



Professional Specialty Cleaning: A Critical Element of Fungal Reservoir Control in Homes of the Immunocompromised and Hypersensitive

Eugene C. Cole

DynCorp Health Research Services, Morrisville, North Carolina

Abstract

As our population ages, and many persons with chronic diseases are living longer, threats to their health from biopollutant exposures in the home environment take on major importance. Opportunistic fungal infections are increasing, as are the number of individuals convalescing at home due to managed care and other factors. Individuals experiencing cancer chemotherapy, transplant recovery, and AIDS require clean living quarters to minimize the risk of opportunistic infections from undue exposures to environmental molds. A critical element of control will be provided by the trained, certified, professional specialty cleaner, who will meet the challenge of reducing fungal reservoirs by maximizing the cleaning of porous furnishings and hard surfaces, while minimizing dust resuspension and cleaning residues. With a working knowledge of indoor ecology and related pollutant reservoirs, and by using high performance equipment and effective cleaning products, the professional specialty cleaner becomes an essential component of the indoor environmental quality team.

Background

Infections from common indoor environmental molds such as *Aspergillus*, *Penicillium*, *Alternaria*, *Fusarium*, and *Rhizopus*, are increasing dramatically in HIV-infected and other immunodeficient persons (Ampel, 1996; Walsh, 1998). Those at increased risk for opportunistic fungal infections include those im-

munocompromised due to HIV infection, neoplasms, chemotherapy, transplantation, steroid therapy, and underlying lung disease (Nash et al., 1997; Teh et al., 1995). Children with neutropenia or prolonged antibiotic therapy are especially susceptible to infection (Shenep & Flynn, 1997). Species of *Aspergillus*, in particular, are recognized as significant emerging pathogens in persons with HIV/AIDS, causing invasive sinusitis and invasive pulmonary disease (Mylonakis et al., 1997; Nash et al., 1997). Many others are at risk for allergic hypersensitivity to inhaled microbes and animal proteins. And yet others are recognized as chemically hypersensitive, which makes the selection and use of cleaning chemicals a professional challenge.

Microbial Ecology

Each home environment supports a microbial ecology that can influence the quality of the indoor air. The indoor environment is an ecosystem comprised of an interrelated series of microenvironments, each of which can serve as a reservoir of microbial contamination, which if not controlled, can become a source of airborne pollution. Microbial reservoirs, such as wall-to-wall carpet, upholstery, mattresses, pet areas, and hard surfaces associated with moisture, allow pollutants such as mold spores and animal allergens to increase on a continual basis and potentially affect air quality. Recent research has shown that dusts from carpet, upholstered furniture, pet areas, and hard surfaces harbor more than 30 different types of fungi, representing the spectrum of potential opportunistic, allergenic, and

toxigenic molds (Cole et al., 1999). Dusts from upholstered furniture averaged 4.2×10^4 fungal CFU/g, including *Aspergillus fumigatus*, *Aspergillus flavus*, *Fusarium*, *Alternaria*, and others. Similarly, dusts from pet areas averaged 5.0×10^4 fungal CFU/g, to include *A. fumigatus*, *Alternaria*, *Penicillium*, *Fusarium*, and others. Likewise, dusts from nonwater-damaged carpets have been shown to exceed 1.0×10^5 fungal CFU/g (Cole et al., 1996). Critical in addressing the risks of opportunistic infection and respiratory hypersensitivity, in addition to moisture control, is the routine cleaning of carpet, upholstery, other porous materials, and hard surfaces by qualified individuals using high performance equipment and effective, nonpolluting cleaning products.

