

---

## **NOT ALL REMEDIATION IS THE SAME**

### **Improving the Environment for Sensitized Individuals**

Part 2 of 2

---

The first part of this article dealt with our growing awareness that when certain individuals become ill from the contaminants in a water-damaged-building (WDB), their bodies develop sensitivity to those specific pollutants, as well as to other compounds. And it explained why it is crucial for both restoration contractors and the impacted people to know how to approach such problems so that any remediation or ancillary cleaning has the best chance of success. Covered previously:

- Looking for Mold-Related Health Answers in all the Wrong Places
- Medical Science Explains Some Anecdotal Data that Occupants and Remediation Professionals Have Long Puzzled Over
- What Does this Mean to Occupants and Remediation Contractors?
- Proper Removal of Fungal Sources is Not Rocket Science—But Must be Science Based

We'll take up here where Part 1 left off.

### **The Basics of Source Removal When There are Sensitized Occupants**

Proper isolation, engineering controls, and work practices must be employed on every project focusing on contaminant removal from water-damaged buildings because bad remediation can be worse than no remediation at all. Activities that disturb sources of biological growth and distribute bacteria, spores, fragments, and byproducts such as mycotoxins into the air where they can migrate to other areas of the structure must be done under controlled conditions. While failure to understand or follow this standard of care may create some problems for the average individual, conducting such work without proper controls can literally create a life-threatening situation for one who is genetically susceptible or previously sensitized to contaminants from water-damaged buildings.

Although entire books have been written on proper remediation,<sup>6</sup> a typical project involving individuals who have known or suspected mold sensitization utilizes these sequential steps:

- A. Isolation from the rest of the structure of the specific work area where visible or hidden contamination will be removed, utilizing sheet plastic or other materials sealed tightly against structural components.
- B. Sealing off of supply and return air ducts for the duration of the remediation effort.

- C. Installation of a decontamination chamber that acts as both a transition zone between the contaminated work area and the rest of the structure and a device that controls the amount of air flow into the workspace.
- D. Creation of negative pressure inside the isolated workspace through the use of exhaust fans. In most cases the exhaust air is pushed through HEPA filters before being exhausted out-of-doors in order to create a pressure differential of 0.02" of water column (equivalent to 5 pascal).
- E. Minimization of spore deposition through HEPA vacuuming or sealing of visible mold with adhesive plastic prior to disturbing the visible colonies.
- F. Careful planning of the demolition aspects of the work so that sections of drywall or other finish material are kept small enough to fit into bags without having to be broken.
- G. Requiring individuals working inside the isolated area to wear protective suits with hoods, slip-on safety boots, gloves, and respiratory protection is an important means of preventing cross-contamination. When the workers remove those items in the decontamination chamber it keeps contaminants from being carried into other areas of the building.
- H. Utilization of dust free demolition techniques, such as panel saws with a dust collection cowl around the blade, connected to a HEPA-filtered vacuum for cutting of plaster or drywall.
- I. A work sequence that follows the air flow, generally starting at the decontamination unit and finishing at the area closest to the negative air machine.
- J. Immediate bagging of debris and careful attention to frequent cleanup of dust with a HEPA vacuum.
- K. Wiping plastic bags of debris at the entry to the work area and then double bagging the material in the decontamination unit into bags that have never been inside the work area.
- L. Transport of double bagged debris out through occupied areas of the structure in solid containers with tightfitting lids, such as Rubbermaid garbage cans.
- M. Thorough cleaning of the isolated work area following the removal of all contaminated materials, using the "HEPA sandwich," a three-step process consisting of HEPA vacuuming, damp wiping with an antimicrobial, and a second HEPA vacuuming.
- N. Air scrubbing for 8 to 24 hours following completion of removal and cleaning activities. During this air scrubbing one HEPA-filtered unit should be used to maintain negative pressure, with a second unit set up inside the isolated work area with an exhaust tail to diffuse the air.
- O. Post-remediation review of the work area by means of a thorough visual inspection, collection of air samples with proper analysis, and comparison of data to a stringent evaluation criteria.<sup>7</sup>

## Dealing With the Often Forgotten Transport Mechanism

Although it seems difficult for the layperson to imagine, many remediation projects in water-damaged buildings emphasize sealing the supply and return vents in the isolated work area with poly sheeting and then simply allow the plastic to be removed after successful sampling results are received. No testing or cleaning of the register vents, ductwork, or mechanical components of the heating, ventilating, and air conditioning (HVAC) system is ever considered. Given that the microscopic particles that cause so many problems for sensitized individuals are present prior to the remediation effort, the default position should be to consider all HVAC mechanisms to be contaminated and in need of cleaning rather than being ignored.

