPE maintenance etc.

Recirculating LEV systems for control of welding fume

Recirculating LEV systems rely on an appropriate filter to remove the welding fume before the air is returned to the work room. Recirculating LEV systems are not recommended for welding processes which generate a lot of gases, for example ozone generated from MMA and MIG welding on aluminium metal or TIG welding on stainless steel. LEV systems vented outdoors should be preferable for dutyholders because they avoid these problems. However, this is not possible in all situations and therefore recirculating LEV will be used.

Where the DH does not have an effective filter inspection and replacement programme in place and the efficiency of the filter or its performance cannot be determined by the information provided by the LEV supplier, a recirculating LEV system may be failed by a TExT engineer. If you come across this and the only critical defect is about there being no filtration efficiency information on the filter, then any enforcement should be targeted to address the lack of the DH's filter management system:

- a Notification of Contravention would be appropriate, about ensuring adequate control (COSHH Reg 7) where some exposure is possible from exhausted air which has not been suitably cleaned by the filter; alternatively,
- verbal advice about absence of filter filtration efficiency would be appropriate where it is judged that the recirculating LEV is effective.

Effective General Ventilation

- Welding fume is hot and will rise upwards. Effective general ventilation provides rapid fume clearance and a through draught to disperse and remove fume. It is necessary to minimise the fume build-up over the shift in any situation where welding fume is not fully removed by LEV.

- Mechanical general ventilation uses fans mounted in the ceiling or high up on a wall to extract the air in the room and draw in clean air to disperse airborne contaminants. In most welding workshops, mechanical general ventilation will be required because natural ventilation from open doors and windows is not sufficient to disperse the fume generated from the work tasks.

- For processes which produce little fume in a substantially sized work area, effective general ventilation may adequately control exposure. Examples include low-intensity resistance spot-welding and low-intensity TIG welding. Mechanical general ventilation systems can work well with a number of **low fume** sources in large work areas with high ceilings.

Carcinogens

All welding fume (including mild steel) is now classified as a carcinogen which can cause lung cancer and has the potential to cause kidney cancer. This is based on the outcome of recently published report by the International Agency for Research on Cancer (IARC).

Asthmagens

Stainless steel welding fume contains nickel and hexavalent chromium, which are known to cause occupational asthma. (N.B. COSHH Regulation 7(7)(c) has the requirement to ensure exposure is reduced to as low a level as is reasonably practicable (ALARP) and cannot be applied to welding fume unless the dutyholder's risk assessment identifies it as a potential cause of occupational asthma).

Manganese in welding fume (including mild steel welding fume)

Improving the control of welding fume will have other benefits such as controlling exposure to manganese. It is likely that the respirable manganese limit will be exceeded during many welding activities unless effective controls are introduced and used properly. The new respirable manganese WEL of 0.05mg/m3 (8hr TWA) is appropriate because much of the manganese in the fume will be small particles that reach the deep lung resulting in neurological effects.

Exposure monitoring for compliance testing is one method that employers can use to demonstrate that there is a low probability of non-compliance with the WEL.

Health Surveillance for Occupational Asthma (e.g. stainless-steel welding):

To set up a health surveillance programme, the duty holder should seek advice from a competent person i.e. an Occupational Health service provider (OHSP).

Respiratory health surveillance is likely to be necessary when welding stainless steel, where a known asthmagen (e.g. chromium) is present in the fume, unless the risk assessment has shown there isn't a reasonable likelihood of developing the condition.

Health and safety

The risk of ill health depends on the concentration of welding fume and the duration and frequency of exposure. In the course of typical regulatory interventions, inspectors and visiting officers will experience very low levels of exposure to welding fume and the risk to health is very low.

Inspectors and visiting officers should take simple steps during interventions to minimise exposure, including the following:

- Keep away from the plume of welding fume, observing at a safe distance, and dealing with issues away from the welding work area. (Do not look directly at the welding arc and stand behind the welding curtain to protect your skin and eyes from UV radiation when observing at a distance.)

