## Indoor Exposure Potential of Pyrethroid Pesticides Following Fogger or Crack and Crevice Applications by Homeowners

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Pyrethroid products are extensively used in residential pest management. This study involved use of a crack and crevice spray (Air Devil™ HPX) with 0.1 % cypermethrin and a fogger (Raid Deep Reach™ Fogger) with 1.7 % cypermethrin. Families included 42 children (< 12 years old) and 52 teens/adults (≥ 12). Total µg/kg pyrethroid equivalents following crack and crevice treatment were 1.5 ± 1.1 and 0.55 ± 0.21 µg/kg for children and teens/adults after 8 days, respectively. Total µg/kg pyrethroid equivalents following fogging were 11 ± 8.3 and 2.6 ± 1.65 for children and teens/adults after 8 days, respectively. After use of foggers exposure was still above background on day 8 while after crack and crevice exposure did not increase above background on any day following application. Back-calculated exposures below known LOAELS and regulatory NOAELs for cypermethrin indicate about a 4-fold greater elimination of pyrethroid equivalents by children than teens/adults.

## Human Exposure to Surface Pesticide Residues: Dislodgeable Foliar Residues and Pilot Studies to Predict Bioavailability

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Contact-transfer of chemical residues from surfaces (TSR) potentially exposes harvesters following crop protection. The Iwata et al. (1977) procedure for determination of dislogeable foliar residues (DFR) is standard. This method utilizes a weak detergent solution to wash residues from the surface of leaf samples. This chemical process contrasts with the predominantly physical contact-transfer that occurs in the field. We are investigating procedures to measure DFR and physical TSR (Transferable Surface Residue). An Automated Surface Wiper (ASW), intended to test color-fastness of textiles, automatically wipes the leaf surface with an attachment covered by cotton cloth and foil. Another device for physical surface sampling is the Benchtop Surface Roller (BSR). This machine, intended to make pasta, simulates direct worker contact with treated foliage. A cotton cloth and foil containing leaf samples is used to obtain residue. Urine biomonitoring data will be used to evaluate DFR and TSR data.

## Chemical Surface Residues: Critical Determinants of Occupational and Residential Human Pesticide Exposure

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Contact-transfer of chemical residues from surfaces (TSR) potentially exposes humans in occupational and residential environments. Dislodgeable Foliar Residues (DFR; ug/$cm^2$) were first measured to estimate potential harvester pesticide exposure following unexplained, sporadic illnesses among California citrus harvesters. DFRs became the key determinant of safe field entry programs for hand-harvested crops. Similarly, California Food and Agriculture scientists used analogous procedures to evaluate the exposure potential of chemicals following residential use. Measurement of biphasic residue decay (pseudo first order and zero order) utilizes chemical liquid-solid, liquid-liquid extraction (DFR) or physical sampling (TSR) to estimate potential human exposures. Residues measured within hours of pesticide applications form more complete residue decay curves but the practice may obscure the future, low level exposure potential of the chemical residues in the days ahead. Biological monitoring of harvesters and residents is important when evaluating environmental residue data to refine measurements of potential human pesticide exposure.

## Potential Pine Seed Cone Harvester Pesticide Exposures Are Probably Not Determined By Dislodgeable Foliar Residues

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Southern pine seed orchards are essential for establishment of pine forests. In 1998, 22,000 pounds of seed was lost to coneworms and seedbugs in the South alone. Losses to insects of 50% are not uncommon. Azinephosmethyl and phosmet have been important in orchard IPM, but registration issues including worker exposure remained. This research sought a generic transfer coefficient (TC; $cm^2$/h) for harvesters. Pyrethroid insecticides were advocated replacement insecticides. Exposure, dislodgeable pine needle residues and time worked were obtained. Needle residues were less than minimal reportable levels (~ 0.05 µg/$cm^2$) and became an unlikely source of harvester exposure. We biomonitored elimination of dimethyl- and dimethylthiophosphate AZM biomarkers in spot urine specimens of 13 harvesters from Texas and Louisiana who eliminated 0.1-5.3 µg AZM/kg bw-day (creatinine corrected). Unexposed controls were unavailable and low level biomarkers were probably contributed from diet and other environmental exposures. For regulatory purposes, follow-up studies will evaluate the low pesticide exposure potential of seed cone harvesting.