



Skin Exposure Found to be a Primary Pathway for Exposure to Potentially Hazardous Flame Retardant in Spray Foam Insulation

Exposure to organophosphate flame retardants in spray polyurethane foam applicators: Role of dermal exposure

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Overview

Spray polyurethane foam (SPF) containing organophosphate flame retardants is commonly used to insulate residential and commercial buildings. This study was the first of its kind to characterize construction workers' exposures to tris 1-chloro 2-propyl phosphate (TCIPP), a common fire retardant in SPF. While the potential health effects are not fully understood, TCIPP is a suspected endocrine disruptor (a compound that interferes with the body's hormone systems, including thyroid function, fertility and metabolism). Fourteen workers (10 sprayers and helpers, 2 involved with foam remediation work, and 2 site managers) at four SPF insulation sites and one foam removal site participated in the study. All 10 SPF workers wore supplied air respirators (SARs), nitrile gloves, and coveralls, and adhered to best hygiene practices for SPF workers. To measure exposures, the researchers simultaneously conducted personal inhalation and dermal exposure assessments and pre- and post-shift tests of urinary TCIPP biomarkers.

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See abstract:

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Key Findings

- SPF applications create a high potential for exposure to TCIPP from breathing it in and/or absorbing it through the skin.
- The geometric mean concentrations of the two TCIPP biomarkers were 26 to 35 times higher in the urine of workers in the study than reported in other studies for the general population. These were the highest concentrations of the TCIPP biomarkers ever reported.
- Higher TCIPP biomarker levels were documented in the workers' urine at the end of the shift, despite using appropriated gloves, SAR respirators, and coveralls.
- Among all 14 workers, the highest airborne TCIPP concentrations were found during mechanical removal of SPF foam.
- Higher post-shift TCIPP levels suggest that dermal exposure may be a primary exposure pathway in workers wearing SARs, and an important pathway among SPF applicators. A major source of this exposure may occur from direct skin contact when a worker stops spraying to unclog the spray gun, inspect foam quality, and remove SPF waste. Hand-to-mouth exposures to SPF foam dust may also occur during lunch or smoking breaks. TCIPP exposure can also occur by breathing in foam particles present in the air after SPF spraying has completed.
- In separate work, researchers tested breakthrough performance of several garments against TCIPP and found limited permeability of TCIPP through thin nitrile gloves and Tyvek and polypropylene (PP) coveralls. They recommend using thick nitrile gloves and coveralls during SPF.



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