- Minimise the time you need to spend in a work area where there is uncontrolled fume or visible haze in the air. Ask the dutyholder to take photos of the work and the controls used, or to stop the welding activity and clear any fume before you enter the area.

- For areas where the dutyholder's workers are required to wear RPE at all times, and there is a need for regulatory action which significantly outweighs the usual approach of supporting the dutyholder's practices, then the actual risk from entering the area will still be low – remember to apply the principles of time and distance. In most cases, you should be able to establish what welding is being undertaken and what controls are in place outside of the area. If you think welding fume may not be adequately controlled and further time is required in the welding area, then request a joint visit with a specialist occupational hygiene inspector from SG2 who has been issued with suitable RPE.

If you are concerned about particular premises or exposure beyond the low levels expected, please discuss with your PI.

Inspection

Follow protocol under 1.3. 'What must be covered at the Inspections?' and examine the necessary exposure controls expected **considering the following:**

How much welding was being carried out?

- High intensity - welding throughout the shift; welding arc time of more than 1 hour per welder per shift.
- Low intensity - welding lasting less than 1 hour per welder per shift

How often was welding carried out?

- Regularly - welding daily or weekly and at any intensity
- Sporadically – occasional welding carried out less than once per week, which is incidental to the businesses core activity and cannot be planned for

Where does welding take place?

- Outdoors
- Indoors
- In a confined space

What types of welding are carried out?

Are any of the processes automated?

What fume controls were in place?

What type of LEV was used?

- Extracted bench
- Extracted booth
- Moveable capture hood
- On-torch extraction
- Extraction fixed to jigs
- LEV vented to outside
- Recirculating LEV (filtered air returned to work room)

If LEV was used, was it effective?

- Does the LEV appear to extract visible welding fume?
- Do operators position work and/or LEV hood to minimise fume escaping the LEV capture zone
- Do operators check LEV is working?

Were the LEV systems for welding fume expected and maintained?

- Were there records of regular inspection and maintenance?
- Was there an in-date report for each LEV system stating the system passed the TExT?
- For recirculating LEV only, were the fume filters regularly checked and replaced when required?

For any RPE used, was it suitable?

- Were powered respirators or breathing apparatus used if worn over 1 hour?
- Were the filters at least an APF of 20 - P3, FFp3 or TH2/TH3?
- Was there a RPE programme ensuring good condition - clean storage, user checks and filter replacement?
- Was face fit testing for all tight fitting RPE carried out?
- Were welders clean shaven when wearing tight fitting RPE?
- Did operators wear RPE correctly and was it compatible with other PPE?
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Was there good general ventilation (natural or mechanical) effectively dispersing and removing the fume?

Were there adequate arrangements for welding in a confined space?

- Was work arranged to minimise welding in confined spaces?
- Suitable arrangements to ensure a safe system of work to adequately control task specific risk?
- Training records provided for work in confined spaces?

Were the management arrangements for welding fume effective?

- Does the COSHH assessment identify the increased risk of occupational asthma from welding fume containing hexavalent chromium and nickel, eg during stainless steel welding?
- Do workers know that exposure to welding fume can cause asthma and cancer and what controls to use?
- Is health surveillance for occupational asthma undertaken by a competent occupational health provider?
- Are there procedures in place for reviewing welding fume controls when symptoms are identified?
- Did the duty holder carry out occupational hygiene monitoring for exposure to metal fume constituents (e.g. manganese, chromium, nickel, copper)?

Overall were the managers effectively achieving the 'Plan, Do, Check, Act' approach?

- Did they appear competent and willing to comply with the law?
- Were workers clear about how to use control measures correctly?

Priorities

1. Welding carried out in a restricted or confined space* (e.g. internal welds for containers or tanks) and there is no effective LEV or suitable RPE provided. (N.B. see OC18/12 re MECs)
2. High intensity welding using med-high fume emission techniques indoors e.g. MMA or MIG undertaken with inadequate controls.

