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ADDITIONAL POSTHEARING COMMENTS OF THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH ON THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION PROPOSED RULE ON OCCUPATIONAL EXPOSURE TO METHYLENE CHLORIDE

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
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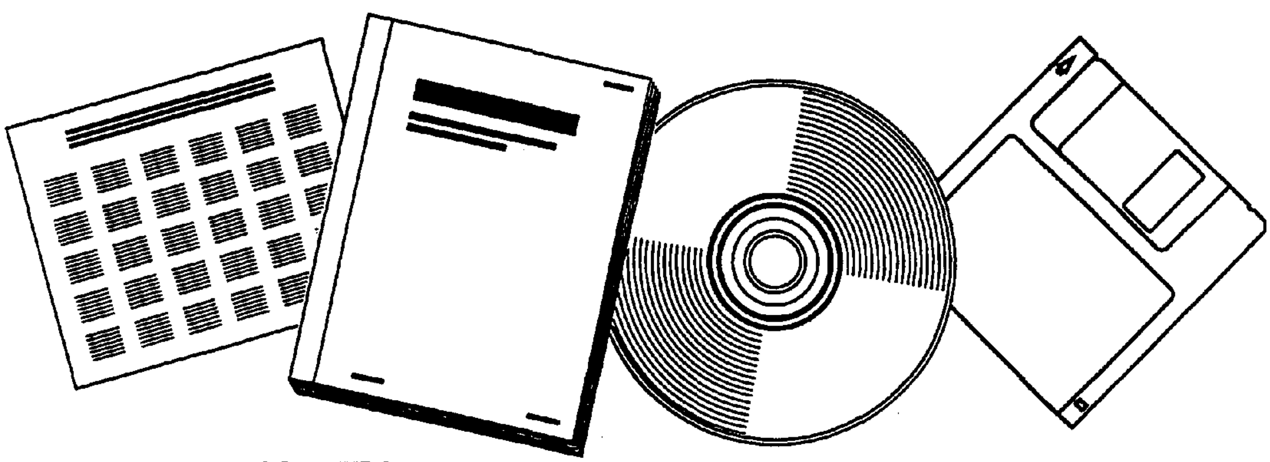

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

NIOSH

Additional Posthearing Comments to OSHA

ADDITIONAL POSTHEARING COMMENTS OF THE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ON THE
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
PROPOSED RULE ON
OCCUPATIONAL EXPOSURE TO METHYLENE CHLORIDE

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16. Abstract (Limit: 200 words) This testimony contains specific information and comments from NIOSH regarding the proposed ruling on occupational exposure to methylene-chloride (75092) in the paint stripping and flexible foam production industries. The concerns revolve around the recommendations concerning local ventilation, the solvent degreasing tank, push/pull ventilation, localized strategies, the use of a fan, and dilution ventilation as determined in research with the furniture refinishing industry. Examples were offered of local exhaust ventilation designs that can reduce methylene-chloride exposures to below the proposed limit of 25 parts per million (ppm). Push/pull ventilation is not felt to be adequate for furniture stripping operations as the workers must apply stripping solution and scrape the furniture in the area between the push jet and the exhaust slots. A recent publication of NIOSH described a localized dilution ventilation system using an axial fan that permitted concentrations of methylene-chloride ranging from 19 to 110ppm with an average of 65ppm. Eight hour time weighted average concentrations for two workers were 48ppm and 1ppm, stripping for 323 minutes and 24 minutes, respectively.

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In response to the Occupational Safety and Health Administration (OSHA) reopening its docket on methylene chloride, the National Institute for Occupational Safety and Health (NIOSH) has comments on two sets of materials pertinent to OSHA rulemaking:

1. Two reports on control technology for the paint stripping and flexible foam production industries

   A. *"Review of the Technical and Economic Feasibility of the Proposed Methylene Chloride Rule for the Furniture Refinishing Industry" (3/7/94) by Richard Green*

   Mr. Green has concluded that a control system could be installed in average-sized furniture stripping shops for $2285 (ventilation system capital costs). Local exhaust ventilation systems, such as those described in the NIOSH reports [NIOSH 1990, 1991, 1993, Hall et al. 1993], do not cost substantially more than the "localized" dilution ventilation systems described by Mr. Green. Furthermore, the systems described in the NIOSH reports should have lower operating costs because less air is exhausted, requiring less energy to heat and move the air, and are much more likely to reduce worker exposures below the proposed OSHA PEL of 25 parts per million (ppm). A "localized" dilution ventilation design would be adequate to reduce exposures at the rinsing operation.

   Specific Comments:

   Recommended Local Ventilation (Section IIIC4d, pp. 36-37)

   Mr. Green proposed that 2400 to 5600 cubic feet per minute (cfm) be used to ventilate a 4-ft by 8-ft tank. This range is probably sufficient for local ventilation, but not "localized" dilution ventilation as proposed by Mr. Green.

