ly proposed damper adjustment method based upon predictions of ratios of the static pressures (SP) upstream and downstream of the dampers that should exist if the dampers were correctly adjusted. The prediction method employs airflows and pressures observed in the installed system when all dampers are open. The dampers were then adjusted so that each ratio of measured static pressures was as close as possible to the predicted values for that duct. After the dampers were adjusted by this procedure, the resulting airflows were measured using standard pitot tubes and a calibrated digital manometer. Observed and predicted duct velocities were compared for four airflow distributions, with one round of repeat measurements for each. Considering data normalized to the same total system airflow, some branch airflows were changed by as much as 42%. The average change from baseline to predicted velocity in branches was 23%, considering both positive and negative changes, with a standard deviation of 17.9%.

Of the 64 predicted airflows, the mean of the absolute value of the error was approximately 2.1% of the target value. The standard deviation of the positive and negative errors was 1.7%. Therefore, roughly 98% of the branches had errors that were less than 5%, either above or below the target velocities. The largest single error was 7.35% Generally, in ventilation balancing practice, methods that achieve accuracy within 5% are deemed successful.

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ERROR FROM USING SHORTCUT ESTIMATES INSTEAD OF FULL PITOT TRAVERSES. S.E. Guffey, L. Wang, University of Washington, Seattle, WA

Two perpendicular pitot traverses of velocity pressures can reliably determine mean duct velocity, but traverses are discouragingly time-consuming. It would be convenient if the shortcut method of multiplying the centerline velocity by the estimated "pipe factor" (ratio of the average to centerline velocity) were accurate.

This study compared estimates of mean duct velocity from three shortcut approaches to values obtained from two perpendicular traverses. In the "pipe factor=0.9 method" the pipe factor was given the commonly used value of 0.9. In the "empirical pipe factor method," the pipe factor was determined from the first round of data. The "single traverse method" omitted the second traverse.

Two perpendicular 10-point traverses were taken repeatedly over several months on a total of 35 branch ducts on 4 working industrial exhaust ventilation systems using a calibrated digital manometer connected to a laptop computer. Duct velocities ranged 1625 ft/min to 6477 ft/min.

The pipe factor=0.9 method produced deviations from "true" values ranging from minus 25% to plus 10%, with a median deviation of minus 4% and a standard deviation of nearly 7%. An attempt to improve the method by using the geometric mean of two measurements of the centerline value instead of a single value made no discernible difference.

The empirical pipe factor was 0.88 (R^2=0.98), which was too close to 0.9 to change results significantly.

Omitting the second traverse rarely produced errors above 3% if the pipe factor was between 0.8 and 1.0. When the pipe factor exceeded unity, the error exceeded 3% in about 11% of cases. A procedure that required a second traverse if the pipe factor exceeded unity deviated from two-traverse results by more than 3% in less than 4% of cases.

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AIR-VOLUME MIGRATION FROM NEGATIVE PRESSURE ISOLATION ROOMS DURING ENTRY/EXIT. C.S. Hayden II, O. Johnston, R. Hughes, P. Jensen, NIOSH, Cincinnati, OH

Negative-pressure isolation rooms (NPIR) are used to isolate patients who have a suspected or known airborne infectious disease from the general hospital environment. When a person passes through an NPIR doorway, there exists an exchange of air between the isolation room and the area beyond its door. In a recent study, National Institute for Occupational Safety and Health (NIOSH) researchers used sulfur hexafluoride (SF_6) tracer gas to examine the magnitude of air-volume migration (AVM) as a function of several independent variables. A small cart carried a mannequin through a doorway, separating a laboratory NPIR and an SF_6 measurement chamber. The configuration provided simulated entry/exit of a health care worker through the doorway. Upon completion of experiments using a swinging door (including various cycle speeds for the door), a sliding door was installed and the experiments repeated. In all cases examined, airflow rate differential between the air supplied to and exhausted from the NPIR was the only statistically significant factor in determining the level of AVM. Across the range of flow differentials examined (50 to 220 ft^3/min), AVM ranged from 35 to 65 ft^3. This range of AVM remained statistically unchanged regardless of door type, operating speed of the door, or entry to or exit from the NPIR (although entry/exit did significantly increase AVM, travel direction whether entering or exiting the NPIR did not). By knowing the level of AVM during entry/exit through a doorwayCa cause of airborne contaminant migration through a facilityCa more complete assessment of the risk of transmission of an airborne infectious disease is made possible. This study shows an anteroom or buffer zone outside the contaminated area's doorway will offer a degree of containment during entry/exit not otherwise obtainable. While this study concerned itself primarily with the engineering control of the transmission of airborne infectious diseases provided by ventilation systems, the results are applicable to any environment where a clean area is separated from a less-clean area by a doorway.

