design standards and future research on capture hoods must be based upon non-idealistic, workplace conditions.

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Experimental Study on the Performance of a Benchtop Enclosing Hood — Effects of Five Different Face Treatments

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Benchtop enclosing hoods are used to protect workers from airborne contaminants. Very little has been published on the effectiveness of plain enclosing hoods. Nearly all studies involve lab hoods with sashes. **Objective:** To compare performance of a 36'x30' enclosing hood with a plain opening to the same hood with external flanges, cowling or sashes attached to the face. **Methods:** This study was also conducted for three levels (111, 170, and 229 *fpm*) of hood face velocity and two levels (14 and 46 *fpm*) of wind tunnel cross-draft velocity combinations with two replications in a factorial design for each treatment: plain, collar flange, bottom flange, cowl, and sash. Freon-134a concentrations were measured on an anthropometrically correct, heated, breathing manikin holding a source between its hands while standing at the enclosing hood face. Samples were taken simultaneously at the nose, mouth, outside the wind tunnel, downstream of the wind tunnel and the exhaust duct. Every location was sampled at 0.15 LPM for 20 minutes. **Results:** All four interventions significantly ($P<0.001$) affected the performance of the enclosing hood. Both Flanges and cowl increased the worker's exposure dramatically. The sash was the only intervention that improved hood protection efficiency to 100% for all combinations of face velocity and cross-draft velocity. **Conclusion:** Outside flanges and cowling should not be employed and the sashes are likely to be highly effective in cases where material handling makes them feasible.

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Engineering Control Assessment for Liquid and Powder Flavorings

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Objective: Researchers from Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health conducted an evaluation of engineering controls for reducing exposure to chemicals during liquid and powder flavoring production. **Methods:** Evaluations involved various tests including air velocity measurements, smoke release, and control on/off testing using real-time monitoring. Video exposure overlays of the real-time data were used to show the reduction in worker exposure. The evaluated systems included: 1) a ventilated lid developed to contain chemical vapors from a large mixing tank; 2) a side-draft slot hood installed on a powder blender; 3) a fume extraction hood used during liquid and powder flavor packaging; and 4) a ventilated workstation used to contain vapors during small batch mixing activities. **Results:** Control on/off tests on the mixing tank ventilated lid hood showed a reduction of 76% during the production of liquid caramel flavoring. The use of a fume-extraction hood during packaging of the liquid caramel mix resulted in a reduction of 93% compared to the standard packaging procedures without controls. The local exhaust ventilation hood for the smallest capacity blender showed that the ventilated side-draft slot hood reduced dust exposure by 96% during bag dumping activities. The discharge hood reduced dust exposure by 96% during emptying of the blender, and the use of the fume extraction hood reduced dust exposure by 65% during powder packaging. The evaluation of one ventilated bench-top workstation in the mixing room showed an exposure reduction of 97% during staged tasks such as weighing, hand-whisking, and pouring. **Conclusions:** The evaluation showed positive results in reducing worker exposure with simple engineering control solutions that effectively control chemical exposure during the making and handling of food flavorings. Regular maintenance should be conducted to ensure proper functioning of the local exhaust ventilation system.

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Practical Technical Aides for Field Inspection and Certification of Local Exhaust Ventilation Systems

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Situation/Problem: The Los Alamos National Laboratory Industrial Hygiene and Safety Division maintain a Ventilation Team that inspects and certifies more than 700 Local Exhaust Ventilation Systems (LEV) across the complex. These systems range from laboratory fume hoods to welding snorkels, dip tanks to spray booths, and mitigate radiological, chemical, carcinogenic, nanoparticles, biologic, and a myriad of other types of industrial hazards. **Resolution:** With such a wide range of systems and hazards we have had to develop a number of practical tabular, graphical, and computational aides that allow technicians (non-CIHs) to perform meaningful field inspections and certifications of our local exhaust ventilation systems. Using widely accepted industrial ventilation velocity models and performance criteria (i.e., empirical correlations and tables) we have developed the capability to quantify the operating characteristics of most of the systems that we encounter in the field. Specific techniques that we employ include nomographs and tables that define acceptable cross flow ranges and sampling variations with the actual face velocity measurements obtained in the field. **Results:** These aides have allowed us to avoid costly and error-prone field computations and lower the cost per unit inspected. All this while delivering a more comprehensive and quantitatively based assessment of performance than we were able to provide before we adopted these techniques. **Lessons learned:** By going through each step in the development of our system, we will show how these methods could be easy to adapt to any facility that employs industrial ventilation to capture hazardous airborne substances.