   The following are examples of local exhaust ventilation designs that can reduce methylene chloride exposures to below the proposed PEL of 25 ppm:

   -- For dip tank furniture stripping, NIOSH researchers performed a study at Tri-County Furniture Stripping [NIOSH 1990]. A lateral slot hood was installed similar to the Open Surface Tank (Plate No. VS-70-02) in the ACGIH Ventilation Manual [ACGIH 1992]. The hood exhausted 2900 cfm for an 8-ft by 4-ft tank. This local ventilation system controlled methylene chloride concentrations during stripping to a geometric mean of 13 ppm. This design cost $3,500 including the fan, materials, and labor to fabricate and install the hood and ductwork. If this hood were mass produced as an integral part of the stripping tank, the cost should be reduced. The estimated annual cost of heating replacement air is $560, calculated using equation 7.2 from the ACGIH Ventilation

Manual and using St. Louis, MO as representative of annual degree-days of heating [Hall et al. 1993]. The additional cost to ventilate the rinsing area using "localized" dilution ventilation as proposed by Mr. Green would be expected to be in the range of $750-1000.

-- For solution-recycling furniture stripping, NIOSH researchers performed a study at the Association for Retarded Citizens (ARC) with three different local ventilation designs--a slothood (2900 cfm), a downdraft hood (2100 cfm), and a combination of the two (3600 cfm). All three local ventilation systems used an 8-ft by 4-ft tank and controlled methylene chloride concentrations to geometric means of 26 (slothood), 29 (downdraft), and 20 (combination) ppm while stripping [NIOSH 1991]. The cost of this system is estimated to be similar to the system described above for dip tanks.

Local Ventilation Models (Section IIIC4b(1) and (2), pp. 34-35)

Two methods are used by Mr. Green to determine the velocity required for the local ventilation. The first used Table 10.70.4 in the ACGIH manual [ACGIH 1992] which showed that 150 to 225 cfm/ft^2 is needed if a lateral exhaust system is used. The second method used Table 3.1 in the ACGIH manual in which Mr. Green determined that 50 to 100 feet per minute (fpm) is required. The first method, using Table 10.70.4, should be used to determine the volume of air required.

Solvent Degreasing Tank (Section IIIC4b(3), pp. 35-36)

Mr. Green designed the solvent degreasing tank according to the design specifications in the ACGIH Ventilation Manual (Plates VS-70-20 & 21). These specifications assume minimal background air currents (air velocities less than 11 fpm.) For furniture stripping, background air velocities near the tank will be much higher. Therefore, the air flow capacity recommended by the author is too low for the present application. However, the same local ventilation design can be used as shown in the ACGIH Ventilation Manual for Open Surface Tanks (VS-70-02).

Push-Pull (Section IIIC4c, p. 36)

Push-pull ventilation is not appropriate for furniture stripping operations because the worker must apply stripping solution and scrape the furniture in the area between the push jet and the exhaust slots. This will result in the push jet air, laden with solvent, striking the workers' arms or the furniture and being deflected into the breathing zone. Mr. Green has attempted to overcome this by angling the push jet upward; however, this angle will likely result in entrained air not being captured by the exhaust slot. This will cause increased concentrations of methylene chloride in the general room air. In addition, the worker would have to reach far over the tank to work on the furniture if it is placed at the back of the tank to avoid the push air jet. This would cause extremely poor work postures, which would bring the worker's breathing zone into the contaminated air and would possibly result in musculoskeletal injuries.

Localized Strategies (Section IIIC4d, p. 36)

The author, Mr. Green, recommends three localized dilution ventilation strategies; one was the push-pull system, which, as discussed above, is not appropriate for this application.

The second system by John Krenson (Besway) would work if it could be made with a plenum velocity which is one-half of the slot velocity. The PVC pipe would have to be 2-ft in diameter to make a large enough plenum to meet this constraint. These large plenums are required to make the ventilation system exhaust evenly around the tank. A two-foot diameter PVC pipe would probably get in the way of the workers. Therefore, another design is required which would have a large square plenum down the front and back such as the one described in the NIOSH Tri-County study [NIOSH 1990]. Also, the plenum should be made of sheet metal or other durable materials instead of wood, because of fire codes and problems of methylene chloride soaking into the wood and becoming a reservoir, causing increased exposures.

The third design (the enclosed stripping tray) could work if it was modified as follows: 1) a slot velocity of 2000 fpm for each slot, 2) a plenum velocity which is one-half the slot velocity or less, 3) a centrifugal fan which is rated with a large enough exhaust volume and static pressure to handle the local ventilation system, 4) a make-up air system which would supply the same volume of air that is exhausted, and 5) the hood and all components are made of sheet metal (not wood).

The cost for either of these systems should be similar to the cost mentioned earlier for the NIOSH system installed at Tri-County Furniture Stripping.

Fan (Appendix C-3)

The author, Mr. Green, chose an axial fan which is designed for 1/8-inch static pressure and intended for use in general ventilation. However, a centrifugal fan is needed for a local ventilation system because it is designed to exhaust air from systems with high-static pressure. Also, unlike axial fans, centrifugal fans are made to attach to ductwork. A single-phase, spark-resistant, centrifugal fan can be purchased for approximately $1,000, excluding installation.