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CONTROL OF PRESS CLEANING SOLVENT EMISSIONS IN SMALL LITHOGRAPHIC PRINTING ESTABLISHMENTS. K.G. Crouch, NIOSH, Cincinnati, OH

The printing industry is comprised of about 80-85% small businesses (<20 employees). More printing is done using the lithographic process than any other. In this segment of small lithographic printing establishments, NIOSH has found a persistent occurrence of overexposure and potential overexposure of press operators to the airborne vapors generated by press cleaning operations. The cleaning operation must be carried out periodically during a press run by hand-scrubbing the blanket and plate with solvent-soaked wipers. High volatility and solubility for ink are valuable solvent characteristics, so that printing is interrupted minimally. The solutions used to clean presses are a highly variable mixture of chemicals, a small number of which may have carcinogenic potential (e.g., methylene chloride). Recent EPA regulations have resulted in the development of cleaning solvents having lower volatility, thus reducing worker exposures in some cases. However, small printers typically have no provision for an adequate supply of conditioned fresh air necessary to dilute the airborne solvent vapors to safe concentrations while maintaining temperature and humidity in a range suitable for comfort and good printing.

NIOSH conducted studies of airborne solvent concentrations at three small printers before and after the installation of fresh air systems having an air-to-air heat exchanger for economy of operation. In one case, the fresh air was introduced to the press room at one end and stale air exhausted from the other end. In a second case, the fresh air was fed to the return air side of the press room HVAC system and the exhaust was taken from points several feet above the operating presses. In the third case, the fresh air was introduced from several ceiling outlets, the exhaust provided by inlets attached to the bed of the presses. The resulting reduction in airborne solvent concentration ranged from about 30-80%. In addition, airborne solvent concentrations at two small printing establishments that supplied unconditioned fresh air from window units were found at an acceptable level.

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FILTER LEAK TESTING OF PORTABLE HEPA FILTERED DIFFERENTIAL PRESSURE UNITS. D.A. Lessley, BCM Engineers, Mobile, AL; M. Evans, ATC Associates, Albuquerque, NM; G. Lipka, Sandia National Laboratories, Albuquerque, NM

High efficiency particulate air (HEPA) filtered units are used extensively to provide differential pressure during abatement activities involving asbestos and lead. They exhaust air that has been filtered to remove 99.97% of particles at 0.3 microns in size.

These units are moved from job to job and may not be maintained between moves or tested as to field efficiency at any time. Compared with fixed HEPA filtration systems used in research facilities or industry, these units are normally not tested to ensure their efficiency in the field. This study provides insight into the efficiency of such units in the asbestos abatement industry.

The study was done as part of the asbestos management program at Sandia National Laboratories (SNL) in Albuquerque, New Mexico. The testing was conducted by a firm under contract to SNL. The firm conducted the testing in accordance with applicable industry standards. Units set up for a project were tested with a smoke aerosol challenge. A particle counter was used to determine the amount of leakage in the exhaust. Of those initial units, only one of six was acceptable. Failures were due to leakage around the frames, a result of a poor filter-to-frame fit. Upon retesting four of the five units that failed, three of the units again failed. These were repaired in the field and

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