

35. The Use of Ambient Aerosol for Testing Agricultural Cabs for Protection against Pesticide Aerosol

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Enclosures on agricultural vehicles can be used to protect workers from airborne pesticide. These enclosures were evaluated using optical particle counters to measure the concentration of ambient aerosol inside and outside of the cab. The field tests were conducted on a John Deere 7000 series tractor cab (tractor manufacturer's cab) and a Nelson Spraycab® (retrofit cab). Both cabs were equipped with High Efficiency Particulate Air (HEPA) media. HEPA media was used to eliminate filtration efficiency considerations and to remove atmospheric condensation nuclei which was used as the test aerosol. Thus, the major source of aerosols was assumed to be leakage around filters and seals. Two Portable Dust Monitors (PDM, Model 1106, Grimm Labor Technik GmbH & CoKG, Ainring, Germany) which count particles in eight size channels between 0.35 and 6.5 μm ; were used to measure ambient particle concentrations inside and outside of the cabs. During our evaluations, the instruments were switched to prevent instrument bias from effecting the findings. The ratio of the two measurements was used to calculate size-dependent aerosol penetration into the cab. PDM results for the tractor manufacturer's cab and the retrofit cab indicated that penetration was less than 0.02 (inside/outside concentration) for particles larger than 3 μm . The results from this study indicate that tractor cabs can be very effective at removing different size aerosols depending on the seals and filters used with the enclosure. This study has also demonstrated the practical use of real-time aerosol counting instrumentation to evaluate the effectiveness of enclosures and to help identify leak sources. As a result, the American Society of Agricultural Engineers (ASAE) incorporated the use of optical particle counters in ASAE standard S525. This standard provides performance specifications for environmental enclosures which are intended to protect operators from pesticide exposures during application. As part of the standard, optical particle counters and ambient aerosol are used to quantitatively evaluate the performance of these enclosures. This consensus standard specifies that the penetration of 3 μm aerodynamic diameter particles shall be less than 2% of the particles outside of the enclosure. This standard is used by equipment manufacturers in improving equipment designs and by regulatory agencies in order to evaluate compliance with the worker protection requirements.

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