Dilution Ventilation

A recent NIOSH Health Hazard Evaluation [NIOSH 1993] describes a "localized" dilution ventilation system (using an axial fan). The stripping tank was enclosed on the top, sides, back, and most of the front, leaving a 3-ft by 3-ft opening. A 16" tubeaxial fan rated at about 2000 cfm provided an exhaust volume of 1400 cfm with a face velocity of 130 fpm in the opening with no worker present. The rinse booth was enclosed in the same manner as the stripping tank. An 18" propeller fan rated at approximately 2000 cfm provided an air velocity through the opening in the rinsing booth of 200 fpm (calculates to 1800 cfm).

Using this ventilation system during stripping, methylene chloride concentrations ranged from 19 to 110 ppm with an average of 65 ppm. Eight-hour time-weighted average concentrations for two workers were 48 ppm (stripping for 323 min) and 1 ppm (stripping for 24 min) [Hall et al. 1993]. This system is similar to one possible design (p. 40) proposed by Mr. Green. The exhaust volume of the ventilation system in the NIOSH study [Hall et al. 1993] is somewhat lower than proposed by Mr. Green, but the tank in the NIOSH study is more fully enclosed than it would be in the design proposed by Mr. Green. Increasing the volume of exhausted air would not likely reduce worker exposures substantially, because it would cause eddy currents around the worker which can bring contaminated air into the breathing zone. An additional problem in the design by Mr. Green is that the workers must place their heads and upper bodies inside the enclosure to perform their work.

B. Report from Center for Emissions Control on Flexible Foam Production Facilities

- Letter from Center for Emissions Control (p. 2): The water-based formulations seem to be a possible alternative that deserve further research from a control technology perspective; however, more information on cost and product performance is needed to determine if they are economical.

- Attached study by Rust Engineering (9/28/93, p. 1): No information on exposure concentration is given. The proposed ventilation (4000 cfm) should control methylene chloride concentrations to below 25 ppm, especially considering that the old ventilation system with 300 cfm controlled to 40 to 60 ppm (from Ventilation Project Description [5/3/93, p. 3]). The cover letter, nor either Rust report, addressed the feasibility of the proposed design. However, the system appears to be technically feasible and the proposed individual workstation design by Rust Engineering appears to be a reasonable design to meet the OSHA proposed PEL.

Rust Engineering Report (9/28/93, p. 2): In addition to covering the top, the front opening of the enclosure should be made smaller, if possible. While NIOSH has not seen the process, it is not apparent why a 10-foot-wide workstation is needed, because the work is performed on a turntable which could only be 3½ feet in diameter considering the depth of the workstation. If the workstations were not so wide or were more fully enclosed, less air would be required to control the methylene chloride.

Rust Engineering Report (10/6/93, p. 2): The suggested design provides only enough exhaust and makeup air to properly exhaust four workstations at a time, even though there are 24 exhaust hoods on the ventilation system. This design does not seem appropriate because if the process requires only four hoods, then the added expense of ventilating 24 hoods seems unnecessary. On the other hand, if the process requires more than four hoods to operate at a time, then it is not appropriate to design a system that will not meet these needs. If more than four hoods are necessary, the capacity of the make-up air system would need to be increased to meet the capacity of the ventilation system.

2. **Two (unpublished) National Cancer Institute studies on occupational exposure to chlorinated aliphatic hydrocarbons and risk of astrocytic brain cancer [Heineman et al., Gomez et al.]**

The paper by Heineman et al. presents the results from a case-control study of brain cancer. Controls for this study were deaths other than brain cancer and a few other causes that were believed to be potentially associated with brain cancer (i.e., cerebrovascular diseases, suicide and homicide, lung cancer, liver cancer, leukemia, Hodgkin's lymphoma, and cirrhosis of the liver). Occupational histories were obtained from next of kin for 74% (n=483) of the cases and 63% of the controls (n=386). These occupational histories were linked with an exposure matrix for several chlorinated hydrocarbons, which is fully described in the companion paper by Gomez et al., to develop estimates of exposure probability and intensity, duration of exposure, and a cumulative exposure index. The risk of brain cancer was found to increase with probability and intensity and duration of methylene chloride exposure, but not with the cumulative exposure index.

This is a well-conducted investigation. The major weakness of this study, which is recognized by the authors, is the indirect source of the exposure information (i.e., interview with next of kin). This is a typical problem in population based case-control studies of this type. The net effect of this is to produce a potential misclassification of the exposures of the cases and controls. This type of error often results in bias towards not observing any effect, but may in some cases, create a bias in the opposite direction [Prentice 1982]. The fact that a relationship was not observed between the cumulative exposure index and brain cancer could conceivably be related to this potential bias.

As Heineman et al. note, the results from this investigation should be interpreted cautiously given that this is the first paper to report an association between brain cancer and methylene chloride exposure. Other studies of methylene chloride exposed workers have not observed an increase in brain cancer risk [Hearne et al. 1987; Lanes et al. 1990], nor has brain cancer been observed in toxicologic studies. Perhaps this study might best be viewed as an hypothesis generating study that would require further confirmation in other studies before the association with brain cancer can be considered established. Meanwhile, if anything, these findings raise additional concerns about the risks associated with methylene chloride and may provide additional reason for OSHA to lower the current PEL.

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