Applications and Risks of Nanomaterials in Construction

Characterizing Applications, Exposure Risks, and Hazard Communication for Engineered Nanomaterials in Construction

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Overview

The remarkable properties of engineered nanomaterials (ENMs) have resulted in their addition to an increasing number of products, including in construction. Studies suggest that engineered nanomaterials (ENMs) may pose health risks to workers and that these hazards have not been adequately communicated via the safety data sheets (SDSs) required for hazardous chemicals. Effective hazard communication is critical to support precautionary recommendations that occupational exposure to ENMs should be minimized by applying the hierarchy of controls. NIOSH has established Recommended Exposure Limits (RELs) for several nanomaterials, and CPWR has shown that exposures during high-pressure spray painting can exceed at least one of those RELs. This current research examined applications of ENMs in construction to identify exposure scenarios and to assess the quality of information in the accompanying SDSs. Descriptive statistics such as frequency distributions were calculated for affected trades, product categories, and types of ENMs. Thirty-three SDSs indicated the product contained a nanomaterial for which NIOSH published an REL, allowing comparison of the evaluation results against criteria for accuracy and completeness developed by NIOSH researchers.

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Key Findings

- Twenty different construction trades (particularly concrete and cement masons, painters, laborers, carpenters, brick masons, glaziers, and insulators) are likely to encounter nano-enabled products.
- There has been significant progress investigating the risks engineered nanomaterials (ENMs) pose to construction workers, but safety data sheets (SDSs) for ENMs still need major improvements to communicate risks effectively and to inform workers of existing occupational exposure limits.
- Seventy percent of SDSs were classified as in need of significant improvement, while only 18% were rated as satisfactory.
- Bulk material analyses revealed several discrepancies between the actual product composition and what was listed in the SDS.
- For more than a third (38.1%) of the 907 nano-enabled construction products this study examined, the chemical composition of purported nanomaterial additives could not be determined.
- Over 50 types of ENMs have been added to construction products, according to manufacturers and distributors of these products.
- Paints and coatings comprised the bulk of the CPWR inventory of products containing one or more nanomaterials (n=483, 53.3%), followed by pre-market additives, cementitious materials, thermal insulation, and lubricants.
- Nanoscale polymers and metal oxides were tied for the most frequently reported type of nanomaterial (n=87, 9.6%). Other frequently reported additives include nano silica, graphene, carbon nanotubes, and silver nanoparticles.

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