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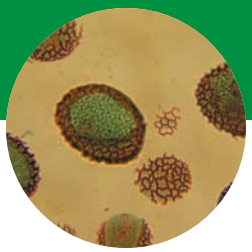

By Michael A. Pinto, CSP, CMP

Cleaning Contaminated Contents: The Neglected Aspect of Remediation — Part 2

Last month I began this series by discussing some of the challenges of cleaning contaminated contents and emphasizing that proper cleaning is a process that needs to be integrated into the overall approach of the restoration contractor. Oddly, the worldwide response to the H1N1 (swine) flu pandemic actually strengthens the case for understanding both content and surface cleaning as a process.

From the earliest days of the "swine flu crisis," health officials emphasized that mitigation involved changes in both personal habits (hand washing, etc.) and cleaning techniques. Our changing world is the primary rationale for restoration and cleaning contractors to look at both traditional approaches to cleaning soft goods and some of the newer techniques that I categorize as *specialized laundry*.

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Traditional Industry Approaches to Soft Goods

As mentioned previously, cleaning of non-porous items is fairly straightforward. It is the soft goods that 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.

Nevertheless, there are a number of tried and true cleaning technologies and approaches to dealing with contaminated soft goods that have been verified through sampling by safety and health professionals. These approaches are primarily based on the type of loss. For example, in a fire loss a number of cleaning techniques are considered acceptable alternatives. Soft goods that are damaged by soot and smoke odors can often be cleaned by a combination of HEPA vacuuming, detergent washing, commercial laundering, dry cleaning, chemical deodorization, and oxidation through exposure to ozone gas or hydroxyl radicals. The existing options for sewage-contaminated items, contents recovered from flooded structures, or those exposed to residue from trauma incidents is much less extensive with disposal and replacement being the current standard.

Fortunately, there are some emerging technologies for dealing with contaminated contents. One technique that has been popularized by the mold remediation industry is a cleaning technique 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 such as damp-wiping, washing or hot water extraction is utilized.

While this HEPA sandwich approach has been used extensively for cleaning non-porous or semi-porous building surfaces, it has also been used successfully for a number of porous materials. For example, carpeting 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 salvaged using this method.

Cleaning and treatment options from other industries are finding their way into the restoration field. Radiation in the form of ultraviolet light has been used in healthcare facilities for decades to assist in sterilization of equipment and surfaces. Although there are reports of some attempts to use ultraviolet light to decontaminate soft contents, its benefits are restricted to the surface of the objects, limiting its usefulness.

In a similar fashion, many chemical treatments are used to remove smoke odors, biological contamination and staining. The multitude of formulations available to assist with this process can be bewildering as the chemical cleaning agent must be matched with both the material to be cleaned and the contaminant.

Dense or multi-layered soft goods pose additional problems as the chemical treatment must penetrate at least as far as the contaminants have. This is more difficult than it may seem at first glance, as contaminants carried on flood waters or through the heat action of a fire can work their way to the very depths of a pillow, cushion, teddy bear, boot, sleeping bag, or similar bulky item.

Since heat and water movement are two major players in carrying contaminants deep into soft goods, many restoration professionals consider the combination of heat and water in the form of steam to be the perfect decontamination media. This has taken on greater interest since the development of specialized steam cleaning systems for hard surfaces such as restroom equipment and tile floors. However, two practical difficulties keep steam from being effective on soft goods. Since much of the heat energy of steam is dissipated on contact, it takes considerable temperature or pressure to enable the steam to thoroughly penetrate multi-layered items. And the consequence of high temperatures or pressure is the potential for damage to the surface of the article.

Power washing is frequently used to decontaminate non-porous contents such as lawn furniture, folding chairs, shelving units, hand tools, and the like, but the pressure and spray pattern of such systems generally produces too much destruction if directed at soft goods.

A New Approach Known as Specialized Laundry

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 washing system intended to clean sports equipment, known as the Esporta Wash System. This machine 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 multi-layered 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 a mixture of 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. Multiple studies have demonstrated impressive effectiveness dealing with contaminated soft goods.[3] Matching these test results, which consistently show a near total kill rate of bacteria on washed items, with anecdotal data from the machine operators and their customers provides numerous lines of evidence that support the claim of removal of fire residue, odors, and other contaminants. The deep penetration of water and chemicals allows for the cleaning of otherwise un-washable items.

