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BUFFING, BURNISHING, AND STRIPPING OF VINYL ASBESTOS FLOOR TILE

Bruce A. Hollett, Alva Edwards, and Patrick J. Clark
U.S. Environmental Protection Agency
Risk Reduction Engineering Laboratory
26 West Martin Luther King Drive
Cincinnati, Ohio 45268
(513) 569-7654

John R. Kominsky, Ronald W. Freyberg, and James M. Boiano
Environmental Quality Management, Inc.
1310 Kemper Meadow Drive
Cincinnati, Ohio 45240

INTRODUCTION

Studies were conducted to evaluate airborne asbestos concentrations during the three principal types of preventative maintenance (low-speed spray-buffing, ultra high-speed burnishing, and wet-stripping) used on asbestos-containing floor tiles. These were done under pre-existing and prepared levels of floor care maintenance. Airborne asbestos concentrations were measured before and during each floor care procedure to determine the magnitude of the increase in airborne asbestos levels during each procedure. Airborne total fiber concentrations were also measured for comparison with the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) of 0.1 f/cm^3. Low-speed spray-buffing and wet-stripping were evaluated on pre-existing floor conditions and three levels of prepared floor care conditions (poor, medium, and good). Ultra high-speed burnishing and wet-stripping were evaluated on two levels of prepared floor care conditions (poor and good). Floor care conditions were defined in consultation with the Chemical Specialty Manufacturers Association and other representatives of floor-care chemical manufacturers. Controlled studies were conducted in an unoccupied building at the decommissioned Chanute Air Force Base in Rantoul, Illinois, with the cooperation of the U.S. Air Force. The building offered approximately 8600 ft^2 of open floor space tiled with 9-inch by 9-inch resilient floor tile containing approximately 5% chrysotile asbestos.

METHODOLOGY

Configuration for Experiments

Approximately 6500 ft^2 of floor space was isolated as the experimental test area. A containment shell was constructed to provide five equally-dimensioned test rooms, each with approximately 1300 ft^2 of floor space and 7-foot ceiling height. The ceiling and walls were covered with polyethylene. Four high-efficiency particulate air (HEPA) filtration units were placed in the hallway outside of the five test rooms to ventilate the test rooms and reduce the airborne asbestos concentrations to background levels after each experiment.

Upon completion of the low-speed spray-buffing and wet-stripping experiments, the test area was reconfigured to accommodate the ultra high-speed burnishing and wet-stripping experiments. The test area was reconfigured to provide a single test room of approximately 6500 ft^2 of floor space and 7-foot ceiling height.

Experimental Design

Low-speed spray-buffing was first evaluated on the pre-existing floor-care condition. Low-speed spray-buffing of the pre-existing floor-care condition was evaluated five times, once in each of the five test rooms. Wet-stripping (including polish and sealant removal) was also evaluated on the pre-existing floor-care condition. Wet-stripping of the pre-existing floor-care condition was evaluated five times, once in each of the five test rooms.

Low-speed spray-buffing was evaluated on three levels of prepared floor-care conditions: (1) poor floor-care condition defined as a floor with one coat of sealant and one coat of polish; (2) medium floor-care condition defined as a floor with one coat of sealant and two coats of polish; and (3) good floor-care condition defined as a floor with two coats of sealant and three coats of polish. Each floor-care condition was evaluated five times, once in each of the five test rooms, to yield a total of 15 experiments. Wet-stripping after low-speed spray-buffing was evaluated on two levels of floor-care conditions (medium and good). This comparison addresses the effectiveness of two coats of sealant versus one coat of sealant to limit the extent of airborne asbestos concentrations during polish removal. Wet-stripping of each of the two floor care conditions was evaluated five times, once in each of the five test rooms, to yield a total of ten experiments.

Ultra high-speed burnishing was evaluated on two levels of prepared floor-care conditions: (1) poor floor-care condition (defined as a floor with two coats of sealant and one coat of polish) and (2) good floor-care condition (defined as a floor with two coats of sealant and four coats of polish). Each floor-care condition was evaluated four times to yield a total of eight experiments.