Proper cleaning of HVAC systems is a sub-specialty, even in the remediation field. While many service providers claim to clean ductwork, few have the equipment and experience to do it well when the work is part of a remediation process in a water-damaged building with sensitized individuals. A thorough understanding of the cleaning guidelines put out by the National Air Duct Cleaners Association (NADCA) is a bare minimum starting point.

Above and beyond the basics, sensitized individuals require a thorough cleaning of the HVAC system that typically involves isolation of all supply and return points. Negative pressure is then installed at the mechanical unit, with the preferred method being a van- or truck-mounted filtration device connected to the HVAC unit by a long flexible duct. One at a time, starting at the supply and return vents farthest from the mechanical components, the grilles are uncovered and cleaning brushes, wands, or other specialized equipment is inserted into the ductwork. This process dislodges contaminants and pushes debris and microscopic impurities downstream, where it can then be sucked to the outside capture device in the specially-equipped vehicle.

Duct cleaning in the homes of sensitized individuals adds a number of complexities that are not present in the typical project. There is significant debate in the HVAC cleaning industry about the practicality and effectiveness of cleaning flexduct (polyethylene tubing that has spiral wire ribs in it—like a Slinky toy—that allow it to expand and contract). For occupants suffering from biotoxin illness or other sensitivities that are triggered by microscopic contaminants, it is best to remove and replace flexduct as part of the cleaning process. Such clients should also have the fan and coils actually disassembled from the unit. Although this requires the use of a licensed mechanical contractor, it allows those critical pieces to be taken outside and thoroughly cleaned, while enabling access to inspect and completely sanitize the drip pan and associated piping.

If the main trunk lines are constructed of fiberglass duct-board rather than sheet metal, a thorough cleaning will roughen the interior surface. Unless addressed at the time of the cleaning, the damaged interior will shed more particulates when the system is used and provide many more areas where moisture can be trapped and support future fungal growth. Therefore, as much as excess chemical use is avoided in homes with sensitized individuals, this is one situation

where application of a low odor, EPA-approved coating inside the ductwork is imperative as part of the cleaning process.

The use of spray or gaseous sanitizers in ductwork as an adjunct to cleaning is also controversial. For sensitized individuals, the general industry preference is to avoid adding additional chemicals to the HVAC system—even those that are expected to quickly break down to inert materials. As noted in the remediation section, the focus of the cleaning should be on removing the small particulates to as low a level as practical, not on killing or inactivating the contaminants.

### **The Contents Conundrum**

Despite many statements to the contrary, most contents from water-damaged buildings can be salvaged and cleaned to the point where they are safe for even the most sensitized individual. Therefore, the more relevant question is not whether the contents can be cleaned, but, can the contents be cleaned thoroughly at a price that makes it financially feasible?

Two key pieces of information need to be reviewed when dealing with contents: the type of material to be cleaned, and whether the contamination is actual biological growth or rather deposition of spores and fragments. This means that sorting and inventory are the main tasks at this step in the remediation operation. The following table, summarized from a more detailed article,<sup>8</sup> describes many of the techniques currently available for addressing contaminated contents for sensitized individuals, and provides a great starting point for the sorting.

Type of Material	Type of Contamination & Suggested Cleaning Techniques	
	Spore Deposition	Visible Growth
<u>Porous</u> Fabric, paper, upholstered furniture, clothing, etc.	Air washing for documents, HEPA sandwich cleaning (HEPA vacuum, hot water extraction with drying and HEPA vacuum), dry cleaning (chemical residue may be a significant problem), specialized laundering such as Esporta	Disposal and replacement unless high value, then specialized restoration such as freeze drying papers and HEPA sandwich clean, specialized cleaning of furs, etc.
<u>Semi-porous</u> Raw wood, furniture, etc.	HEPA sandwich cleaning, HEPA vacuuming with stiff bristle nozzle; may also include surface sealing after cleaning and inspection	Disposal and replacement if structural damage or significant rot; scraping, scrubbing, sanding, or abrasive blasting if surface contamination followed by HEPA sandwich cleaning
<u>Non-porous</u> Metal, plastic, glass, sealed wood, etc.	HEPA vacuuming, wet wiping, washing, power washing, air washing, air blasting	HEPA vacuuming, scrubbing, immersion washing, ultrasonic cleaning, power washing, air washing, air blasting, steam cleaning
<u>Specialty items</u> Paintings, photos, electronic goods, taxidermy displays, sculpture, artwork, oriental rugs, etc.	HEPA vacuuming in conjunction with air washing; disassembly, cleaning with deionized water, drying	Professional, specialized restoration

Cleaning of non-porous items is fairly straightforward. Soft goods pose a greater challenge because contaminants can become infused throughout the entire item. The more layers that make up the porous item or the bulkier the material, the more difficult cleaning and verification of the cleaning become. The ever-increasing variety of fabrics and materials that are used for soft goods compounds the problems because certain cleaning techniques are only appropriate or effective for specific materials.

