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Target Audience:
All visiting staff including Local Authority Inspectors
Health Unit

REDUCING ILL HEALTH IN THE MOTOR VEHICLE REPAIR (MVR) INDUSTRY. DEVELOPING ISSUES

This SIM follows on from SIM 03/2005/14, which outlined the aims and objectives of National Project 27 'reducing the risk of respiratory illness from 2-pack isocyanate-containing paints in the motor vehicle repair (MVR) industry'. Several Safety and Health Awareness Days (SHADS) have now been held as part of the project and the feedback has been overwhelmingly positive. A number of issues have emerged that visiting staff will need to be aware of. Some are new requirements (checking spraybooth clearance time, biological monitoring etc) whilst others are clarifications of priorities or industry myths that need dispelling.
The SIM includes links to suppliers of equipment, which may assist inspectors. This does not imply any approval or endorsement.

BACKGROUND

1 The aims of the National Project are to reduce the risk of respiratory illness from isocyanates and to raise awareness of and reduce the risk of skin disease in MVR bodyshop workers. This contributes to the "Fit 3" Strategic Programme and specifically the Disease Reduction Programme in relation to occupational asthma and skin disease. Visiting staff are not being asked to carry out visits in work year 2005/06 but are encouraged to attend one of the SHADs to familiarize themselves with the issues.

OBJECTIVES

~~2.~~2 16 SHADs are being delivered (at least two in each Division) in 2005/6 and a further 12 are planned for 2006/7. They cover the following issues:

- How isocyanates may affect health
- How exposure occurs
- How control measures can minimise exposure

- Checking that control measures are working by measuring exposure (using biological monitoring)

- The risk of dermatitis to body-preparation workers and sprayers and how to control it

- What respiratory and skin health surveillance needs to be in place and who should do it.

EMERGING ISSUES

3 A number of issues relating to bodyshop work practice and risk control measures have developed during the preparation and running of the SHADs. Some of these relate to new requirements others will need significant changes to industry practice based on new evidence of the causes of risk in MVR bodyshops. The changes have been agreed with the industry as reasonably practicable measures, which will maintain or improve standards.

ISOCYANATE EXPOSURE AND RISK

4 Over the years, various erroneous beliefs have developed in the industry and need to be dispelled so that people can concentrate on the important causes of exposure. One belief concerns how isocyanate paint spray gets into the body and others concern which processes cause the most exposure.

5 Evidence from visits to well over a hundred bodyshops shows that MVR bodyshop workers believe that the main health effect caused by isocyanates is cancer. There is no clear evidence to support this and it detracts from the real problem, which is that isocyanates are the single biggest cause of occupational asthma. And, amongst those using isocyanates, MVR bodyshop sprayers are the work group most at risk in the UK. They are 80 times more likely to develop occupational asthma than the average for the UK working population.

6 Many sprayers believe that a significant or even the main route of entry for isocyanate paint spray is through the skin with the **"thin skin around the eyes"** being a particular concern. These views are confusing and wrong. The overwhelming route of entry for isocyanate paint mist in MVR bodyshops is through inhalation of fine airborne paint mist and this is what puts sprayers at risk of getting occupational asthma. Getting mixed 2-pack isocyanate paint or liquid hardener drips/splashes on the hands/skin can cause dermatitis but that is a different issue.

7 As with the overemphasis on skin absorption, many believe that certain processes and tasks can cause significant exposure to airborne isocyanate. As the MVR Project developed these assumptions have been tested by HSL and the key sources of isocyanate exposure in an MVR bodyshop have been identified:

(1) **Paint spraying** is overwhelmingly the most important source. Task-based exposures in spray booths will be in the hundreds of micrograms per cubic metre of air ($\mu g/m^3$) and in spray rooms exposure will be an order of

magnitude higher; in the thousands of µg/m^3. Both are well in excess of the long and short-term limit values of 20 µg/m^3 and 70 µg/m^3.

(2) **Poorly controlled spray gun cleaning** is the other potential major source. If the gun is cleaned with thinners and sprayed through (whether in a booth or, inappropriately, outside in the workshop) exposure in the hundreds of µg/m^3 can occur.

Other activities and tasks previously thought to cause significant exposure have now been shown not to be a problem. These include:

(1) Paint mixing - good natural ventilation is adequate to dilute any solvent vapour and the very small amount of isocyanate vapour that might be released when the hardener tin is opened.

(2) Dry sanding of fresh 2-pack isocyanate paint film – there is no isocyanate detectable in the dust. But the fine dust generated by this process (and largely invisible under normal lighting conditions) should be controlled using on-tool exhaust extraction.