Wet-stripping after ultra high-speed burnishing was also evaluated on two levels of floor-care conditions (poor and good). Each of the two floor care conditions were evaluated four times to yield a total of eight experiments.

Analytical Methods

The mixed cellulose ester filters were prepared and analyzed in accordance with the non-mandatory transmission electron microscopy (TEM) method specified in the Asbestos Hazard and Emergency Response Act (AHERA) Final Rule (October 30, 1987; 52 CFR 4826) to achieve a sensitivity of 0.005 s/cc, plus the specific length and width of each structure were measured and recorded. The phase contrast microscopy (PCM) samples were prepared and analyzed according to the National Institute of Occupational Safety and Health (NIOSH) Method 7400, with an analytical sensitivity of about 0.01 f/cc. Specific quality assurance procedures outlined in the AHERA rule were used to ensure the precision of the collection and analysis of air samples, including filter lot blanks, open and closed field blanks, and repeated sample analyses.

Statistical Methods

The relative change in airborne asbestos concentration was measured by the ratio of the average concentration during the specific maintenance procedure to the average concentration before the maintenance procedure. These ratios were then compared by taking the natural logarithm and comparing the averages by standard analysis of variance (ANOVA) techniques.

RESULTS

Low-speed spray-buffing and wet-stripping was first evaluated on the pre-existing floor-care condition. Larger (and statistically significant) increases in the TEM airborne asbestos concentrations were observed during wet-stripping than during spray-buffing. None of the individual PCM concentrations exceeded the OSHA PEL of 0.1 f/cm^3. Consequently, 8-hour time-weighted average (TWA) concentrations based on these measured levels would not exceed the OSHA PEL. The highest individual PCM concentration (0.023 f/cm^3) was measured during wet-stripping.

For the prepared floor studies, the mean relative increase in TEM airborne asbestos concentrations during low-speed spray-buffing tended to decrease as the floor care condition improved (i.e., poor condition resulted in a larger relative increase than medium, and medium condition showed a larger relative increase than good); however, the differences between the three levels of floor care were not statistically significant ($p = 0.1149$).

Larger (and statistically significant) increases in TEM airborne asbestos concentrations were observed during wet-stripping of floors in medium condition than on floors in good condition. The relative increase in airborne asbestos concentrations (i.e., compared to baseline measurements) was approximately 14 times greater, on average, during wet-stripping of floors in medium condition than during wet-stripping of floors in good condition. The stripping solution used on these floors was designed to remove only the polish from the floor, leaving the layer(s) of sealant on the floor. Therefore, although significant increases in airborne asbestos concentrations were observed during wet-stripping of floors in both medium and good condition, the extra layer of sealant on floors in good condition appears to significantly decrease the airborne asbestos levels that were generated by the activity. Overall, significantly larger increases ($p = 0.0001$) in airborne asbestos concentrations were observed during wet-stripping than during low-speed spray-buffing (this comparison was restricted to floors in medium and good condition since wet-stripping was not evaluated on floors in poor condition). The relative increase in airborne asbestos concentrations was approximately 18 times greater, on average, during wet-stripping than during low-speed spray-buffing.

PCM Concentrations

None of the individual PCM concentrations exceeded the OSHA PEL of 0.1 f/cm^3. Consequently, 8-hour TWA concentrations based on these measured levels would not exceed the OSHA PEL. The highest individual PCM concentration (0.032 f/cm^3) was measured during low-speed spray-buffing.

Ultra High-Speed Burnishing and Wet-Stripping Experiments

Similar increases in airborne TEM asbestos concentrations were seen during ultra high-speed burnishing and wet-stripping of floors in both poor and good condition. No floor condition or maintenance procedure resulted in significantly higher or lower increases in mean airborne asbestos concentration.

Overall, ultra high-speed burnishing and wet-stripping resulted in an 11-fold statistically significant increase, on average, in airborne asbestos concentration.

