

Biomonitoring of isocyanates during applications to metal structures suggests the need for better exposure controls

Exposures and urinary biomonitoring of aliphatic isocyanates in construction metal structure coating

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Overview

Isocyanates—highly reactive chemicals used widely in coatings applied to metal structures such as bridges—are potent respiratory and skin sensitizers and a leading cause of occupational asthma. Since there is no cure for isocyanate asthma, the best management for it is complete avoidance or elimination of isocyanate exposures. Currently, little is known about isocyanate exposures and the effectiveness of exposure controls at metal structure coatings sites, such as bridge painting. The research team has previously examined worker exposure from applications of other materials containing isocyanates, such as spray foam insulation. As part of this study, they measured airborne and dermal exposures to 1,6-hexamethylene diisocyanate (1,6-HDI) and its oligomers (biuret, isocyanurate and uretdione) and assessed the adequacy of existing work practices and exposure controls via urinary biomonitoring of isocyanates at the beginning and end of work shift.

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Read the article:

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Key Findings

- Substantial inhalation and dermal exposures to aliphatic isocyanates were documented during industrial coating applications in construction.
- Breathing zone exposures during painting were the highest for biuret, followed by 1,6-HDI monomer, isocyanurate, and uretdione. Painting inside enclosed spaces, especially in summer days, was associated with the highest exposures.
- Twenty percent of samples were above the NIOSH ceiling exposure limit for 1,6-HDI, and 35% of samples were above the UK-HSE ceiling for total isocyanate group (TNCO).
- Thirty-two percent of workers didn't wear a respirator, 47% wore standard clothing with short-sleeve shirts, and 14% didn't wear gloves. The most frequently used personal protective equipment were half-face organic vapor cartridge respirators, disposable palmar dip-coated polymer gloves, and cotton coveralls.
- Biomonitoring found that 58.4% of urine samples exceeded the biological monitoring guidance value of 1 μmol hexamethylene diamine (HDA)/mol creatinine. Post-shift HDA increased 2.5-fold from pre-shift when normalized to specific gravity.
- Biomonitoring results suggest that current practices and exposure controls employed at metal structure coating sites are not adequately protective.
- To reduce isocyanate exposures and associated health risks among this cohort of construction workers, employers need to implement exposure control programs to reduce exposures in enclosed spaces and increase awareness about proper PPE use.



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