(3) Baking of paint - (in spray-bake booths) was thought to generate significant isocyanate monomer levels in the recirculating air. Measurements by HSL show that the levels involved are insignificant. Even so, it would be prudent and good practice to allow a purge time, when all air in the booth was discharged to atmosphere through a stack (as occurs during painting) to allow the booth to clear of paint ‘fume’ and any products of combustion from the baking heater.

(4) Brush and roller painting - tests by HSL show that rollering and brushing body panels produces no measurable airborne exposure to isocyanates but gloves are required to protect against drips and splashes on the skin (to protect against dermatitis).

”THE INVISIBLE MENACE” – HOW EXPOSURE REALLY OCCURS

8 Spray painters do not see most of the airborne paint mist they are exposed to. Paint spraying creates large clouds of fine paint mist, which like sanding dust, is invisible under normal lighting conditions. This can be breathed in when, for instance, the sprayer lifts his facepiece to view the quality of the paintwork or takes off his air-fed breathing apparatus before the booth/room has cleared. Priming the spray gun and cleaning the gun by spraying through thinners will also create an isocyanate-containing mist.

HOW MIST IS GENERATED AND CLEARED IN SPRAY BOOTHS AND ROOMS

9 Even modern spray guns (that comply with environmental legislation) waste nearly 40% of the paint used and most of this “over-spray” is propelled into the air by the jet-action of the spray gun. The fine, invisible, airborne mist needs to be removed by the extraction system. Under normal lighting, the over-spray appears to be extracted more-or-less instantaneously. In fact, the fine mist spreads throughout the spray

area and circulates in vortices against the walls, and other parts, of the booths. The time taken to dilute and remove the mist after spraying ceases is known as the 'clearance time' and varies enormously depending on booth or spray room design and characteristics. Spray rooms are much less effective devices than spray booths. Exposure within rooms is much higher and clearance times are much longer. The way that air re-circulates within a booth or room will depend on air input and extract arrangements and dimensions. Fully-extracted floors can clear in less than 30 seconds while downdraught spray-bake booths with pit extraction might take up to 5 minutes and spray rooms (typically having a wall fan and filtered inlets) up to half an hour. Whoever has to use or enter a spray booth or room **must** know the clearance time and when the most recent spraying finished to be confident that the booth/room is clear.

WHY IS CLEARANCE TIME IMPORTANT?

10 The quality of the paint finish is a top priority for sprayers (and their employers). Even the smallest application defects or shade variations give rise to unsatisfactory results. The sprayer therefore needs to see the paint film applied clearly and quickly so tends to raise the air-fed visor for an unrestricted view almost immediately after spraying has finished. The majority of sprayers (and their employers) do not appreciate that fine paint mist remains in the booth/room for sometime **after** they've finished spraying. This mist contains high concentrations of isocyanate, and it is vital that sprayers keep their RPE on until the booth or room is clear or they have left the booth/room. Others who may need to enter the space need to understand the risk and must also know the clearance time and wear RPE.

HOW TO MEASURE CLEARANCE TIME

11 Fine paint mist behaves like smoke in air. A fog-generator can be used to find out how long fine paint mist takes to clear from a booth or spray room. Professional machines are typically used in theatres and clubs (and typically cost over £500) but versions are now available in the high street for less than £50 (eg from Argos, Maplins and DJ suppliers). HSL are currently assessing a number of fog-generators and a report on their effectiveness will be published shortly. Professional smoke generators are available for Inspectors to use in each Division. To measure clearance time:

- Set up the booth for a normal spray job (though it may be preferable to carryout the test without a car in-situ as glycerine-derived smoke can leave an oily deposit);

- Carry out the test just before the booths filters are due to be replaced because this is when the extraction efficiency is likely to be at its lowest;

- Switch off the extraction and fill the room with smoke from the fog generator (you should not be able to see the opposite wall viewed from the longest side). With some fog machines this may take several minutes;

- Switch the extraction on and measure the time taken to clear the area of smoke;

- To make the smoke more visible a parallel-beam light source (eg a 1 to 3 million candle power rechargeable spot lamp, particularly those that can be mounted on a tripod) can usefully be employed. At the same time, someone standing outside should check the booth/spray space for leaks from joints, ductwork, door seals etc.

- Repeat the process a sufficient number of times to establish a reliable benchmark (ie at least twice if the clearance time is approximately the same, more if the times differ significantly).

