

## Control Technology Papers 351-355 351

CONCENTRATION OF VENTILATION SMOKE TUBE REACTANTS DEPENDENT UPON DIRECTION OF AIRFLOW THROUGH TUBES. E. Meier, R. Bruhn, D. Wannigman, Los Alamos National Laboratory, Los Alamos, NM

Exposures to the reactants of one type of ventilation smoke tube depend in part on the direction of airflow through the tube. One commercially available ventilation smoke tube produces visible smoke by a chemical reaction of two liquids: acetic acid (AA) and ethylenediamine (EDA). During evaluation, it was found that the direction of airflow through the smoke tube affects the ratio of the reactant residues in the smoke cloud, while apparently not affecting the density of the smoke product, ethylenediamine acetate (EDAA). The manufacturer's directions do not specify the airflow direction through the tubes. This finding is notable because the reactants vary in the significance of their toxic effects. AA is an irritant, but EDA is both an irritant and a sensitizer.

Exposures to the reactants were not measured in excess of applicable exposure limits under proposed use conditions. Due to the sensitization effect of EDA, however, it would be desirable for users to direct the airflow through the tube so that the EDA concentration is minimized.

Because the visible smoke is produced via a chemical reaction, it was hypothesized that one control measure would be to break the AA and EDA ampoules and mix the reactants in a capped tube to yield the less hazardous EDAA smoke product before aspirating the contents. The results of that series of tests indicate that there is not a change in the concentration of the reactants. Instead, a chemical equilibrium is reached. The "hazardous" components of EDA and AA will always be present in the "nonhazardous" smoke product in a somewhat predictable ratio.

## 352

MAINTENANCE OF VENTILATION SYSTEMS: A CASE STUDY AT A FURNITURE STRIPPING FACILITY. D. Watkins, C. Estill, NIOSH/Division of Physical Science and Engineering, Cincinnati, OH

Little attention has been focused on routine preventive maintenance and designing ventilation systems for preventive maintenance. This study examined the preventive maintenance of a ventilation system installed on a furniture-stripping dip tank to reduce employee exposures to methylene chloride.

In 1991, a new ventilation system was installed on the dip tank. The system consisted of two slots (one on the front and one on the back of the tank) and a gasoline-powered centrifugal fan. The exhaust rate was 3200 fpm and 2900 cfm. Wood furniture was also sanded nearby in this facility. No maintenance was performed on this system during the subsequent years, but the fan was replaced with a similar electric fan and a rain cap was added.

In 1997, the exhaust system was re-evaluated. The slot velocity had dropped to 780 fpm and the exhaust volume was 1060 cfm using an electric, centrifugal fan. The slots on the dip tank were clogged with stripping solution. A T-duct had a hole due to rust. Inside the plenums were nine inches of paint chips and sawdust. It was apparent that access for cleaning was now a problem.

These improvements were made to the ventilation

system: hinges were added to the slots so they could be opened for cleaning; access holes were made in each plenum for cleaning; a new stack head was installed for rain protection; and the rusted T-duct was replaced by a 90° duct. After these renovations, the slot velocity increased to 1700 fpm and exhaust volume increased to 2080 cfm.

Preventive maintenance should be performed at least annually, including cleaning slots and plenums and checking ducts for rust. It is apparent that exhaust ventilation systems that are ventilating over thick solutions and dust need to be designed for cleaning. Small initial design changes can improve the ease of maintenance and thereby increase the exhaust volumes.

## 353

NIOSH ALERT: PREVENTING WORKER INJURIES AND DEATHS FROM EXPLOSIONS IN INDUSTRIAL ETHYLENE OXIDE STERILIZATION FACILITIES. J. Palassis, M. Sweeney Haring, NIOSH, Cincinnati, OH

NIOSH, in collaboration with the U.S. EPA and the Ethylene Oxide Sterilization Association, developed an Alert to raise awareness about the potential for ethylene oxide (EtO) explosions and ways to prevent explosions in industrial ethylene oxide sterilization facilities. The Alert is intended for the owners, managers, supervisors, engineers, safety professionals, and workers involved in industrial sterilization or repackaging of EtO.