A review of the Esporta Wash System shows that both laboratory and real world tests have been conducted:

2004 - Laboratory test of antimicrobial properties of wash additive

2005 - Laboratory test of sports equipment

2005 - Laboratory test of firefighter gear

2006 - Field study of cleaning effectiveness on firefighter gear

2007 - Study of sewage-contaminated soft goods

2008 - Unpublished study of blood-borne pathogens

Using the Sewage Study as an Example

While a number of rigorous tests have been conducted on the Esporta system and are available for public review, the author was personally involved in one of those efforts. Therefore, the 2007 testing of sewage-contaminated items is used as a case study to demonstrate the potential

of specialized laundry systems.[4] The study involved collecting samples to be analyzed for bacteria from a variety of contaminated fabric, leather, and padded soft goods before and after cleaning in the Esporta Wash System.

Carefully measured squares were cut through every layer of the representative items before and after wash cycles, and were evaluated for concentrations of *Enterococcus*, total coliforms, and *E. coli* bacteria to determine the percentage of reduction in bacterial load. Those three specific bacteria types were chosen for analysis because they are the ones most commonly used to assess the presence of sewage contamination. Many industries use this combination of microbial types because they serve as indicators of the presence of pathogenic organisms that are found in human and animal waste.

Due to the expense of laboratory tests and the variation that occurs in the level of contamination from project to project, and even item to item, the study was also designed to determine if a simple quality control test could be completed by cleaning technicians to regularly validate the process. As such, field verification methods were tested on a side-by-side basis using a Hygiena SystemSURE II ATP hygiene monitoring system. This device uses special swabs to measure total biological residue using a non-destructive method that has been used for on-site quality assurance at food service and pharmaceutical manufacturing facilities for years.

The results of the study showed that under the machine's extra heavy wash settings, the Esporta Wash System is more than 98 percent effective (100 percent effective in most cases) at removing *E. coli*, *Enterococcus*, and coliform bacteria from a wide range of fabrics and padded items. Just as important, only one padded item showed any evidence of possible cross contamination during the various wash cycles tested for padded items and fabrics.

A strong correlation between laboratory data and the ATP sampling results was observed. Given that the few discrepancies identified between laboratory and field test results for fabric and padded items recorded false positives that would require recleaning, it was further concluded that ATP monitoring is an effective tool in field verification of the effectiveness of sewage contamination removal in items laundered with the Esporta Wash System.

Because the sewage study is just one of many studies produced by a variety of independent authors and labs that all reported consistent outcomes, we are in a position to take the case study and apply it to the big picture. If the proper use of specialized laundry systems results in a near total removal of a wide range of contaminants, then contents now being disposed of can be saved, producing a win-win-win situation (*i.e.*, owner-insurance carrier-contractor).[5]

Practical Implications Point toward a Process Approach

As noted in the first part of this series, handling contaminated contents is a sizeable and complex challenge. While the extent of the potential market and prospective savings to the industry make contaminated contents a challenge worth accepting, the complexity of dealing with thousands of disparate items and utilizing multiple cleaning procedures clearly indicates that a detailed process is necessary in order to successfully complete each job. However, implementing a process requires pre-project planning and appropriate training, as well as the acquisition and set up of necessary equipment.

For organizations that want to deal with contaminated contents or improve their existing services in this area, trying to identify and develop specific procedures to deal with each type of contamination can be a daunting task. Fortunately, there are universal precautions and procedures that can be used as a starting point for handling all types of contaminated contents, and which then allow minor adjustments to the program to accommodate specific types of materials. For simplicity's sake I have condensed a summary of these essential precautions into a list that I have dubbed "The Dozen D's" which will be explained in detail in the next two issues of *Cleaning & Restoration* magazine. ■

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References

[3] For example, see *Evaluation of the Cleaning Effectiveness and Impact of Esporta and Industrial Cleaning Techniques on Firefighter Protective Clothing — Technical Report* by Jeffrey O. Stull of International Personnel Protection, Inc. published May 10, 2006.

[4] *Evaluation of the Esporta Wash System for Cleaning Sewage-Contaminated Soft Goods* by Wonder Makers Environmental, Inc., September 2007.

[5] The potential is quite amazing. One year of industry figures (2008) collected from Esporta users resulted in the following monetary values (in millions of U.S. dollar equivalents):

Value of contents impacted	$11.6 M
Contents cashed out	2.7 M
Value of cleaned contents	8.9 M
Cost of cleaning	1.9 M
Total savings	$ 7.0 M