- Note the clearance time, rounded up to the nearest quarter minute, and display clearly outside the booth/sprayroom.

The need for measurement and display of "clearance times" has been agreed by HSE and the industry to be an 'appropriate organisational measure' which would meet the requirement of The Control of Substances Hazardous to Health 2002 (COSHH) Reg 7(3)(b) (though there may be other ways to comply with the law). As this is a new requirement, initial enforcement is likely to be advice/letter. As the practice becomes established, EMM indicates that an Improvement Notice would be appropriate where it has not been carried out.
Work is currently being undertaken to develop practical measures that indicate when the clearance time has passed and it is safe to enter the spraybooth/space or remove air-fed breathing apparatus.

SPRAY ROOMS AND SPRAY BOOTHS

12 A spray room is a dedicated room with a fan or fans in a wall. Entry of replacement air maybe planned or unplanned. A spray booth is a purpose built unit. In a typical downdraught booth filtered air is blown through the ceiling and is sucked out through filters in the floor although other input/output arrangements exist. The clearance time for a spray room can be more than 20 minutes and for a booth up to 5 minutes. Despite their inefficiency, spray rooms can continue to be used provided:

- They do not leak

- The extracted air is effectively filtered and discharged safely (eg above roof level)

- Suitable precautions are taken after spraying until it is cleared (eg the sprayed object must not be removed and air-fed RPE must be used by anyone in the room)

- Arrangements are made so that the sprayer can leave and enter the room safely during the clearance time. One way is put the compressed air supply plug-in point outside the room and include a draught-strip, or similar, so that the air-supply hose can be pulled into the room and out when the sprayer leaves. Anyone entering or leaving a spray room (with a long clearance time) would need to adopt a similar procedure.

TYPES OF RPE TO BE USED FOR SPRAYING

13 Filtering respirators are **not** suitable for spraying isocyanate paints and spray work should be prohibited if such RPE is being used. The RPE must be air-fed breathing apparatus (BA). For preference the device should be a visor type air-fed BA, (certified to BS EN 1835:2000[1]). It should be Class LDH3 and should include a low-flow indicator (which may be visual or audible). As described above, many sprayers lift their visor to check the work they have just completed, not realising they are still surrounded by paint mist. This practice must stop if they are to be properly protected. Visibility through the full-face mask can be assisted by using tear-off visor covers (which cost less than £1 each) and by ensuring that light covers are kept clean and lamps replaced when necessary. If vision is still inadequate, half-mask BA (with constant airflow supply) conforming to BS EN 139:1995, or to Class LDM 2 of BS EN 12419:1999 may be suitable **but if these are used the employer must check that sufficient protection is being given by measuring the sprayer's exposure to isocyanate (see paragraph 16).** Checking the sprayer's exposure to isocyanate is particularly important where spraying is carried out in a spray room, as isocyanate levels can rise into the thousands of micrograms per cubic metre of air, and it is not clear that half-mask air-fed BA will provide adequate protection at these high levels. The use of half-mask BA in spray rooms should be strongly discouraged, and only allowed to continue if there is a clear demonstration of risk control through effective and ongoing biological monitoring. A separate visor, to protect against paint splashes, may be required when using half-mask BA.

QUANTITY AND QUALITY OF BREATHING AIR

14 If an insufficient quantity of air is supplied to the BA it may not provide adequate protection to the user. The British Standard for visor-type devices doesn't specify air volume flow rate but each manufacturer should specify **"minimum flow conditions"** [2] in terms of tubing length and internal bore and air pressure - see manufacturer's manual for details. The standards for half-mask air-fed devices specify a minimum airflow rate of 120 l/min and, if adjustable, a maximum airflow rate of at least 300 l/min. The low-flow warning device (see para 13) should be designed so that it immediately draws the attention of the wearer to the fact that the apparatus is not supplying the manufacturer's minimum design flowrate.

15 The COSHH Approved Code of Practice suggests that air supplied to a breathing apparatus should be tested at least every three months to ensure that it is meets the standards laid out in BS4275:1997 **"Guide to implementing an effective respiratory protective device programme".** It may be possible to collect supporting information (e.g. previous air quality test results, siting of compressor, weekly maintenance log to show cleaning of traps, logging of filter checks and replacements) that would provide sufficient confidence in air quality to extend the period of inspection to 6 months or, at most, yearly.

