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## Carpet and Wall Discoloration: Suspected Causes, Prevention, and Clean-up

### **Introduction**

Discolored areas on carpet and walls have been reported to the NAHB Research Center's ToolBase hotline and other sources from locations throughout the United States. Discoloration is characterized by localized darkening of the original color of walls, carpet and other interior surfaces. Carpet discoloration often occurs at the perimeter of the room and along the base of doors. The discoloration of walls can be diffuse, or appear as "ghosting" - a darkened line along the studs in the walls.

Discoloration is caused by accumulation of small particles that are present in the air of homes. Vacuuming or washing usually cannot remove discoloration. However, professional cleaning equipment with enzyme based agents has been shown to be effective at removal on some cases of carpet soiling.

Identification of the particles that cause discoloration is limited and requires expensive laboratory testing. Researchers of the discoloration problem have identified compounds typically found indoors and outside of homes. Examples include particles from tobacco smoke, candle smoke, wood-burning smoke; from dust, such as drywall dust from construction, normal house dust, and dust from household projects such as sanding, grinding, and finishing; and air-borne particles such as pollution, organic material, automotive exhaust, and road dust.

### **Suspected Causes**

The current thinking is that there is not a single cause of discoloration, but rather a combination of conditions that can hasten the discoloration process and visually accentuate the presence of accumulated particles. Conditions associated with carpet discoloration include particle source strength, air movement, attraction mechanisms, and cleaning practices. These variables described in more detail help explain why discoloration occur occasionally and randomly.

First, there has to be some mechanism to move the particles to a location where they will be concentrated enough to become visible. Air movement and temperature gradients are present in every home to some degree. These mechanisms cause attraction of airborne particles to exterior walls or leakage points in the home. When particles are drawn to a leakage path, for example at the base of a wall, the carpet can act as a filter that retains the particles. Over time the particles build up and become visible. Ghosting on the walls, where the studs show as a shadow, can happen when there is a difference in wall surface temperature between the stud and the wall cavity

areas. A wall's thermal characteristics, construction practices, and climatic conditions influence wall surface temperatures.

Second, a light color background makes discoloration more visible. Deposition of particles occurs everywhere and is detectable earlier and discoloration is more dramatic with lighter color carpet and walls.

Third, cleaning patterns, while themselves probably a less important variable than the other suspected mechanisms, are also believed to be a contributing factor. Poor cleaning practices will result in more available particles to contribute to discoloration.

Understanding the suspected causes of carpet discoloration is important in deciding how to fix an existing problem or how to prevent one in a home you are building or planning to build. Except as noted below for extreme cases of ghosting caused by temperature differences (usually associated with steel framing that was not built in accordance with industry recommendations for a thermal break on outside walls), the recommendations for carpet discoloration will also address wall discoloration.

### **Prevention in new homes**

Discoloration of carpets and walls is likely occurring in all homes, but the risk of a serious case may not warrant significant changes in conventional practice to prevent it. However, there are some steps that can be taken to address the suspected causes of discoloration:

Minimizing particle sources by the homeowner:

- Eliminate or reduce tobacco smoking from the home;
- Eliminate or reduce candle burning in the home;
- Minimize the use of solid fuel burning appliances, since they have the potential to produce soot.
- Avoid automotive refinishing, woodworking, and other dust producing activities.
- Minimize running of automobiles in attached garages.
- Use fan hoods during cooking.
- Clean and vacuum on a regular basis. Use crevice tools to clean against baseboards.
- Replace HVAC filters on a regular basis.

Minimizing particle source by design or during construction:

- Construct a tight duct system to minimize whole-house or local pressurization caused by unintentional leaks.
- Change the filter on the furnace prior to occupancy of the home. Don't use the HVAC system during construction activities that generate significant dust or particles.
- Use qualified contractors to install vented fuel-burning appliances, wood stoves, and fireplaces; and verify proper draft at the flue.
- Minimize air leakage from the garage to the home by sealing leakage points through walls or ceilings. Weather-strip doors and seal return ducts in the garage.

Reducing visibility of discoloration:

- There really is only one approach to addressing this variable - educate buyers about the benefit of darker colors. Let them know that discoloration can occur

and is impossible to predict. They increase the risk of encountering the problem when light-colored carpet is used.

- For walls, the option of a darker color is not usually an option. Focusing on source reduction and leakage paths is more likely to be effective on walls.

Avoiding mechanisms that draw particles to walls or leakage points:

- In the case of steel framing on exterior walls, provide a thermal break/continuous insulation across the exterior of studs to reduce the temperature gradient that causes ghosting on exterior walls.
- Minimize airflow through carpet caused by HVAC operation by
  - Undercutting doors or using a non-carpeted threshold in rooms that do not have a separate return duct.
  - Building as tight a duct system as feasible
- Avoid leakage routes that can contribute to discoloration. It is especially important to seal bottom plates adjacent to carpeted areas with sealant or adhesives. Other areas for sealing including the intersection of stair treads and risers.

### **Fixing an existing discoloration problem.**

After discoloration occurs, there are several repairs, change of occupancy patterns, and cleaning methods that can be implemented. Steps that have been effective in test homes are:

- Sealing air leakage paths by pulling back the carpet and applying caulking to seal the space between the sub-floor and the bottom of the baseboard or at other locations where the discoloration has occurred;
- Undercutting doors;
- Adjusting registers and furnace to reduce room-to-room air pressure difference;
- Changing of occupancy habits, such as reducing candle burning, reducing smoking, and reducing dust-creating activities.

Even if these steps reduce or eliminate the discoloration, the original discoloration will still present a problem. If the discoloration is severe, replacement of carpets may be the only option. A darker carpet may sufficiently address the problem. Likewise, repainting of walls that exhibit ghosting will likely be necessary. For less-severe problems, cleaning may be an option.

For carpet, a professional carpet cleaning service using a deep extraction machine with a dry enzyme-based powder has been successful in removing the discoloration in some cases. Spot cleaning can be problematic as well by causing additional color variation.

Keep in mind that replacing or cleaning carpets and repainting walls will only be successful in the long-term if the underlying particle sources and attraction mechanisms are mitigated.

For more information of carpet and wall discoloration, contact the ToolBase Hotline at 800.898.2842.