Safety in isocyanate paint spraying

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Introduction

This leaflet is mainly aimed at owners, managers and supervisors of vehicle bodyshops and also provides useful information for employees. It outlines the risks in using isocyanate paints (also known as 2K, two-pack or polyurethane paints) in motor vehicle repair and how you can minimise them by taking the right precautions.

The leaflet will also be useful to other industries where spraying of isocyanate-containing paints and lacquers takes place.

A checklist at the end of the leaflet will help you prioritise the actions you need to take. More detailed guidance is contained in the HSE publication *Isocyanate paint spraying: Safely managing spray booths and rooms*.[1]

This leaflet does not cover Small and Medium Area Repair Technique (SMART) spraying. You can find more information on that in the HSE leaflet *SMART paint spraying in motor vehicle repair*.[2]

Dangers of breathing in isocyanate paint mist

Almost all bodyshops use paints and lacquers containing isocyanate hardener. It is important to remember that ‘water-based’ paints may contain isocyanates.

Breathing in isocyanate paint mist can cause asthma and vehicle paint sprayers are about 80 times more likely to get asthma than the average worker.

With continued exposure, the asthma can become permanent and severe. There is no cure. Breathing in the smallest amount of isocyanate could then trigger an attack. Almost certainly, the sufferer would have to give up their current job.

Early symptoms include one or more of the following:

- recurring blocked or runny nose;
- recurring sore or watering eyes;
- chest tightness, often occurring outside working hours;
- persistent cough;
- flu-like shivers;
- wheezing;
- breathlessness.

The main source of isocyanate exposure is paint spraying. It may also occur from cleaning the spray gun and from paint curing. But you can prevent exposure, and therefore the risk of asthma, by having:

- properly designed spray booths and rooms;
- correct working procedures;

- appropriate personal protective equipment;
- regular checks to confirm that the controls are working properly.

Spray booths and rooms

Restrict paint spraying to a properly designed spray booth or room.

A paint spray gun creates a visible fan of paint, and large quantities of paint mist that is invisible under normal lighting. The mist quickly spreads through the whole spray enclosure, enveloping the operator. Special lighting can show up this mist.

Figure 1 'Now you see it…'
Special lighting and black background show paint mist enveloping sprayer

Figure 2 'Now you don't'
Under normal booth lighting the mist is invisible

The paint mist is not, as is often imagined, instantly removed by the ventilation. The ventilation air is overwhelmed by the spray-gun air jet and the invisible mist builds up.

The time ventilation takes to remove the paint mist is known as the 'clearance time'. Typically, a booth clears in less than 5 minutes, whereas a room can take 20 minutes or longer and you must know the clearance time for your spray booth or room.

Figure 3 Party fog machine

You should measure the clearance time for your booth or room. For most car booths you can safely and visibly imitate the paint mist with a 'party fog' machine and measure how long the ventilation takes to remove it. This will also show whether the booth or ductwork is leaking.

Clearance time may vary over a period, especially when the filter needs changing. Test several times to start with and, once you know the likely worst-case situation, you can test clearance time less often. Clearance tests should form part of the thorough examination and test, which must be done at least every 14 months.

Put up a sign at all entrances to the booth or room showing:

- the clearance time (in large letters);
- when it was tested;

- who did the test;
- when the next test is due.

Commercial vehicle (CV) booths are much larger and the clearance test will require an industrial smoke machine.

Figure 4 Example of a manometer fitted to a spray booth

Some CV booths have pits to spray the underside of vehicles. This can create a 'dead space' where mist can linger after the main booth has cleared and pits may need their own extraction or air blowers. Check the effectiveness of pit clearance by smoke testing.

Operate all spray booths and rooms at a slightly lower air pressure than the surroundings (at 'negative pressure') to prevent paint mist escaping into the workplace. Provide an indicator (such as a manometer) to show that negative pressure is being maintained and check it daily.

Personal protective equipment (PPE)

Air-fed breathing apparatus (BA) must always be worn by anyone present in the booth or room during spraying, gun cleaning (spray-to-dry) and throughout the clearance time.

Use visor-type, air-fed BA with a low-flow indicator, or half-mask BA (with constant airflow supply) when spraying isocyanate-based products.

All BA users should be trained to wear it correctly, look after it, and test that it works properly before every use. Air supplied to the BA should be uncontaminated and in sufficient quantity to protect the user.

Where there is a risk of paint splashing, wear coveralls and suitable gloves (eg disposable nitrile gloves) and chemical protective goggles.

Do not store any PPE where it could become contaminated.

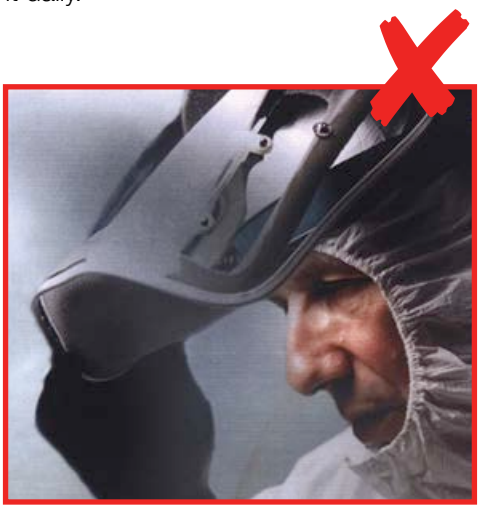

Figure 5 Never lift the visor during spraying or before the clearance time has elapsed after spraying

Figure 6 Only use air-fed breathing apparatus

Working procedures

Many sprayers lift their visors soon after spraying to check the work quality, unaware they are still surrounded by invisible paint mist. This practice can cause significant exposure, so don't do it!

