

Meeting date: 5&6th October 2005

Open Govt. Status: Fully Open

Type of paper: For debate

Paper File Ref:

Exemptions:

WATCH COMMITTEE

Biological monitoring for isocyanates

Issue

1. Establishment of a biological monitoring guidance value (BMGV) for isocyanate metabolites in urine, as an indicator of isocyanate exposure.

Timing Considerations

2. No particular timing issues.

Recommendation

3. WATCH is invited to consider the issues noted in this paper and to agree the proposals in paragraph 16.

Background

4. Many isocyanates are classified in the Approved Supply List as respiratory sensitisers. EH40 currently lists WELs (8h TWA and 15-min STEL), accompanied by a SEN notation that applies to total isocyanate (monomer, prepolymer and reacting mixtures). Workers' exposure to isocyanates should be kept as far below the WEL values as is reasonably practical.

5. In some industries, particularly where surface coatings are sprayed (construction, motor vehicle repair, ship & transport repair and engineering) adequate control of exposure to isocyanate-based spray products requires the use of air-fed Respiratory Protective Equipment (RPE). Measuring the effectiveness (including behavioural aspects) of such control is difficult. Exposure in this sector may increase as a consequence of the Solvents Directive which is likely to increase the use of isocyanate-based paints.

6. On 27 May 2004, the ACTS COSHH Essentials Working Group (CEWG) agreed that WATCH should appraise scientifically the evidence on biological monitoring for isocyanate exposure and in January 2005 WATCH considered a paper and a proposal for a BMGV (WATCH/2005/4). WATCH recommended that biological monitoring be used as appropriate, within a well-considered risk management strategy, to assess the effectiveness of control measures for isocyanate exposure. However, a numerical value for a BMGV was not agreed.

7. In April 2005 a meeting of key stakeholders, chaired by a WATCH member, discussed issues and concerns raised in the WATCH meeting and a brief verbal report was made to the WATCH meeting in May 2005. In summary, it was generally accepted that biological monitoring has a role as part of a balanced risk management strategy for isocyanates. The April meeting of

stakeholders concluded that biological monitoring would be particularly useful where effective control of inhalation exposure relies on appropriate use of RPE. In such situations, biological monitoring is a practical way of assessing the effectiveness of exposure controls. The industry group felt that additional guidance on sample collection, analysis and interpretation of results would help (draft at Annex 1).

8. The ACTS COSHH Essentials working group agreed that guidance on biological monitoring for isocyanates should be placed in the COSHH Essentials system. Sectors currently affected include motor vehicle repair and printing.

9. Biological monitoring is being recommended in a series of Safety and Health Awareness Days (SHADS) for motor vehicle repair workers to assess the adequacy of exposure control (Part D of Annex 2).

Argument

10. Biological monitoring, by analysis of metabolites in urine, is a relatively simple and inexpensive way to assess exposure to isocyanates, and a way to evaluate the effectiveness of control measures including RPE. It can also be used to evaluate secondary exposure (i.e. exposure of bystanders to the specific process). Urine samples collected at the end-of-exposure are hydrolysed to release free isocyanate-derived diamines from protein conjugates. After extraction and derivatisation, the samples are analysed by gas chromatography – mass spectrometry (GC-MS). The analytical methods are sufficiently sensitive to detect exposures well below the WELs, and for exposures of short duration.

11. Volunteer studies of exposure to HDI, TDI and MDI monomers show good relationships between inhalation of isocyanates and levels of metabolites in urine. However, the small number and size of these studies limits their utility to establish quantitative relationships. Nevertheless, field studies have used the same methods for the determination of diamines to detect exposure to monomeric and polymeric isocyanates and demonstrate the utility of biological monitoring to assess exposure.

12. HSE has studied exposure to hexamethylene diisocyanate (HDI) in motor vehicle paint spraying. The results from 1350 urine samples show that 90% of the values found are less than 1.4 μmol urinary HDA / mol creatinine and where exposure is well controlled, concentrations of hexamethylene diamine (HDA) in urine are <0.5 μmol urinary HDA / mol creatinine. Similar, less extensive studies in other industries indicate that the relationship between good control practice and low urinary diamine concentrations remains true for diamines derived from toluene diisocyanate (TDI), methylenediphenyl diisocyanate (MDI) and isophorone diisocyanate (IPDI). A biological monitoring guidance value of 1 μmol urinary HDA / mol creatinine could be proposed based on an association with good occupational hygiene practice (rather than risk of ill-health). This value is currently achievable by most of UK

industry and would be a useful tool to aid the assessment of the adequacy and effectiveness of control measures including RPE.

Link to HSC Strategy

13. Disease Reduction programme (DRP); this issue is a component of the work on isocyanates, part of the asthma strand of the Respiratory Disease Project.

Consultation

14. There has been no wider consultation beyond HSE on this particular paper. However, presentations to conferences (eg BOHS 2004) and to various interested groups (eg the HSE Motor Vehicle Repair Forum) show that biological monitoring is an acceptable method of assessing control (both engineering and behavioural aspects). A meeting with representatives of the major isocyanate industry groups agreed that biological monitoring would be a useful aid to the assessment of occupational exposure to isocyanates, particularly for those relying on RPE in motor vehicle repair using isocyanate-based paints. The industry group asked for additional guidance and drafts of two documents are attached for information.

European Context

15. The EU DG EMP/SCOEL process is currently reviewing isocyanates for an exposure limit value.

Action

16. WATCH, having reached the position at its January meeting that “biological monitoring be used as appropriate, within a well-considered risk management strategy, to assess the effectiveness of control measures for isocyanate exposure”, is now invited :

- i. To agree that a BMGV would aid the interpretation of biological monitoring results
- ii. To agree a biological monitoring guidance value (BMGV) of 1 µmol urinary diamines / mol creatinine, released by hydrolysis of protein conjugates of HDI, TDI, MDI or IPDI. The basis for this BMGV is that a concentration of urinary diamines at or below this level is associated with good control of exposure.

Contact:

Nicola Gregg WATCH Secretariat

References / Attachments

- Annex 1 Analysis of urine to assess exposure to Isocyanates, Guidance for workers, employers, and occupational health professionals
Annex 2 Overview of Biological Monitoring for Isocyanates