Fortunately, there are some proven technologies for dealing with contaminated contents. One technique that has been demonstrated to be effective is known as the HEPA sandwich. This process involves three steps, with vacuuming being the first and last activity. In between, some form of wet cleaning is utilized, such as damp-wiping, washing, or hot water extraction. While this HEPA sandwich approach has been used extensively for cleaning non-porous or semi-porous building surfaces, it has also been employed successfully for a number of porous materials. For example, carpet that is impacted by deposition of mold spores but is not supporting visible colonies of fungal growth has been efficiently cleaned by HEPA vacuuming before and after a professional hot water extraction of the floor covering. Thousands of pieces of upholstered furniture have also been successfully saved using this method.

The concept of specialized laundry systems to remove contaminants is only about a decade old. It is a rethinking of the standard agitator or tumble washing processes that characterize most top- or front-load washing machines. The primary innovation that led to the term *specialized laundry* was a machine intended to clean sports equipment, known as the Esporta Wash System. This piece of equipment was designed to use hydraulic water pressure rather than agitation as the primary means of forcing cleaning solution through materials.

Once the inventors were able to get complete penetration of multilayered soft goods, they needed to match the physical cleaning action of the water with neutral pH cleaners to preserve washed materials. Since much of the malodor associated with dirty sports equipment comes from bacterial contamination, the Esporta system was engineered to force antimicrobial compounds through dense products like foam-padded hockey gear. As it turns out, this process produces an incredible kill rate for microbial contamination in many items, including those that are constructed of both hard and soft materials. This claim is not simply sales hype from the manufacturer. The Esporta Wash System has been subjected to a number of independent tests to determine the cleaning effectiveness of the process, and multiple studies have demonstrated impressive efficacy dealing with contaminated soft goods.<sup>9</sup>

An often overlooked aspect of content cleaning is the sequencing and transportation of goods. If the same truck that was used to take the contents from the contaminated building is used to return the cleaned goods, without the interior of the truck being thoroughly decontaminated, all the cleaning efforts may be for naught. Whether the contents are cleaned on site or at a dedicated facility, how they will be moved and where they will be stored are critical questions that need to be answered before the work begins.

## Removing the Reservoirs

Perhaps the most common error affecting sensitized individuals who go through a mold control process is the determination of whether or not cleaning is necessary in areas of the structure outside the isolated remediation work area. While detailed cleaning of an entire structure may not be necessary for individuals who are reacting to the water-damaged building with a typical allergic response, additional cleaning is almost always necessary for those who are suffering from biotoxin illness.

The fact that mold and other contaminants were growing in the structure to the point that it triggered or exacerbated a health problem, means that contaminants and reservoirs exist in other areas of the structure. This was graphically demonstrated by the EPA through the development of their Environmental Relative Moldiness Index (ERMI) sampling process. Their studies showed that a good indication of whether any structure had suffered water damage could be obtained from a single dust sample of the flooring.

Building on that government work, there is a growing body of evidence from carefully controlled medical studies that dust samples can be used to predict health concerns for sensitized occupants. One well-known physician, Dr. Ritchie Shoemaker, has even identified core components of an ERMI sample that specifically correlate with health. He compares ERMI-style dust sample results to a score sheet to provide his patients with information about whether a particular space is suitable for their occupation. This process is now migrating to an evaluation of the structure following remediation.

Despite not being high-tech, the primary method of removing reservoirs of contaminants from building surfaces is detailed cleaning. Every square inch of the surfaces in the structure are cleaned using HEPA vacuums (sealed and tested with a particle counter to ensure that they are not spreading dust around rather than collecting it), microfiber cloths, and carefully selected cleaning agents. This work is supplemented by air washing (directing compressed air across the surfaces toward an exhaust fan) and air scrubbing (recirculating air through a HEPA-filtered device). Sometimes fogging with water or non-toxic solutions is also utilized to help lift particles from surfaces and give them greater mass so that they are more easily captured.