EtO is a flammable liquid; its vapors can easily form explosive mixtures during sterilization procedures. If these explosive atmospheres are vented to certain emission control devices such as oxidizing emission control devices (OECs), a significant explosion might result. Between 1994 and 1998, 10 explosions involving EtO occurred in industrial sterilization and EtO repackaging facilities. An explosion incident at an EtO repackaging facility caused 1 worker fatality and 59 injuries. All incidents resulted in damage to the facilities.

Most of these facilities used OECs to control EtO emissions. There are more than 200 industrial sterilization facilities in the states. Many facilities use wet scrubbers to remove approximately 95% of EtO emission, and there were no problems with explosions with these devices. However, to meet the new EPA regulations and increase the removal/destruction efficiency of EtO, many facilities selected and installed OECs, and that where the problems emerged.

In the future, EPA might also require hospitals to use such emission control devices to control ethylene oxide releases to the atmosphere from their sterilization units, resulting in a greater risk for explosions and worker injuries.

## 354

A COMPARISON OF OCCUPATIONAL AND ENVIRONMENTAL RISKS ASSOCIATED WITH AIRCRAFT DEPAINTING OPERATIONS: CHEMICAL- VS. NONCHEMICAL-BASED TECHNOLOGIES. D. Carpenter, G. Carlton, J. Kent, IERA/RSHI, Brooks AFB, TX

Aircraft in the U.S. Air Force are some of the most sophisticated machines ever developed and must be able to withstand extreme conditions, including rapid changes in temperature, pressure, and radiation. To protect the aircraft from these extreme conditions, numerous coatings have been developed and applied to the aircraft surface. These applied coatings include a variety of different chromates, isocyanates, radiation-absorbing materials,

and other hazardous substances. Unfortunately, these coatings do not last forever and must eventually be removed. In doing so, they expose workers to a multitude of hazards. This removal process (i.e., depainting) is one of the most costly and complex industrial operations performed in the Air Force. Depainting an aircraft requires multiple man-hours, wearing and maintaining personal protective equipment, use of numerous environmental controls, and an entire infrastructure to support the process.

Historically, the Air Force has used chemical methods to remove surface coatings. During the past 10 years, the Air Force has supplemented the chemical-based depainting process with several new technologies. Each of these technologies has unique occupational and environmental advantages and disadvantages.

In this presentation, we will describe the new technologies the Air Force is using to repaint aircraft and the accompanied worker exposures, personal protective equipment, and environmental controls. We will discuss the occupational and environmental risks related with each process and, most important; we will demonstrate how utilizing new technologies has lead to a decrease in occupational and environmental stresses associated to aircraft depainting.

## 355

UNIQUE ROTATING LOCAL EXHAUST VENTILATION SYSTEM. V. Ivensky, T. May, Urban Engineers, Inc., Philadelphia, PA

A manufacturer of special long-life batteries for the space industry needed to mitigate a personnel exposure to extremely toxic byproducts of sulfuryl chloride (SO<sub>2</sub>Cl<sub>2</sub>) used as electrolytes in a state-of-the-art battery assembling process. Sulfuryl chloride easily decomposes in the gas phase into sulfur dioxide and chlorine. In the presence of moisture, it produces sulfuric acid and hydrogen chloride.

Micro spills of sulfuryl chloride on the dispense electrolyte assembly station had caused several serious incidents of worker illness. After each spill, the contaminated nest was carried by the turntable to other stations inside the assembly module as the turntable moved. Traditional ventilation solutions were not feasible due to the high cost for conditioning make-up air (process constraints required the room to be kept at extremely low relative humidity [2%-5%] and low temperature [40°F-45°F]). A unique ventilation system was designed and implemented to minimize spreading of contamination utilizing a minimal amount of exhausted air. Cost-effective ventilation was accomplished by attaching hoods to the source of contamination to move along with the source in the assembling process, effectively suppressing the spread of contamination. The hoods and the collector are attached to the system via a ball-bearing connector that rotates with the turntable.

Testing of the new rotating exhaust ventilation system indicated that it had high performance in worst-case spill situations and during normal operation of the battery assembly module.

## POSTER SESSION 302 Papers 356-379, 255

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