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NIOSH/DRDS/FSB
1095 Willowdale Road, Mail Stop H-2800
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RE: Mycobacteria, Storage Mites, and Phthalates (EH&E 11767)

Dear Dr. Pearce,

Environmental Health and Engineering, Inc. (EH&E) is pleased to provide the National Institute for Occupational Safety and Health (NIOSH) with a summary of mycobacteria, storage mite, and phthalate issues in relation to the investigation of indoor environmental quality and occupant health at 25 Sigourney Street (the Building), Hartford, Connecticut.

MYCOBACTERIA

On August 18, 2004, EH&E collected carpet dust samples from two locations on each of three floors (6, 8, and 18) in the Building. The samples were cultured for slow-growing mycobacteria by incubation in Middlebrook 7H10 media at 35 degrees Celsius (°C) for 8 weeks. One sample from the sixth floor contained 74,000 colony forming units per gram (cfu/g) of mycobacteria, while the other five samples did not contain culturable mycobacteria (Table 1).

Table 1 Mycobacteria Sample Results Collected from 25 Sigourney Street on August 18, 2004

Sample ID	Location	cfu/g
65828	Floor 18B	<400
65829	Floor 18A	<400
65830	Floor 8B	<430
65831	Floor 8A	<420
65832	Floor 6B	74,000
65833	Floor 6A	<400

cfu/g colony forming unit per gram

Dilution: 1:10, 1:100, 1:1000, 1:10000

Samples incubated in Middlebrook 7H10 media at 35 degrees Celsius (°C) for 8 weeks.
Samples analyzed by Environmental Microbiology Laboratory, Inc. (San Bruno, California)

The scientific literature contains only limited information on mycobacteria levels in indoor dust that can provide benchmarks for interpretation of these results. Rapid-growing strains of mycobacteria were present at concentrations of approximately 10^6 cfu/g from gypsum board of a building with intermittent moisture intrusion in Finland (Andersson, et al. 1997; Vuorio, et al. 1999). Mycobacteria levels in the carpet dust of 25 Sigourney Street were substantially below the levels found in that study. Another study in Finland reported detectable levels (<5 colony forming units per cubic meter [cfu/m^3] to 150 cfu/m^3) of slow-growing mycobacteria in indoor air during the remediation of buildings with and without a history of moisture damage and mold (Rautiala, et al. 2004). Thus, detectable levels of mycobacteria do not appear to be limited to buildings with known moisture problems.

EH&E did not observe any visible signs of historic water damage where the dust samples were collected. Although the carpeting was worn in some locations, the carpeting appeared to be typical of office environments. The area with culturable mycobacteria did not differ from the other sampling locations in terms of current moisture, temperature, or airborne mold concentrations.

The method used to culture carpet dust samples from 25 Sigourney Street did not identify the species of mycobacteria present in the sample obtained from the sixth floor, thereby limiting further interpretation of the results. The Middlebrook media used to culture these samples will support multiple mycobacterium species that cannot be differentiated. Unfortunately, an archive of the plate is no longer available for further evaluation, including speciation.

Pathogenic mycobacterium species have been postulated as a possible cause of respiratory symptoms and disease in some occupational settings (Falkinham 1996; Huttunen, et al. 2000). However, because of the rare occurrence of mycobacteria in dust samples collected from 25 Sigourney Street in August 2004, mycobacteria appears to be an unlikely cause of current respiratory illness among the Building occupants.

STORAGE MITES

Storage mites consist of several genera, of which the most common types are *Lepidoglyphus, Tyrophagus, Glycyphagu, Acarus,* and *Blomia* (van Hage-Hamsten and Johansson 1992). Storage mites are generally found in grain, flour, hay, and straw; however, at least one study found storage mites in dust samples obtained from homes in Spain with a history of dampness (Boquete, et al. 2000). Optimal conditions for storage mites appear to be around 25 – 30 °C and 80% relative humidity (RH) (van Hage-Hamsten and Johansson 1992; Boquete, et al. 2000), conditions common to tropical climates. Although storage mites are generally associated with rural settings, recent studies have shown that storage mite sensitization may occur in non-rural settings as well (Bernd, et al. 1996; Boquete, et al. 2000). Increasing RH and farming occupations are associated with human sensitization to storage mites (Boquete, et al. 2000).

