

# Biological Monitoring for Isocyanates

Guide for employers



## Employers

Guidance for Employers and Occupational Health Providers on the analysis of workers' urine to assess exposure to isocyanates



### What is the problem with isocyanates?

'Isocyanates' occur in many 2-pack (2K) paints and other products. Breathing in isocyanate is one of the leading causes of work-related asthma in Britain. Anyone getting asthma from isocyanates will be unable to work with them again.

As an employer, you have a duty to control adequately your workers' exposure to isocyanate (COSHH Reg.7). For example, you may be providing ventilated spray booths, air-fed breathing apparatus and extracted gun cleaners. But how can you prove that your employees are safe, particularly as sprayers are engulfed by invisible mist when spraying and you are relying on correct behaviour as well as equipment maintenance to prevent exposure? Your industry has agreed that the best and simplest way to do this is by analysing your worker's urine for traces of isocyanates (biological monitoring (COSHH Reg.10)).

If you use isocyanate-based products, you normally need a health surveillance scheme (COSHH Reg.11). We recommend your surveillance scheme provider helps you with biological monitoring. There is a biological monitoring guidance value for isocyanate traces in urine. The value is "1 micro mol urinary di-amine per mol creatinine" for a urine sample collected at the end of the task. Most companies using good control can get below 1.

The guidance value is about exposure control: it has no direct meaning for health.

### Why analyse urine?

The body breaks down any isocyanates that are breathed in and quickly eliminates them (as di-amines) in urine. The more isocyanate is breathed in, the more di-amine there is in urine. If controls are working correctly – e.g. the breathing apparatus is working and used properly, the workers will not breathe in any isocyanate and we will not find any di-amines in urine.

### Who needs monitoring?

You should monitor all workers who may breathe in isocyanates. In MVR bodyshops this normally means the sprayers.

### Is it compulsory?

Employees may refuse to give a sample. Hopefully, if you explain why the sample is required and assure them that nothing else is checked for, their concerns will be addressed. Nevertheless, legally, they must cooperate with you so that you can fulfil your health and safety duties (Health and Safety at Work etc. Act 1974 Section 7). If your COSHH risk assessment indicates that monitoring of exposure is necessary to ensure your controls measures are working (and for spraying isocyanates in a spray booth/room it should) then you have a legal duty to monitor (unless you can demonstrate compliance by some other method of evaluation). We are not aware of any other procedure that can demonstrate this compliance. Consequently, monitoring requires their cooperation.

If, after explaining all of this to the employee, they still refuse to cooperate you will need to decide whether you are prepared to place yourself in breach of the Regulations or take further action. You may wish to discuss this with your local HSE inspector. Ultimately, you may decide to move the employee to a position where they are no longer potentially exposed to isocyanates.

## Informed consent

It is important that your workers understand what is being done and why, so they can give informed consent. We recommend your health surveillance scheme provider helps you with biological monitoring.

- You need to explain to workers that you are checking the controls to prevent exposure to isocyanates that could give them asthma. This will normally be done once a year, unless the results show there is a problem.
- Ask them to provide a urine sample at the end of a typical spray session using isocyanate products.
- Tell them that only things related to isocyanates ('biomarkers') will be measured in the sample - not drugs, alcohol etc. (they have not given permission and you are not paying for it).
- Ask them if they will let you see their results because if there is a problem you will need to work together to sort out any problems.
- Tell them that the results will not say anything about their health or risk of ill-health, only their exposure.
- Tell them that if the results show controls are not working properly, you will both need to find out why, sort it, and then have a further urine sample measured.

## How to collect samples

- We provide 30ml plastic bottles containing a small amount of white preservative.
- The worker should provide a sample of urine into the bottle at the end of a work session, and close the bottle firmly. Nobody wants leaks!
- Label the bottle with the worker's name and the date.
- Complete the sample request form, and tell us where to send the results.
- Put the bottle and form in our packaging.
- Send it to us by first class post. A pre-paid label is provided.