## **A Word About Ozone**

A number of contractors are now pitching the process of “treating mold in place” with high levels of ozone instead of removing contaminated materials in a controlled and careful way. They have expanded their promotion to include ozone flooding of structures after remediation as “insurance” against problems from hidden sources. This is bad for normal occupants and could be devastating for the sensitized individual. This approach is so far out of bounds that the New York City guidelines use this pretty clear language:

*The use of gaseous, vapor-phase, or aerosolized (e.g., fogging) biocides for remedial purposes is not recommended. Using biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold.*

Other documents from the American Conference of Governmental Industrial Hygienists (ACGIH), the Restoration Industry Association (RIA), and the Institute of Inspection Cleaning and Restoration Certification (IICRC) say the same thing. Several of them specifically call out ozone as being inappropriate for mold remediation, particularly when it is used as a stand-alone technique.

## **Putting It All Together to Protect the Sensitized Person Who is Trying to Heal**

There is no doubt that the relationship between water-damaged buildings and health effects is complicated. But this has been the case with every material that was eventually determined to be a hazardous contaminant. There will always be more to learn. Nevertheless, it is important to work intelligently with the existing information even as we strive for better data. This is especially true when many of the corrective action steps that can be employed have a proven track record with real-world success in helping sensitized individuals recover their health and lives.

At times, the process of trying to deal with a water-damaged environment that needs to be occupied by a sensitized person can seem overwhelming. In those moments both the occupants and the contractor chosen to assist them should drop back to the core concepts related to remediation for people with special sensitivities:

- There is a connection between many significant health symptoms and contaminated environments that is not explained by the dose/response relationship.
- Proper remediation must go beyond source removal and deal with residual contamination in the HVAC system, on contents, and on surfaces outside the isolated work area.
- At a minimum, remediation practices must follow the standard of care and then plus-up from there to address the special needs of the occupants.
- Attention to detail in all aspects of the work is crucial. A small gap in a barrier or an item missed in the cleaning process could trigger a significant reaction.
- Everyone should be clear on a specifically-defined endpoint for each phase of the work before it begins.

Having a detailed project plan and an individual that acts as a central coordinator for the effort is one way to help such projects proceed smoothly. By the very definition of a sensitized individual, such projects that assist them are not routine. Even so, a thoughtful approach and a strict focus on completing each step properly can restore buildings to the point where medical intervention can be more effective in resolving health issues and giving these suffering people their lives back.

## References

1. “Germ Culprits in Moldy, Water-Damaged Buildings Identified”; Health.usnews.com; June 22, 2012.
2. “How Our Buildings Are Making Us Sick”; *Forbes* online; August 8, 2012.
3. Cox-Ganser, Jean; “NIOSH Field Studies on Dampness and Mold and Related Health Effects”; 6<sup>th</sup> International Bioaerosols Conference, September 6-9, 2011.
4. California Department of Public Health; “Statement on Building Dampness, Mold, and Health”; September 2011.
5. Pinto, Michael A.; “Medical Evidence Connecting Mold Exposure to Illness Continues to Build”; *Cleaning & Restoration*, Nov/Dec 2011.
6. Pinto, Michael A., Wonder Makers Environmental; *Fungal Contamination: A Comprehensive Guide to Remediation*; 2008.
7. Pinto, Michael A., Mike Davis, Sara Eager; “Mold Clean-Up Projects—Post-remediation criteria are crucial to success”; *Professional Safety*; November 2004.
8. Wonder Makers Environmental; “Recommended Cleaning Practices for Materials Potentially Contaminated by Mold”; July 2001.
9. Stull, Jeffrey O., International Personnel Protection, Inc.; “Evaluation of the Cleaning Effectiveness and Impact of Esporta and Industrial Cleaning Techniques on Firefighter Protective Clothing - Technical Report”; May 10, 2006.

## About the Author

**Michael A. Pinto** currently serves as Chief Executive Officer of Wonder Makers Environmental, Inc., a manufacturing and environmental consulting firm that specializes in identification and control of asbestos, lead, IAQ, mold, industrial hygiene, and chemical problems. He has more than 30 years of safety and environmental experience from jobs in the private sector, the non-profit arena, and regulatory agencies. He completed doctoral course work in environmental engineering and holds numerous certifications in the environmental and safety areas, including Certified Safety Professional and Certified Mold Professional. In addition to being a frequent speaker at industry events, Michael has been honored with such prestigious awards as the Golden Quill, Martin L. King Award, the Phoenix Award for Innovative Restoration from the Restoration Industry Association, and the President’s Award from the Environmental Information Association. Michael can be reached at 269-382-4154 or [map@wondermakers.com](mailto:map@wondermakers.com).

**This article was published in the August 2014 issue of *The Journal of Cleaning, Restoration & Inspection*.**