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Working Safely With Formaldehyde

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Situation/problem: Robot Tenders who hand-spray cars occasionally are being overexposed to Formaldehyde. Eight-hour personal breathing zone test results were lower than the PEL (Permissible Exposure Limit). No testing was previously done to determine STEL (Short-Term Exposure Limit). Testing for STEL was done and found to be higher than allowable for 15 minutes. Maintenance overexposed as well. Engineering and Work Practice Controls. Local exhaust ventilation. General dilution ventilation. Rebalance paint booths to allow for sufficient airflow and so downdraft is more efficient. **Resolution:** Engineering rebalanced the booths and tried to ramp up ventilation to keep our workers underexposed. After another round of sampling was

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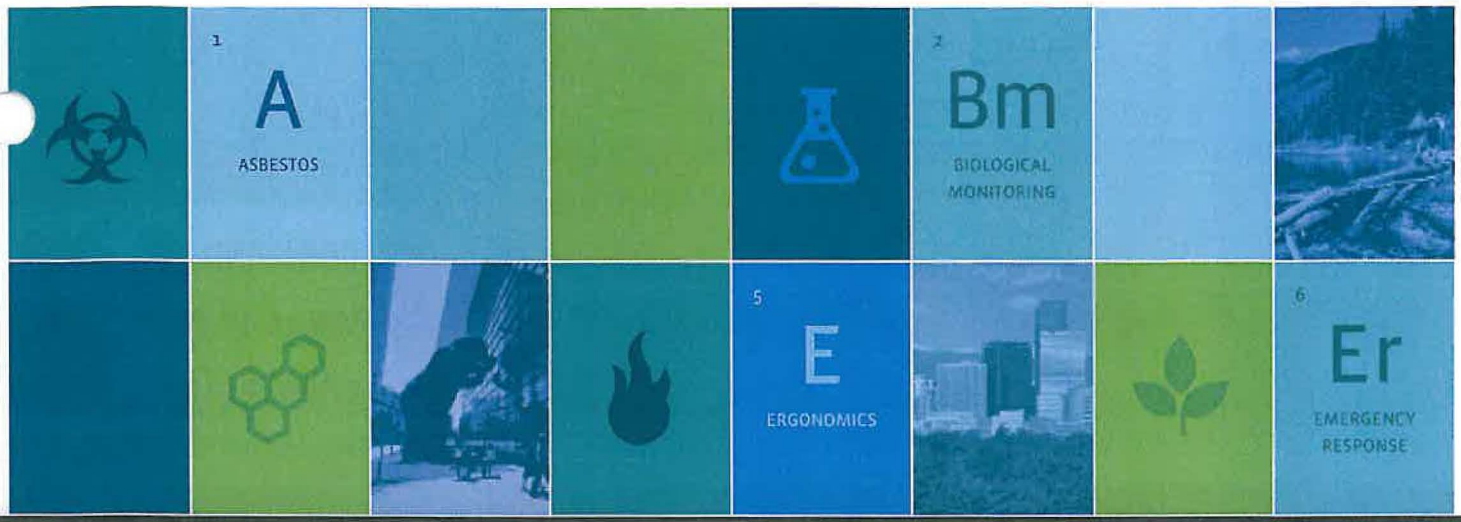

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