See Initial Enforcement Expectation Table for some example scenarios. * welding within a 'confined space' is an MEC

Safety Priorities

The Manufacturing Sector Plan details HSEs' safety priorities for the Sector. Although these safety priorities are not a specific focus of this inspection programme, these safety issues are the most common causes of safety-related deaths and serious injuries in the Sector and visiting staff should be aware these issues may well manifest as MECs:

- The movement and storage of heavy loads e.g. large structures, tanks and vessels
- Maintenance activities: including issues of access (fall from height) and machinery intervention

Guidance

Presentation giving refresher briefing on welding fume plus IEE table below:

- RPE Webpages
- LEV Webpages
- L5 - Control of Substances Hazardous to Health Regulations 2002 ACOP
- L22 - Provision and use of Work Equipment Regulation 1998 ACOP
- HSG129 - Health and Safety in Engineering Workshops
- Health Surveillance for Occupational Asthma (G402)
- HSG139 – Safe use of Compressed gases in welding, flame cutting and allied processes
- INDG390 - Choosing a welding set
- INDG327 - Take care with acetylene
- INDG297 - Safety in gas welding, cutting and similar processes
- INDG314 – Hot work on small tanks and drums

NOTE: HSE acknowledges the application of the BOHS Breathe Freely Selector Tool, as an appropriate method for complying with the COSHH Requirements for Good Practice, in controlling exposure to welding fume.

Contact

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The benchmark is nil/negligible for EMM Likelihood descriptor for welding fume which has a serious health effect.

Welding Fume Exposure IEE's				
Task		**Situations**	**IEE**	**Comment** **See WL3 for suitable control options**
Regular and/or High Intensity Welding Weekly or more often, and/or more than 1hr arc time per shift	MMA or MIG welding indoors	• No effective LEV • No supplementary RPE used where LEV alone is not adequately controlling welding fume • LEV damaged or poorly repaired **and** is ineffective • LEV is ineffective **and** is not thoroughly examined or tested	IN/ Consider PR	Adequate control is: • LEV e.g., Extracted bench or on-torch for MIG welding of small-med sized work pieces; or, • LEV **and** RPE when welding on large-XL sized workpieces (e.g. bigger than a car) - when using LEV with a moveable fume capture hood on a flex arm, careful positioning and repositioning of the capture hood is needed as often as necessary to maintain the optimal fume capture, making the effectiveness of control dependent on the user When enforcing on LEV: • Enforce COSHH Reg 9 if effective LEV is damaged – no maintenance • Enforce COSHH Reg 7 if LEV will remain ineffective after repairs – inadequate control • Enforce COSHH Reg 9 if TExT is absent, out of date or inadequate (ACOP para186)
		Recirculating LEV with some degree of risk due to lack of appropriate filter management system	NoC	Recirculating LEV systems rely on an appropriate filter to remove the welding fume before the air is returned to the work room. Enforce COSHH Reg 7 where the DH does not have an effective filter inspection and replacement programme in place and the efficiency of the filter or its performance cannot be determined by the information provided by the LEV supplier, a recirculating LEV system may be failed by a TExT engineer. In such cases, any enforcement should be targeted to address the lack of the DH's filter management system.
		Recirculating LEV which appears to be effective but there is no filter filtration efficiency information	Verbal	This action should be taken when the filter information is judged to be an administrative issue and not risk based.
	MMA or MIG welding outdoors	• No RPE used • Unsuitable RPE used • Welder using tight-fitting RPE and not clean shaven	IN	Adequate control is: • Powered RPE for >1hr use • Face fit test for wearer when RPE with a tight-fitting face seal is used. • P3, FFP3 filter or TH2/TH3 • RPE programme in place for clean storage, replacement filters and user checks (Note: Same standard applies to gas cutting)
	TIG welding	• No effective LEV • LEV damaged or poorly repaired and is ineffective	IN	Adequate control is: • Effective LEV is required to capture and remove welding fume and ozone