Professional Specialty Cleaning

Qualified individuals are those experienced in professional carpet and upholstery cleaning, who have received professional training and certifications, such as those of the Institute of Inspection, Cleaning, and Restoration Certification (IICRC). The IICRC (www.iicrc.org) is a nonprofit certifying and standard-setting body for the inspection, cleaning, and restoration industry, and has promulgated standards for Carpet Cleaning (IICRC, 1997), Upholstery Cleaning (IICRC, 2000), and Water Damage Restoration (IICRC, 1999). While technical training, certification, and experience in cleaning are mandatory, it is desirable that those cleaning the homes and other indoor environments of the immunocompromised and hypersensitive also have a working knowledge of indoor ecology and related pollutant reservoirs, including a basic understanding of the health conditions of concern and how effective, critical cleaning can reduce pollutant reservoirs and potential exposures.

High performance cleaning equipment is required. This equipment has been quality engineered using the finest materials, its performance has been rigorously tested and documented, and it is backed by the manufacturer's warranty and a strong user-support system. Effective, nonpolluting cleaning products are those that have been formulated and tested to provide maximum cleaning while protecting and preserving the materials to be cleaned, as well as minimizing residues and volatile organic compounds.

Cleaning Practices and Recommendations

Cleaning is the activity of removing contaminants, pollutants, and undesired substances from an environment or surface to reduce damage or harm to human health or valuable materials. Cleaning practices for residences of the immunocompromised and hypersensitive must:

1. Maximize the extraction of pollutants, while minimizing the introduction of moisture; and
2. Minimize the suspension of dusts and associated pollutants into the air, while maximizing their removal through the use of air-scrubbing HEPA filtration.

In regard to carpet, upholstery, and hard surface floor cleaning procedures, the following equipment is recommended in addition to the standard cleaning equipment:

1. A high efficiency vacuum cleaner for prevacuuming, with a new, double-walled disposable inner bag that retains fine particles down to $0.1 \mu\text{m}$, in addition to a multiple filtration exhaust system that includes a final HEPA or ULPA filter; and
2. High-volume, portable, commercial HEPA filtration units, with a charcoal prefilter that can operate during the cleaning procedures to help minimize the airborne suspension of pollutants.

It is desirable that HEPA air filtration units be left running in the home after the cleaning is completed for at least 48 hours to maximize the removal of airborne pollutants and promote acceptable air quality. Recommended airflow for a HEPA unit, and the length of time the unit should optimally operate in each area of a home with or without use of air movers to enhance drying, requires an applied research study. It is essential to remember that all equipment, cleaners, and other materials brought into the indoor environment of an immunocompromised or hypersensitive person must be very clean, with no crossover contamination from other homes or cleaning jobs.

It is recommended that a professional home cleaning be carried out at least 1 week prior to the arrival of the immunocompromised individual. While cleaning may continue to be done on the basis of need or frequency (such as two or three times a year), it is crucial that other means of maintaining the indoor environ-

ment and controlling fungal reservoirs be implemented routinely by persons other than the convalescent. Comprehensive and practical recommendations for home moisture control and reservoir reduction, including topics such as relative humidity, water damage, heating and air-conditioning systems, building materials, track-in, hard surface cleaning, air filtration, and others, have been developed (Cook et al., 1999).

Effective Communication

It cannot be overemphasized that the most important point in conducting professional specialty cleaning in the home of an at-risk person is at the very beginning, when the cleaner and the customer communicate effectively. Each shares important information necessary for proper decision-making. The customer must discuss his or her cleaning needs, while the cleaner discusses his or her cleaning procedures, equipment, and chemicals, all within the context of the specific illness or sensitivity of concern. Appropriate decisions can then be made regarding the best cleaning approach and related options (use of antimicrobials, deodorizers, etc.). The cleaner must be very knowledgeable about product ingredients and be prepared to modify the carpet, upholstery, and hard surface cleaning procedures, if necessary, without compromising the overall cleaning goal.

Future of Professional Specialty Cleaning

As the elderly population increases, the parameters of managed care increase the number of home convalescents. Simultaneously, chronic and infectious diseases and therapies place more and more persons at risk for opportunistic infections and hypersensitivity reactions. The need for professional specialty cleaning in such indoor environments will continue to grow. In this regard, the professional cleaner becomes an essential component of the indoor environmental quality team.

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