Paint Remover Manufacturers Complete Ventilation Project

HSIA recently completed a demonstration project of a prototype ventilation system for commercial furniture stripping operations (Figure 1). The project, funded by HSIA and conducted by the Paint Remover Manufacturers (PRMA) demonstrated significant-potential for lowering exposures to methylene chloride during the stripping, rinsing, and drying stages of the operation.

The objective of the HSIA/PRMA project was to develop a practical method for assisting commercial furniture stripping operations in meeting the federal Occupational Safety and Health Administration's (OSHA) pending 25-ppm permissible exposure limit (PEL) for methylene chloride. The project sponsors also were interested in a design that would lend itself to the control of emissions of methylene chloride to the ambient environment.

The study was conducted in two phases. The first phase addressed exposure to methylene chloride during the actual stripping operation. As a result of the findings of this work, a second phase was added to look at ways to reduce exposures during the rinse stage.

Phase I - Stripping

In Phase I of the project, a standard pumped-flow tank was fitted with a perimeter ventilation system (Figure 2). This system supplemented the existing down-draft vent located below the tank. The perimeter system was designed to draw the methylene chloride vapors evenly away from the operator and out the exhaust plenum. The exhaust fan was operated at two air flows (1800 and 4200 cubic feet per minute, or cfm), divided between the perimeter ventilation system and the down-draft vent. Methylene chloride concentrations achieved under these two conditions were compared to a control situation using the down-draft vent only at an air flow of 4800 cfm.

An analysis of these data revealed the following two significant findings:

> that, at comparable ventilation rates, the perimeter ventilation system significantly reduced methylene chloride concentrations in the worker's breathing zone during the stripping operation; and
> that concentrations in the rinse area have the potential to be significantly higher than in the stripping area.

The concentrations in the rinse area appear to have been increased somewhat by the transfer of some of the air flow from the down-draft vent to the perimeter ventilation system.

Phase II - Rinsing

In Phase II, the rinse area was enclosed and ventilated through a slotted back panel connected to the exhaust plenum at the stripping tank (Figure 3). The enclosure was equipped with a hinged "sneeze shield" so that furniture could be brought in and out of the rinse area. A make-up plenum also was added behind the operator to reduce turbulence that had been observed during stripping in Phase I.

The exhaust fan was operated at two air flows (4300 and 5400 cfm) during Phase II. The air flow was divided between the plenum to the stripping tank and the duct to the rinse enclosure. Air flows at the make-up plenum varied between 1400 and 1900 cfm. Enclosure was found to be an effective method for reducing methylene chloride levels in the rinse area. The hinged sneeze shield, while making rinsing more difficult, achieved a three-fold decrease in methylene chloride levels in the one comparison conducted. Additional design considerations likely could alleviate access problems associated with such a shield.

The make-up plenum was found to be effective at further lowering methylene chloride levels in the worker's breathing zone during stripping. Despite the fact that air flows at the stripping tank (perimeter ventilation system + down-draft vent) were significantly lower in Phase II than those during the higher air flow condition of Phase I, the monitored levels of methylene chloride were as low or lower. It also was determined that the makeup plenum was more effective when located 5 feet above the floor than when located at floor level. Placing the plenum at floor level was found to create turbulence, thereby increasing concentrations in the breathing zone. Reduction of the total air flow from 5400 to 4300 cfm reduced this turbulence and lowered the breathing zone concentration.

Additional Considerations

While the joint CEC/PRMA project provides significant insight into methods for exposure control in commercial furniture stripping operations, several additional challenges remain. Of primary importance is the cost of installing a ventilation system similar to that described above. Depending on the materials of construction and other factors, estimates for such a system run from $15,000-$60,000.

Such a system also would increase operating expenses by increasing chemical and utility costs. Greater air flows increase evaporation of the remover, requiring more frequent replenishment. (Emission control also becomes more difficult with higher air flows.) In addition, the need to heat the make-up air in winter months will increase heating costs significantly in many parts of the country.

While not discussed, the prototype stripping operation shown in Figure 1 also includes a separately ventilated room to control emissions from drying furniture. These emissions can contribute to methylene chloride levels in the facility. The prototype system also includes a four-foot wide pumped-flow tank to accommodate bigger pieces of furniture. The demonstration project focused on chairs which are among the easiest to strip, but may represent only about 3O to 4O percent of the furniture currently stripped. A wider tank may allow for bigger pieces to be handled more easily, minimizing the potential for increased emissions in the breathing zone.

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