phosmet (PH), chlorpyrifos (CL), and malathion (MA). MA was applied by helicopter, and the others with airblast sprayers. Orchard workers (n=43) from eastern Washington were from three occupational groups: pesticide handlers and apple thinners from a conventional orchard, and organic orchard workers. A worker questionnaire covered pesticide safety training, clothes changing and storage, laundry, shower and hand wash facilities, and car use. Dust samples from the participants' homes and vehicles were collected using a high volume vacuum from 1.5 m^2 areas in carpeted rooms, and from the driver's foot well. Samples were analyzed by gas chromatography. One-way analysis of variance followed by pairwise T-test comparisons with a Bonferroni correction, were used to test for differences between occupational groups. Linear regression was used to predict pesticide levels of house dust from vehicle dust, as well as pesticide levels in house and vehicle dust from occupational group and questionnaire variables. The vehicle was found to be a significant predictor of house dust pesticide concentrations for all four pesticides ($p < 0.01$). For vehicle dust, the best model for both PH and MA contained the predictor variables,"change boots or clothes before leaving work" and, "car window open at work" as well as occupational group. For AZ, only "open window" was added. Since CL was applied two months previously, only occupational group predicted CL. For PS house dust, "changes boots or clothes" stayed in the model, and "open window" helped to predict MA levels. Based on these results, subsequent studies will assess workplace interventions to minimize exposure to pesticides.

199.

IDENTIFICATION OF A MAJOR HUMAN METABOLITE OF ACETOCHLOR IN EXPOSED HERBICIDE APPLICATORS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY. C. Hines, C. Striley, CDC/NIOSH, Cincinnati, OH; D. Barr, A. Olsson, R. Bravo, J. Norrgran, L. Needham, CDC/NCEH, Atlanta, GA; J. Deddens, CDC/NIOSH and University of Cincinnati, Cincinnati, OH.

Acetochlor is pre-emergent chloroacetanilide herbicide used to control annual grasses and small-seeded broadleaf weeds. It is the second most abundantly applied herbicide on corn crops in the United States. Acetochlor was widely substituted for alachlor in 1990s. The US EPA has classified acetochlor as "likely to be carcinogenic to humans"; however, data on human metabolites associated with known exposure to acetochlor have been lacking. We positively identified acetochlor mercapturate (ACM) as a primary metabolite of acetochlor in all urine samples collected during a 24-hour period from custom applicators who had applied acetochlor on either the day of or the day before urine collection. Concentrations in applicator urine samples ranged from 0.5–449 µg/L (0.3–121 µg/g creatinine). Total nanomoles of ACM excreted in 24-hrs ranged from 7.71–350 nmol/24h. We observed the highest ACM level (449 µg/L) in the person who had applied the most acetochlor over the two-day period (total of 1,385 lb). Mean ACM concentrations unadjusted for creatinine for the custom applicators were up to 40-fold higher than those reported for farmer applicators. We found that ACM accounted for as much as 42% of the total acetochlor-derived metabolites in urine; however, as the exposure level decreased, ACM became a less abundant metabolite of acetochlor (17%). Unmetabolized acetochlor was also measured in the urine samples analyzed. At high exposures, acetochlor accounted for less than 1% of the total excreted acetochlor metabolites (~2% of the ACM concentrations). At lower exposures, ACM and acetochlor concentrations were similar. Additionally, we tentatively identified two other acetochlor metabolites that appeared to be important at low levels of exposure.

200.

MEASURING NEW FUMIGANTS WITH GAS DETECTION TUBES. F. Arnold, Draeger Safety Inc., Lübeck, Germany.

The detection of fumigants is an interesting market for gas detection tubes. Because of new constraints and the decreased use of older products, new fumigants have to be developed for the future. Otherwise, a profitable production of crops, fruits and other plants is not possible.The phase out of methyl bromide especially forces the development of a couple of new gases. They have received approval in several different countries, but only a cost-efficient detection system helps to optimize the fumigation process. A new application for tubes is the testing of fumigated transport containers. There are strong regulations for the transport and treatment of wood packaging material in the worldwide shipping of goods to protect the importing countries from foreign forest varmints.After the fumigation process in the exporting harbor, the containers are purged with fresh air, and a certificate confirms the process. No labeling is required but depending on the goods placed inside the containers an amount of fumigant stays inside. When the containers arrive at their destination, the concentrations in the containers often are still above limits and are potentially dangerous for the receiving persons. Harbor workers, truckers, customs people and all others who have to open the containers for inspection may come into contact with significant concentrations of fumigants. This is an important task to measure. Some of the solutions are designed to check simultaneously the concentrations to reduce the risk of an exposure. Accidents with fumigants happen all over the world.

201.

FLUORESCENT TRACER AS AN ENHANCEMENT TO HANDS-ON PESTICIDE SAFETY TRAINING FOR PESTICIDE HANDLERS. K. Galvin, R. Fenske, M. Tchong, University of Washington, Seattle, WA; F. Servin, Washington State Department of Agriculture, Wenatchee, WA; K. Lewis, Washington State University Cooperative Extension, Euphrata, WA; O. Borges, Domex, Yakima, WA.

Pesticide safety training is an important tool in educating pesticide handlers to have the ability to protect themselves from pesticide exposure when they mix, load and apply pesticides. The goal of this project is to transfer a research tool for assessing pesticide exposure, the fluorescent tracer (FT) technique, into a training tool for pesticide handler education. FT, a brightener added to laundry detergents that fluoresces under long-wave ultraviolet radiation (blacklight), was incorporated into the Washington State Department of Agriculture (WSDA) Farmworker Education Program's Hands-On Pesticide Safety Training. This is a collaborative project with the Pacific Northwest Agricultural Safety and Health Center, WSDA, and the Washington State University-Cooperative Extension. During hands-on training, pesticide handlers practiced application and personal protective equipment decontamination and procedures to prevent personal contamination when applying pesticides. The training was piloted with a group of eight handlers and then conducted with a group of 24 handlers, half of whom received training with the FT and half of whom did not. Participants completed a pre- and post-training evaluation. Pesticide handlers in the FT group were impressed with the dramatic and immediate visual demonstration of potential pesticide contamination when FT was used in simulated pesticide. When viewed under blacklight, participants were able to see if they had successfully decontaminated the airblast sprayer and PPE. Handlers observed dermal exposure during casual contact with application equipment and when cleaning nozzles. They also observed clothing contamination if they did not properly remove their PPE before using bathroom. FT in hands-on pesticide safety training classes is an effective way to communicate pesticide safety. The training scenarios and technical information for using FT are being put into a manual for use by pesticide safety educators. The manual will be available in English and Spanish. Both print and Web-based versions will soon be available.

202.

PORTABLE WORK BOOT STORAGE FOR AGRICULTURAL WORKERS. M. Tchong, K. Galvin, C. Ballew, R. Fenske, University of Washington, Seattle, WA.

One of the main concerns of agricultural workers is the possibility of exposing their children and families to the pesticides they encounter in the orchards. Agricultural workers may bring pesticides from their workplace into their homes through their clothes and shoes inadvertently. This can be considered as a take-home pesticide exposure pathway. The ideal solution is to stop the pesticides from leaving the workplace. A simple solution for preventing the pesticides from leaving the workplace will be discussed in this case study. The case study was conducted with a group of 20 agricultural workers from an orchard in Washington state. We supplied the workers with a boot bin, which was a clear, plastic box. The concept of the boot bin was to store the work boots inside the boot bin to prevent the workers from entering

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