To leave a booth or room safely during the clearance time, sprayers should:

- walk to the pedestrian door wearing air-fed BA. The air hose must be long enough, and the connection point by the door;
- open the door, unplug the airline and hang it next to the door;
- step out, shut the door and remove the air-fed BA.

Provide extraction for gun-cleaning machines that create mist.

Check controls are working properly

Ensure that all the control measures continue to work properly. This should include the following:

- spray booths and rooms need a 'thorough examination and test' by a competent person at least every 14 months. This should include air velocity and smoke tests;
- train someone to examine all air-fed BA in line with the manufacturer's recommendations (eg monthly);
- keep maintenance records for at least five years.

Monitor exposure

Currently the only practical way to monitor the personal exposure from isocyanate spraying (from all routes of exposure) involves the worker providing a urine sample at the end of a shift.

Urine testing should be carried out at least yearly, on all spray painters and others who may be potentially exposed to isocyanates. For new employees, a sample should be taken during the first few months to show that the controls and working practices are providing protection.

Test results above the biological monitoring guidance value indicate the failure of exposure controls and any failure should be investigated. Repeat samples should be taken to check that controls are implemented fully. Urine testing **only provides information about exposure** and has no direct meaning for your health.

For more information see the HSE publication *Urine sampling for isocyanate exposure measurement.*[3]

Health surveillance

You should also provide health surveillance for paint sprayers.[4] This normally includes:

- a pre-exposure questionnaire and lung function tests for new employees before they start work with isocyanates. These should be repeated after six weeks and six months in the job;

- annual lung-function testing and a questionnaire;
- skin checks for dermatitis (also for body preparation workers).

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) require employers to report any medically confirmed cases of asthma or dermatitis caused by exposure to isocyanates at work. You can find more advice on HSE's website (www.hse.gov.uk/riddor).

Figure 7 Lung-function testing

References

1 *Isocyanate paint spraying: Safely managing spray booths and rooms* HSG276 HSE 2013 www.hse.gov.uk/pubns/books/hsg276.htm

2 *SMART paint spraying: How to control health and safety risks* Leaflet INDG473 HSE Books 2013 www.hse.gov.uk/pubns/indg473.htm

3 *Urine sampling for isocyanate exposure measurement* COSHH essentials Sheet G408 HSE 2006 www.hse.gov.uk/pubns/guidance/g408.pdf

4 *Health surveillance for occupational asthma* COSHH essentials sheet G402 HSE 2006 www.hse.gov.uk/pubns/guidance/g402.pdf

Further reading

Health and safety in motor vehicle repair and associated industries HSG261 HSE Books 2009 ISBN 978 0 7176 6308 8 www.hse.gov.uk/pubns/books/hsg261.htm

Isocyanate paints can take your breath away Poster HSE Books 2010 ISBN 978 0 7176 6390 3

Biological monitoring in the workplace: A guide to its practical application to chemical exposure HSG167 HSE Books 1997 ISBN 978 0 7176 1279 6 www.hse.gov.uk/pubns/books/hsg167.htm

The following publications from the COSHH essentials MR (motor vehicle repair)

series outline practical controls for isocyanate paints and can be found at: www.hse.gov.uk/pubns/guidance/mrseries.htm

MR0 *Advice for managers*
MR1 *Mixing two-pack (2K) paint containing isocyanate*
MR2 *Spraying two-pack (2K) products in a spray booth or room*
MR3 *Cleaning two-pack (2K) paint spray guns*
MR5 *SMART spraying with two-pack (2K) products*

Checklist for spraying isocyanate paints safely

Questions you should ask	**Yes/No**
Are sprayers aware that they may be using isocyanate-based paints? Data sheets from suppliers will give information about hazardous properties in paints. Note: Isocyanates may also be referred to by alternative names such as two-pack, 2K, blocked isocyanate and polyurethane.	
Do sprayers know that isocyanates can cause severe occupational asthma and that warning signs for sensitisation include: ■ sore/watery eyes; ■ blocked/running nose; ■ chest tightness; ■ flu-like shivers; ■ wheezing; ■ breathlessness; ■ symptoms improving at weekends or during holidays?	
Is spraying of isocyanate-based paints limited to an extracted room or spray booth?	
Has the booth or room extraction system been thoroughly examined and tested in the last 14 months?	
Does the booth/room have a gauge to show it is under 'negative pressure'?	
Is the gauge checked every day?	
Questions you should ask	**Yes/No**
Is the paint mist filtered and discharged safely outside? Are filters blocked or missing?	
Is the clearance time of the booth or room known and on display?	
Is airline breathing apparatus (BA) always used whenever spraying isocyanate-based paints?	
Is the supplied air clean, at the right pressure and in sufficient quantity to protect the BA user?	
Is the BA visually checked every time it is used and examined thoroughly every month?	
Is gun cleaning carried out using extracted or enclosed gun-washing equipment (or in booth/ventilated mixing room with normal controls and BA)?	
Are the sprayers having annual health checks for breathing (lung function and questionnaire)?	
Has a 'responsible person' been appointed to carry out skin checks?	
Is the isocyanate exposure of the sprayers measured yearly using urine tests?	

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit 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.

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.

This leaflet is available at: www.hse.gov.uk/pubns/indg388.htm.