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Mastic Removal—An Educational Experience

Dawn Tharr, Column Editor

Case Report by John Kelley

Introduction

The removal of floor tiles during building renovation or asbestos abatement often includes the removal of the underlying adhesive or "mastic." National Institute for Occupational Safety and Health (NIOSH) investigators surveyed two schools in which occupants complained of odor and health symptoms following the use of organic solvents to remove floor tile mastic. The use of chemical solvents is one of three common methods to remove tile mastic. The other two methods are scraping with a sharpened hand-held tool and beadblasting with hardened steel shot.

The use of solvents is effective, uses equipment that is inexpensive, and because it is a wet method, is often preferred for removing asbestos-containing tile mastic. This method, however, may result in undesirable odors and the exposure of removal workers and building occupants to toxic chemicals. Research conducted on 122 mastic products revealed that 33 percent of these contained one or more hazardous ingredients according to 29 CFR 1910.1200 and 1926.59.[1] The composition of mastic removers generally falls into one of three general categories:[2] 1) petroleum distillates, including aromatic hydrocarbons, 2) nonpetroleum products, primarily citrus-based terpenes, and 3) blends of petroleum and nonpetroleum products.

School A

Asbestos-containing tile mastic was removed during a Thanksgiving and Christmas break using a terpene-based solvent. Upon returning from break, student and staff members complained of a strong odor in the building and began to experience eye and throat irritation, nausea, and headaches. Because of community concerns, students were relocated to a local church while remediation efforts took place. Remediation efforts included: 1) cleaning of floors with industrial strength cleaners, 2) passive ventilation using open doors and windows, 3) bake-out procedures using propane heaters, 4) use of ion and ozone air purifiers, and 5) sealing of floor joints with a caulking compound. After several weeks, representatives of the school district began to observe a slight reduction in odors which they attributed primarily to the use of ventilation. In February, NIOSH was asked by the school district to investigate the problem. Air monitoring for volatile organic compounds (VOCs) was conducted at that time.

Emissions of the mastic remover were not detected in the air samples collected at school A. Several VOCs were detected, but the likely source of these compounds was materials used in renovation and construction efforts which were on-going during the collection of samples.

School B

At school B, during July and August, asbestos-containing tile mastic was removed using an organic solvent consisting of aromatic hydrocarbons (mostly $C_{10}-C_{11}$ range). Upon returning to school in September, occupants complained of an odor and began to experience health symptoms which included headaches and stomachaches, respiratory problems, and dizziness. Remedial efforts taken by the school district included: 1) use of an odor counteractant, 2) large fans to increase ventilation through open doors and windows, 3) removal of the carpet in two rooms which were reported to be the worst, and 4) application of a sealant to the floor in one of the rooms. These efforts were reported to be unsuccessful at ridding the building of the odor. The school was eventually closed temporarily in response to community concerns that there was a health hazard in the building. The school district asked NIOSH to investigate the problem in April. Air monitoring for VOCs was conducted at that time.

Emissions from the mastic remover were detected in the air samples collected at school B. Total VOC concentrations of 1 to 2 mg/m^3 were measured in the air samples using the bulk mastic remover as a standard. Although these concentrations do not represent a health hazard when compared to occupational exposure guidelines, it has been suggested that they may contribute to symptoms of eye, nose, and upper respiratory irritation.[3]

An additional problem reported at school B was the secondary emission of remover from porous materials such as ventilation duct lining, expansion material located near the floor joints, office dividers, and even paper products. This may help to explain why the concentrations in school B were greater than in school A, despite the longer time interval between tile removal and sample collection.

Conclusions

The serious health risk perceived by each community was in part due to the strong odor reported in the schools. The odor thresholds for many organic compounds are well below occupational guidelines. An example is naphthalene, a component of the solvent used to remove tile mastic in school B. Naphthalene has a reported odor threshold of 0.084 ppm,[4] with an Occupational Safety and Health Administration permissible exposure

level of 10 ppm as an 8-hour time-weighted average.

Two exposure concerns of interest which were not evaluated in these studies are: 1) the concentrations of VOC emissions in the school buildings when occupants first returned following mastic removal, and 2) the VOC concentrations to which workers removing the tile were exposed.

The persistance of the odor is believed to be largely affected by the construction design and condition of the floor surfaces to which the mastic remover is applied. Joints, cracks, and pores in the flooring can act as sinks if excess solvent is used. Also, the presence of damp-proof membranes in the floor's structure will cause excess remover to pool above them. These "pools" of remover would then continue to emit VOCs into the occupied zone.

Building owners should be aware of the potential health and odor problems which may result from the use of solvent to remove tile mastic. If the solvent method is chosen, measures to prevent odors and health symptoms from occurring include: 1) careful examination of the floor structure for potential "sinks" for excess solvent, 2) the removal of porous surfaces from the work area to prevent secondary emissions, and 3) enclosure of the work area and use of exhaust ventilation to prevent contamination of other areas of the building.

To evaluate VOC concentrations before and after mastic removal, environmental monitoring should be conducted. Also, the exposure of workers to VOCs during removal of the mastic should be evaluated.

If odor or health symptoms arise following tile mastic removal, VOC levels inside the building can usually be reduced by ventilating the area with outside air. This may take a long period of time, however, if flooring or porous surfaces have been contaminated. The addition of heat to the building to promote the vaporization of VOCs, often referred to as "bake-out," may also be of use.[5]

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Editorial Note: John Kelly is with the Health Hazard Evaluation and Technical Assistance Branch of NIOSH. More detailed information on these studies is contained in Health Hazard Evaluation Reports 91-118-2213 and 91-197-2217, available through NIOSH, Hazard Evaluation and Technical Assistance Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226; telephone: (800)-35-NIOSH.