Research & Development Highlights

g2-203 Techni~J Series

Effectiveness of Clean-up Techniques for Leaded Paint Dust

Introduction

Leaded dust in carpets and on other floor coverings can be identified as a major source of lead contamination in housing, especially after renovations. This project was initiated to test the efficiency of various cleaning methods for a typical house carpet and vinyl floor covering.

Research Program

A laboratory study was conducted to examine the relative efficiency of a variety of cleaning procedures.

All testing was conducted in a large environmental chamber maintained at 0.2 air changes per hour of clean, pre-filtered air at 21°C and 50% relative humidity.

The carpet and vinyl floor samples were tested using the "American Society for Testing and Materials Standard Laboratory Test Method for Evaluation of Carpet Embedded Dirt Removal Effectiveness of Household Vacuum Cleaners, F608-89."

A standardized dust mixture containing 0.3% lead was prepared and used to provide two standard dust loadings - 1.0 and 40.0 g/m2 on the floor samples.

Two floor coverings were studied; a medium height nylon carpet and a lightly textured sheet vinyl. Both of these floorings are felt to be representative of those found in Canadian housing stock at present.

Twenty-eight combinations of clean-up methods for various floor samples were examined. Some of the methods involved vacuuming, sweeping, and wet and dry mopping.

Three types of vacuum systems were examined. These included central and portable vacuums - using either a plain tool or agitator head - and a high efficiency particulate air filtration (HEPA) vacuum. Dust mass removal effectiveness, airborne dust concentrations and dust lead concentrations were measured to quantify the efficiency of each cleaning method. The relative efficiency of each method was evaluated by calculating the mass removal efficiency (MRE).

FindIngs

Dust loading of 40 g/m2 on carpet samples gave mass removal efficiencies ranging from approximately 23% to 65% for a single 40-second vacuuming. When several 40-second turns were performed, these results improved to a maximum MRE range from 51% to 100% depending on the appliance used. Typically the vacuums with the agitator heads had the highest efficiency. See the following table for details. Efficiency dropped markedly with the use of a plain tool on the portable vacuum.

Dust loading results of 1.0 g/m2 were suspect and thus disregarded.

Dust loading samples on the vinyl flooring revealed that, wit~i exception of the broom method, all other cleaning techniques gave collection efficiency rates of 99% or greater. Even the broom technique proved efficient, giving a removal efficiency of approximately 96%.

Airbome dust concentrations at >0.3 micrometres ranged from 2,910 to >35,310 particles/litre for carpeting samples and from 151 to 34,004 particles/litre for floor samples. Note that these airborne concentrations were sampled after a single 40-second cleaning cycle, and may not be representative of more extensive cleaning activities.

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For the carpet sample, airborne dust concentrations were much higher with the empty bag than the 10% full bag. Results indicated that much of the airborne dust was due to the action of the tool on the rug and not to dust passing through the vacuum cleaner.

For the floor sample, airborne dust concentrations were best minimized by wet mopping and wet vacuuming. Again the portable empty bag vacuum gave the worst results.

Implications for the Housing Industry

This report highlights a number of interesting findings with respect to potential cleaning techniques for removal of leaded dust in housing.
Some vacuums, those with agitator heads, will efficiently remove recently laid down dust on carpets.

The HEPA vacuum provided no advantage over the portable or central vacuum, either in dust pick-up or dust dispersion, in our test protocol.

All techniques work well for dust removal from vinyl flooring or other types of bare floor.

Vacuuming the sample repeatedly gives better cleaning results.

Sample Project Results

Nominal Dust Loading of 40 g/m^2 (27 g) on Carpet Samples

Cleaning Method	Airborne Dust Conc. at 2 Mins., Particles/Litre ~0.3 Micrometres	Mass Removal Efficiency for One 40-Second Vacuuming	**Max. Mass Removal Efficiency After Multiple 40-Second Vacuumings**
Portable Vacuum, Plain Tool, Empty Bag	34,992	23.7	51
Portable Vacuum, Agitator Head, Empty Bag	35,310	62.6	N.A.
Portable Vacuum, Plain Tool, 10% Full Bag	20,162	24.2	N.A.
Portable Vacuum, Agitator Head, 10% Full Bag	2,910	59.2	N.A.
HEPA Vacuum	23,905	57.4	81
Central Vacuum, Plain Tool	15,819	65.3	67
Central Vacuum, Agitator Head	5,685	65.3	close to 100
Professional Carpet Shampooing	N.A.	62.3	N.A.

Project Manager: Don Fugler
Research Report: Effectiveness of Clean-up Techniques for Leaded Paint Dust (1992)
Research Consultant: Saskatchewan Research Council

A full report on this research project is available from the Canadian Housing Information Centre at the address below.

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