MEASURING ISOCYANATE EXPOSURE TO CHECK EFFECTIVENESS OF CONTROL

1. _____

16 The only practical way of measuring a paint sprayer's exposure to isocyanate, or anyone else using RPE, is by analysis of isocyanate metabolites in a urine sample. This method of biological monitoring was refined by HSL some years ago and has been tested and used extensively in MVR bodyshops. Recently the HSC Working Group for the Assessment of Toxic Chemicals (WATCH) committee has recommended a biological monitoring guidance value (BMGV) for isocyanates of 1µmol urinary diamines/mol creatinine on the basis that a concentration of urinary diamines at or below this level is associated with adequate control of exposure. There is, therefore, a validated technique to determine whether spay painters, wearing air-fed BA, are being adequately protected and a benchmark against which to compare exposure measurement results.

17 Given the risks to employees' health and the reliance upon BA to control exposure, an adequate risk assessment would indicate that exposure needs to be monitored to maintain adequate control. As biological monitoring is the only practical measure of exposure, it becomes requisite for ensuring the maintenance of adequate control of the exposure of employees to isocyanates (COSHH Reg 10(1)). Biological monitoring should be carried out during the first few months of employment to show that RPE and working practices are sufficient to prevent isocyanate absorption. The frequency of urine samples for spray-painters should typically be once per year (but would be more frequent if half-mask BA is used in spray rooms) and currently costs about £50 per person. As more laboratories offer the service the price should come down.
As with the practice of displaying clearance times, biological monitoring is a new requirement and initial enforcement is likely to be advice/letter. As the practice becomes established, EMM indicates that an Improvement Notice requiring biological monitoring would be appropriate unless the employer can demonstrate by some other method that adequate control is being achieved. Note that biological monitoring for isocyanates DOES NOT provide information about a person's health; it indicates whether exposure to isocyanates is occurring. Further information on biological monitoring can be found in the HSE publication "Biological monitoring in the workplace, HSG 167" and more specific details can be found in the HSL leaflet "Biological monitoring for isocyanates in Motor Vehicle Repair"

HEALTH SURVEILLANCE

18. Bodyshops should already have arranged for occupational health surveillance for the respiratory effects of isocyanates (see INDG388 "Working with 2-pack isocyanate paints" for details). Isocyanates are also classified as skin sensitisers. Under normal spraying conditions the amount of skin contact and therefore level of risk of sensitisation is very low. Nevertheless, Ill-health statistics show that spray painters are seven times more likely to develop dermatitis than the average working population. This is probably due to direct contact with liquid paint drips and spills, solvents during mixing, gun cleaning and the use of aggressive skin cleaners. Workers in body preparation are twice as likely as the average working population to develop debilitating skin disease. This is probably caused by a combination of:

- exposure to fine dust during hand sanding that cause abrasion and drying of the skin ('mechanical' damage); and

- exposure to skin sensitisers found in two-part adhesives, body fillers and foam fillers.

Epoxy resins, especially those based on bisphenol A-epichlorhydrin, are among the most common causes of occupational allergic contact dermatitis and are used extensively in bodyshops. As a minimum, a 'responsible person' (who could be a suitably trained employee) should carry out monthly skin inspections of body preparation workers and sprayers. Employees need to be informed of the risks they face, the symptoms to look out for and the simple control measures they can take. Control measures include:

- Using nitrile gloves (rather than latex) for paint mixing, spraying and gun-cleaning;

- Preventing contamination by not re-using disposable gloves;

- Using silk liners (around £6.50 per pair) for extended glove use to keep the hands dry. Liners can be washed at the end of the day and left to dry overnight in a clean area;

- Implementing a skin care program including pre and post-work creams. This is particularly important for cases where gloves may be inappropriate (eg wet sanding of body fillers may require bare hands to check the smoothness of finish)

Skin problems identified by the responsible person should be recorded and referred to a medical specialist.

FURTHER ADVICE

19 SHAD organisational and inspection follow-up guidance is available on the Intranet. The guidance incorporates the lessons from the Pilot SHADs and a set of letters etc is available. The Project Topic Pack, gives further background and guidance on inspection, Notice Schedules and enforcement. The enforcement expectation is explained to SHAD attendees and is supported by trade bodies. Evaluation reports on the first four pilot SHADs and the impact of the Bristol pilot have been published on HSE's website.

20 The MVR bodyshop Project is managed by a team drawn from across HSE disciplines.

21 Date first issued: 15/03/2006

[1] Standards specify what information should be supplied by manufacturer and how devices should be marked. The lists are quite detailed and could be useful if follow-up with RPE maker/supplier is needed

[2] HSL PPE Section will produce a list of *"minimum flow conditions"* for common manufacturers