## Will anything else be measured?

No. The laboratory will only analyse the sample for isocyanate breakdown products and creatinine to check the sample is urine (and not water) and to adjust the result for a weak or strong sample.

The laboratory will not analyse the sample for drugs, alcohol, pregnancy, HIV or anything else.

## How often should we monitor?

It depends. Take several samples, until you are confident about your controls.

- With results that fall at or below the guidance value, sample once a year unless work practices change or you employ new workers.
- With results that are above the guidance value, investigate, make changes and take more samples. Sample until you have confidence in the control measures.

The laboratory will report your results something like this:

Name	_HDI(U) µmol/mol creatinine	_IPDI(U) µmol/mol creatinine	_MDI(U) µmol/mol creatinine	_TDI(U) µmol/mol creatinine
Smith. A	ND	ND	ND	ND
Jones. B	0.5	ND	ND	ND
Smart. C	2	ND	ND	ND
UK guidance value	1	1	1	1

**The columns show the breakdown products of different types of isocyanates:**

hexamethylenediisocyanate (HDI) breaks down to 1,6-hexamethylenediamine;  
isophoronediiisocyanate (IPDI) breaks down to IPDA(u) (isophoronediamine);  
methylenediphenyl diisocyanate (MDI) breaks down to MDA (methylenedianiline);  
toluenediisocyanate (TDI) breaks down to toluenediamine;

The levels of the diamines are reported as 'µmol/mol creatinine' (micromol/mol creatinine).

Creatinine is found in everyone's urine and is used to adjust the level of diamines to compensate for dilute or concentrated urine.

If the results are 'ND' (like Smith. A above), or are at, or below, the guidance value of 1 micromol urinary diamine per mol creatinine (like Jones. B above), your controls in place on the day of the sample are adequate. Keep an eye on the controls, and your workers' use of breathing apparatus. Send new samples in a year's time. If something changes, or you have new workers send in samples before the annual check.

**A result above 1 does not mean you will get asthma. It means that controls are not working properly.**

If the results are above the guidance value of 1 (like Smart. C above), your controls may be inadequate or else not used properly. Check that everything is working. Consider:

- Carrying out a new clearance time test with smoke, this will also reveal if the booth/room is leaking.
- Is the air-line breathing apparatus being maintained and are workers using it properly?
- Has the breathing air quality and quantity been tested recently?
- Are sprayers lifting their visors or take off their breathing apparatus before the spray booth or room has cleared?
- Could exposure be occurring some other way e.g. during gun cleaning?

Repair anything that needs it and/or advise workers on using the controls and breathing apparatus then collect fresh samples.

If the result is the first from a worker then it is sensible to ask for another sample for confirmation. It should be noted that because the guidance value is based on the value found in 9 out of 10 samples in places with good control it is likely that 1 in 10 values will be above the guidance value even in places with good control.

## Further reading

We also produce a guide for employees who are using isocyanates.

Further HSE advice on isocyanate exposure measurement can be found in COSHH essentials: General guidance G408.

We recommend that you only request testing for biomarkers of isocyanates that are actually being used – these should be listed in MSDSs supplied with products.

## Useful Links

### General health and safety

<https://www.hse.gov.uk/coshh/>

<https://www.hse.gov.uk/legislation/hswa.htm>

<https://www.hse.gov.uk/asthma/>

### Isocyanate-specific

<https://www.hse.gov.uk/mvr/bodyshop/isocyanates.htm>

[www.hse.gov.uk/pubns/guidance/g408.pdf](http://www.hse.gov.uk/pubns/guidance/g408.pdf)

<https://www.hsl.gov.uk/online-ordering/analytical-services-and-assays/biological-monitoring/isocyanates>

For further advice please contact: **Sample Reception**, Health & Safety Executive, Harpur Hill, Buxton, SK17 9JN, UK  
T 0203 028 3383  
E <mailto:registration.sample@hse.gov.uk>