The ultra high-speed burnishing operation produced a fine, pale yellow, powdery dust from the wax and/or sealant. PCM concentrations measured during ultra high-speed burnishing were significantly higher than those measured during stripping. The elevated concentrations measured during ultra high-speed burnishing were due primarily to the white dust generated during the process. The fine dust particles (pulverized wax/sealant) that measured greater than 5 μm in length and had a length-to-width aspect ratio of 3:1 were counted as fibers (NIOSH Method 7400, A Counting Rules). The corresponding TEM concentrations show that the PCM concentrations do not reflect an accurate indication of the airborne asbestos concentrations.

The 8-hour TWA concentrations were calculated by assuming zero exposure beyond that which was measured during the experiment. None of the 8-hour TWA concentrations measured during wet-stripping (after ultra high-speed burnishing) exceeded the OSHA PEL of 0.1 f/cm^3 for total fibers.

CONCLUSIONS

This study shows that low-speed spray-buffing, ultra high-speed burnishing, and wet-stripping of asbestos-containing resilient floor tile can be sources of airborne asbestos in building air. Greater releases of airborne asbestos were observed during wet-stripping than during low-speed spray-buffing when performed on floors in both pre-existing condition and prepared conditions. The results of this study further suggest that multiple layers of sealant applied to the floor prior to the application of the floor finish can reduce the release of asbestos fibers during polish removal.

For more information, the EPA Work Assignment Manager, Alva Edwards, can be contacted at the U.S. Environmental Protection Agency, Risk Reduction Engineering Laboratory, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268, (513) 569-7693.

CONTAMINANTS AND REMEDIAL OPTIONS AT PESTICIDES SITES- A TECHNICAL RESOURCE DOCUMENT

Richard N. Koustas
USEPA Edison Facility
2890 Woodbridge Avenue
Edison, NJ 08837
Phone: 908-906-6898

INTRODUCTION:

Pesticide contamination includes a wide variety of compounds resulting from manufacturing, improper storage, handling, disposal, and/or agricultural processes. Remediation of pesticide-contaminated soils can be a complicated process, as most pesticides are mixtures of different compounds rather than pure pesticide. The remedial manager is faced with the task of selecting remedial options that will meet established cleanup levels. There are three principal options for dealing with pesticide contamination: containment/immobilization, destruction, and separation/concentration. This paper is condensed from the technical resource document (TRD) "Contaminants and Remedial Options at Pesticide Sites" and provides a brief summary on treatment technologies that are available or those being developed for pesticide contamination. Technologies that have not produced performance data are not included nor are water treatment technologies. This paper focuses on potential remediation techniques of soils.

CHARACTERISTICS OF PESTICIDES

Pesticides, as defined by the U.S. Federal Environmental Pesticide Control Act, are "...any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insect, rodent, nematode, fungus, weed or any other form of terrestrial or aquatic plant, animal life, or virus, bacteria, or other microorganism which the Administrator declares a pest". Pesticides include insecticides, fungicides, herbicides, acaricides, nematocides, and rodenticides as well as any substance or mixture of substances intended for use a plant regulator, defoliant, or desiccant. Pesticides do not include such substances as fertilizers or veterinary medicines. Pesticide wastes are generally complex chemical mixtures and not pure pesticides. These mixtures can include solvents, carriers and other components that will have a direct effect on toxicity, mobility, transport, and treatment.

Several classification criteria are utilized when grouping pesticides. Conventional classification methods are based on the applicability of a substance or product to the type of pest control desired. In addition, the EPA has its own classifications under the Resource Conservation and Recovery Act (RCRA) and Superfund. For the purpose of treatment, pesticides may be classified based on three characteristics: water solubility, contains metals or contains halogen. Therefore, TRD categorizes pesticides into four waste groups based on data needs for available treatment technologies:

WG01 - Inorganic pesticides
WG02 - Halogenated water insoluble organics
WG03 - Halogenated sparingly water soluble organics and organo-linked compounds
WG04 - Non-halogenated organics and organo-linked compounds.

The TRD provides details of the four pesticide waste groups and gives examples of commonly found pesticides. These groups are subdivided further to show the chemical class or family each pesticide belongs to according to their molecular structure or key functional group. Applicable treatment technologies for each waste group are also provided. References to pesticides and pesticide wastes in this document use the above waste group categories.