Task		Situations	IEE	Comment **See WL3 for suitable control options**
Sporadic, Low Intensity Welding <weekly <1hr arc time per shift	MMA or MIG welding indoors	• No LEV or suitable RPE when carrying out occasional welding	IN	Adequate control is: • Effective LEV (where reasonably practicable) OR • Suitable RPE (if LEV not reasonably practicable) AND good general ventilation, ensuring no other workers are exposed to the welding fume • Welders MUST be clean shaven when wearing RPE with a tight-fitting face seal and face fit tested.
	TIG welding	• effective general ventilation with rapid dispersal of the fume	No action	For processes which produce little fume in a substantially sized work area, effective general ventilation may adequately control exposure. Examples include low-intensity resistance spot-welding and low-intensity TIG welding. It is unusual for a skilled welder who is employed to be a welder to only carry out sporadic and low intensity TIG welding. It is likely that welders will also conduct other welding in the same day and the risk from their cumulative exposure to welding fume requires assessing.
	TIG welding	• Poor general ventilation	IN	Adequate Control is: • Effective general ventilation sufficient to mix with the fume and disperse it. It is unusual for a skilled welder who is employed to be a welder to only carry out sporadic and low intensity TIG welding. It is likely that welders will also conduct other welding in the same day and the risk from their cumulative exposure to welding fume will require assessing.

Please note:

- High intensity welding means repeated welding throughout the shift; welding arc time of more than 1 hour per welder per shift.
- Low intensity welding refers to welding lasting less than 1 hour per welder per shift
- Regular welding is daily or weekly welding of any intensity
- Sporadic welding covers occasional welding carried out less than once per week which is incidental to the businesses core activity and cannot be planned for

Appendix 5.2. Safety Priorities and Matters of Evident Concern (MEC's)

The Manufacturing Sector Plan details HSE's safety priorities for the Manufacturing Sector. These safety issues are the most common causes of safety-related deaths and serious injuries in the Sector. They are:

- The movement and storage of heavy loads
- Maintenance activities: including issues of access (fall from height) and machinery intervention
- Integrity of machinery guarding and interlocking

Although these safety priorities are not a specific focus of this inspection programme, visiting staff should be aware that these issues may well manifest as MECs. Inspectors must consider action in relation to Matters of Evident Concern (MEC) or Matters of Potential Major Concern (MPMC) at all visits (see OC18/12).

Appendix 5.3. Examples of Industry Specific Matters of Potential Major Concern (MPMC)

Inspectors must consider action in relation to Matters of Evident Concern (MEC) or Matters of Potential Major Concern (MPMC) at all visits (see OC18/12). Inspectors should discuss with their Process Safety Champion if further assistance is required.

These are specific industry examples that could lead to potentially catastrophic events. There are other events common across the industries that are not included here. See OC18/12 for more details.

Ship / boatbuilding Potential Catastrophic Event:	Due to:	Examples of indicative issues:	Existing Guidance:
Fire and explosion	Use of fuel gases and oxygen	Poor control of cylinders and tubing	Welding microsite – Safety Risks from Welding Safe use of oxygen and fuel gases on board ships - EIS43
Entry in confined spaces	Poor controls or understanding	Manufacturing process creating smaller spaces. Refurbishment of existing ships / boats. Use of solvents. Tanks or other contaminated areas being worked on	Welding Microsite - Safety Risks from Welding
Fabricated Metals Potential Catastrophic Event:	Due to:	Examples of indicative issues:	Existing Guidance:
Fire and explosion	Use of fuel gases and oxygen	Poor control of cylinders and tubing etc.	Welding Microsite – Safety Risks from Welding
Fire and explosion	Ignition of metal powders/dusts	Inadequate control provided	Safe handling of combustible dusts - HSG103
Entry in confined spaces	No risk assessment, poor controls, inadequate training and emergency procedures	Manufacturing process creating smaller spaces. Refurbishment of metal structures/tanks etc. Use of solvents and welding kit during activities in enclosed space	Welding Microsite - Safety Risks from Welding
Heavy loads	Poor management and control of movement and storage of heavy loads	Poorly designed workplace transport arrangements, no segregation, lack of planning and poor storage arrangements	Safety in the storage and handling of steel and other metal stock - HSG246f