With respect to 25 Sigourney Street, carpeting around the perimeter of the upper floors appears to have been damp for a period of time prior to 2002. The conditions on those floors may have been consistent with the moisture and temperature requirements of storage mite populations. However, EH&E is not aware of evidence that would suggest the presence of storage mite populations in the Building. Nevertheless, a limited amount of dust sampling and analysis for common storage mite allergen would be needed to reach a confident conclusion about the potential for storage mites to be a cause of work-related respiratory illness among the occupants of 25 Sigourney Street.

EH&E understands that dust samples collected from the Building by NIOSH have been archived. If stored under refrigeration, these samples may be tested against antigens specific to available and appropriate storage mite genera. *Tyrophagus putrescentiae* and *Lepidoglyphus destructor* are commonly included in storage mite assays, although the scientific literature indicates that additional storage mite allergens suitable for testing are commercially available. Based on discussions with a laboratory qualified to undertake a storage mite assay, EH&E

estimates that analyzing dust extracts would cost approximately $200 per sample, not including the cost of the antibody reagents (~$400 to $800 per antibody, based on availability). If the archived dust extracts are not usable, additional effort would be required to obtain dust samples from the Building.

PHTHALATES

Phthalates are common constituents of building materials that contain polyvinyl chloride (PVC) including carpeting and floor tiles (Norback, et al. 2000; Afshari, et al. 2004). The type and amount of phthalates in building materials varies across product types and manufacturers. Many building products contain percentage-level amounts of PVC. For instance, the fiber-forming substance in the commercial fiber Vinyon must contain at least 85% weight of vinyl chloride units (http://www.fibersource.com/f-tutor/vinyon.htm). While the commercial product name provides useful information, the specific PVC content of any particular product may be best determined by review of the product label. Product manufacturers are another possible source of this type of detailed product information.

In chamber tests, dibutylphthalate and di(2-ethylhexyl)phthalate (DEHP) have been shown to volatilize from PVC floor tiles and polyolefine flooring treated with wax (Afshari, et al. 2004). In a similar study, the rate of DEHP emission from PVC flooring was inversely related to the amount of dust on the flooring material (Clausen, et al. 2004). Other research indicates that reactions between water and DEHP in PVC building materials form the volatile organic compound 2-ethyl-1-hexanol that in turn is associated with various respiratory symptoms (Wieslander, et al. 1999; Norback, et al. 2000).

Other recent studies suggest that further investigation of the effects of phthalate inhalation is warranted. For example, urinary concentrations of phthalates were inversely associated with pulmonary function in a 240-person sub-sample of the National Health and Nutrition Examination Survey III population (Hoppin, et al. 2004). In another study, rhinitis in children was associated with phthalate concentrations in dust samples taken from their bedrooms (Bornehag, et al. 2004).

Given the history of water intrusion at 25 Sigourney Street, phthalate-related exposures associated with building materials that contain PVC could be a determinant of respiratory illness

among the Building occupants. A records-based assessment of the types of construction materials in the building and their constituents could provide information necessary to reach a preliminary conclusion about the importance of this issue. If warranted, targeted bulk and air sampling for selected phthalates and volatile organic compounds could then be performed. EH&E has identified an analytical laboratory affiliated with the Harvard School of Public Health that is capable of analyzing air and bulk samples for phthalates.

CONCLUSION

I trust that the information contained in this letter is useful to the ongoing assessment of indoor environmental quality and health for occupants of 25 Sigourney Street. I look forward to discussing the issues of mycobacteria, storage mites, and phthalates with you in the near future.

Please do not hesitate to contact me if you have any questions about the content of this letter.

Sincerely,

David L. MacIntosh, Sc.D.
Senior Associate/Project Manager

Enclosure

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