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operations costs at approximately an acceptable level. There are two separate central supply-exhaust air ventilation systems for general air exchange and for local ventilation systems. Both systems have recuperative indirect heat recovery units with a circulating fluid medium. To extract dangerous and abrasive materials, additional separate local systems were provided. Automation of ventilation systems is characterized by a short-time response operation. The system of automation has several additional functions, such as to ensure the minimum main air exchange rate in the rooms (so-called standby conditions), signaling about system disturbances and noneconomical operation in some of the rooms to guarantee the required level of CO_2 concentration or indoor air temperature. To assess the operating systems and to achieve the established aims, special testing of joint work between fume cupboards and main ventilation was conducted, using airflow smoke to emphasize the effect. During this monitoring, CO_2 concentration in the rooms and the air speed values in the fume cupboard openings were investigated. Results of monitoring demonstrate that investments for these ventilation systems were justified and the installed ventilation systems corresponded to our technical and sanitary-hygienic expectations.

33.

A SYSTEMS APPROACH TO THE OPTIMAL DESIGN OF SAFE-ROOMS FOR SHELTER-IN-PLACE SCENARIOS.
J. Bennett, NIOSH, Cincinnati, OH.

The protection of building occupants from hazardous outdoor releases can involve many strategies of varying cost and complexity. One method is known as "shelter-in-place," in which a space within the building is isolated to a practical degree from ambient and the remaining building air. The design of such a space involves decisions about size and level of permeability. An obvious issue is the comfort and health of occupants during the event. Because a design cannot satisfy all needs entirely, engineering the space becomes an optimization problem. This research provides an analytical framework for considering the effects of the variables volume, air exchange or ventilation rate, concentration, and time. Intuition suggests that the room should be as large as possible to keep the balance of O_2 and CO_2 at safe levels. However, the current work quantifies the optimal room size using a systems analysis of a three-compartment building model consisting of ambient, building, and safe-room zones. The results provide the optimal safe-room volume as a function of ambient, building, and safe-room concentrations, ambient/building and building/safe-room air exchange rates, contaminant generation rate within the safe-room, and building volume. Also, the analysis can be used to rank the importance of the variables affecting safe-room concentration so that control efforts can be efficiently applied. This information will be helpful in choosing among existing rooms to use for shelter, making room modifications, or for designing a new space.

34.

INFLUENCE OF WIND ON INDUSTRIAL VENTILATION NETWORKS BEHAVIOR.
S. Soares, IRSN, Gif sur Yvette, France.

In the nuclear industry, the response of a ventilation network to accidental disturbances, either mechanical (fan failure, damper blockage, etc.) or thermal (fire, etc.) is difficult to evaluate when the network becomes complex. In order to determine and analyze the consequences of these disturbances on the radioactive materials confinement, a code called SIMEVENT has been developed. Among the external parameters likely to affect a ventilation network, the wind effect is actually basically modeled due to a lack of qualified data concerning the wind impact on complex building's geometries and the interaction between wind and chimney exhaust. In view of the network's complexity and the installations diversity, a research program including experimental and model studies has been launched to assess the pressure coefficients due to wind on different chimneys and reference buildings geometries. Different chimney terminals have been placed in a wind tunnel (the variables are the incline angle, wind velocity, and airflow in the duct); for each angle, the evolution of the pressure coefficient versus wind velocity is determined and is characteristic of a chimney terminal geometry. Two types of scale-model have been chosen for representing either nuclear power plants or plants and laboratories buildings. The different values of wind pressure coefficients have been measured on both scale models placed in a wind tunnel. The modeling of wind influence on the networks consists then in fixing measured wind pressure coefficients at all air inlets and outlets in the code; then, SIMEVENT calculates the consequences on pressure and flow rate values inside the whole building, for the normal operating mode or degraded ones (such as fan failure or appearance of fissures on walls).

Finally, the use of such a code allows the evaluation of contamination release in environment due to degraded operating modes in ventilation networks, integrating the influence of wind.

35.

RECOMMENDED METHODS TO EVALUATE PERFORMANCE OF VARIABLE AIR VOLUME FUME HOOD SYSTEMS.
T. Smith, Exposure Control Technologies, Inc., Cary, NC.

The desire to save energy in laboratories by reducing the volume of tempered air exhausted from chemical fume hoods has increased use of variable air volume (VAV), ventilation systems. VAV systems can provide significant opportunities for energy savings in laboratories, but they are complex systems comprised of numerous interacting components, including sensors, actuators, and computerized controls that must accurately adjust flow in response to user demand. As will be demonstrated in this paper, improper response of a VAV system and inability to provide stable control of flow can significantly affect hood performance or the ability of the fume hood to provide desired containment. The tests described in currently published standards are inadequate to evaluate VAV performance. To ensure that VAV systems provide the opportunity to save energy without jeopardizing hood performance, a series of tests may be added to the ASHRAE 110 "Method of Testing Performance of Laboratory Fume Hoods." The additional VAV tests are necessary to verify proper operation, define operating conditions, and identify potential problems. This paper provides a description of VAV fume hood systems, examples of how improperly operating VAV systems affect hood performance, and a description of recommended methods to evaluate performance of VAV fume hood systems.

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36.

USER'S EXPERIENCE WITH LOW FLOW FUME HOODS. T. Ogansanya, P. Greenley, K. Ahn, L. DiBerardinis, Massachusetts Institute of Technology, Cambridge, MA; H. Palacios-Fernandea, Harvard University, Cambridge, MA.

The effect of training on chemical fume hood work practices will be presented for two MIT buildings where low flow fume hoods were installed. MIT's chemistry building was renovated in 2001. One of the goals of the renovation was to increase the amount of fume hood space for each graduate student. For project budget reasons, the larger fume hoods had to be accommodated with very little increase in supply air to the building. This resulted in hoods with combination sashes being installed along with a reduced design opening vertical sash height. A survey was conducted in the summer of 2005 to evaluate hood sash use with regard to safety and energy conservation. It was observed that hoods were used only in the horizontal sash mode and were not closed when not being used. Training of fume hood users was conducted to see if hood use practices could be changed for increased safety and energy conservation purposes. Hood work practices before and after training will be presented. The Brain and Cognitive Sciences Building was opened in September of 2005. The research being conducted and the fume hood controls design is very different from the Chemistry Building. The setup of the constant volume, vertical sash, snf low flow fume hoods will be described. Training and monitoring of fume hood use will be conducted and reported on for this presentation.

37.

LABORATORY EVALUATION TO REDUCE RESPIRABLE CRYSTALLINE SILICA DUST WHEN CUTTING CONCRETE ROOFING TILES USING A MASONRY SAW. R. Valladares, W. Sieber, J. Kratzer, CDC/NIOSH, Cincinnati, OH.

Respirable crystalline silica dust exposure in residential roofers is a recently recognized hazard resulting from cutting concrete roofing tiles. Roofers who cut tiles using masonry

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