CLEANING CONTAMINATED CONTENTS

The Neglected Aspect of Remediation

A Large and Complex Challenge for Restoration Professionals

The challenge of properly dealing with damaged contents is present in just about every loss. The cumulative effect is quite astounding from a monetary standpoint with the latest available estimate of the annual cost of damaged contents in the U.S. from fire and floods at 2.7 billion dollars[1]. Nor does that represent the total cost. Unfortunately, getting an estimate of the cost of contents damaged from sewage backflows and trauma incidents is difficult because many of those losses are not covered by insurance. As State Farm insurance company bluntly states in their website factsheet entitled *Reduce sewer and drain losses in your basement:*

> Each year, sewer and drain backups cause millions of dollars in damage to the homes owned by State Farm® policyholders. State Farm homeowner policies do not cover losses incurred from sewer or drain backup.

Cleaning of hard non-porous contents that are subjected to fire and smoke damage, flooding, sewage backflow, or blood borne pathogens is fairly straightforward. However, considerably more time and effort is expended on the cleaning of soft contents to the point where cash out of such materials has become the norm for the industry. The difficulty in salvaging soft contents is related to both the concerns of the contractors as well as the claimant and other individuals involved in the restoration process. Specifically the difficulty in salvaging soft contents is related to four different concerns:

- Anxiety of the contractors about their ability to properly clean a wide variety of items.
- Hesitancy of safety and health professionals to document that the cleaning was conducted appropriately.
- Perception of the claimant that such items cannot be restored.
- Reluctance of insurance adjusters to undertake cleaning rather than cash-out if the insured is going to resist accepting the items.

Dealing with fire, flood, sewage, or blood contaminated contents raises a host of safety and health questions for both the contractors responding to the situation and the occupants who must live with the consequences of decisions made in the field. Because of the wide variation in cleaning effectiveness of standard processes for such losses (such as onsite vacuuming and hot water extraction or off site cleaning using standard laundry or dry cleaning techniques) it has been difficult for restoration professionals to determine if such impacted contents have been

properly cleaned without destructive testing or massive testing protocols. As such, the response to such losses has generally involved the cash out of any soft goods or porous materials which are damaged in such cases. While this conservative approach does protect the occupants, it is expensive and wasteful if a proven alternative is available.

Know Your Enemy

Sun Tzu, the great Chinese military strategists who wrote *The Art of War*, advised that the individual who "knows his enemy" is more successful in battle. This counsel is certainly applicable to the restoration professional who wants to provide safe and cost efficient content recovery services to clients following a fire or similar loss. In this case, the enemy is not human, but the odorous and hazardous residues that permeate valuable contents after they have been exposed to unexpected circumstances.

While there are general similarities between handling contents that are contaminated by fire, flood, sewage or trauma incidents there are important differences as well. For example, fire and smoke contaminants include soot, carbon particles, polynuclear aromatic hydrocarbons (PNAs), corrosives (such as nitric and hydrochloric acids), sulfur compounds, aldehydes, and vaporized metal residues. Many of these compounds combine to create the universally recognized smoke odors and discoloration that is so typical of fire damaged materials. In contrast, sewage contaminates are primarily biological in nature. Nearly 100 different types of disease causing viruses have been identified in sewage including rotaviruses, the hepatitis A virus, and adenoviruses. Bacteria, the other main class of biological contamination found in sewage, also have a diverse representation in typical household waste water. Bacteria types such as Escherichia coli (often referred to as E. coli), salmonella (as many as 1,700 different types), and a variety of shigella species are typically found in samples collected from sewage sources.

Floodwater contaminants are a veritable "witch's brew" of widely varying contaminants depending on the location and cause of the flooding. Extensive environmental studies conducted by the Federal Emergency Management Association (FEMA) to assess the impact of hurricane Katrina on New Orleans showed that most flood damaged contents were contaminated with bacteria, mold, heavy metals, pesticides, and oil[2]. In contrast, trauma scene contaminants are more similar to the hazardous materials found in sewage as the blood borne pathogens are primarily viruses (hepatitis strains, TB, HIV, etc) and bacteria (Coliforms, Enterococous, etc.)

Content Cleaning Is a Process

This extreme variety in contaminants, from objectionable but nonhazardous odors to life threatening viruses, is what makes dealing with contaminated contents so challenging. If we build on the thinking of these contaminants as the enemy then Sun Tzu's further advice to never under estimate your opponent can be valuable. Regardless of the type of loss or physical

appearance of the materials, professional restoration contractors should have standardized procedures in place for properly dealing with contents which protects the workers handling the objects as well as the valuables themselves. Treating all contents from loss situations as if they are contaminated also means that the transport vehicles and the facility where the items are cleaned and processed are also protected.

An additional benefit to adopting a comprehensive process for contents which treats them as if they are contaminated is that it opens up the range of services that a restoration contractor can offer. With minor adjustments to meet the various regulatory requirements for employee training, a well thought out content processing system could be used for other types of contamination such as asbestos, bird droppings, illicit drugs like methamphetamines or cocaine, bed bugs/dust mites, lead, mold, and public outbreaks of avian flu or Norwalk virus.

Recap

I began 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 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*.

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 multilayered 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 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 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[4] is used as a case study to demonstrate the potential of specialized laundry systems. 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 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% effective (100% 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,[5] producing a win–win–win situation (*i.e.*, owner–insurance carrier–contractor).

Practical Implications Point toward a Process Approach

As noted at the beginning, 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".

The Dozen D's of Cleaning Contaminated Contents

We have looked at the issue of cleaning and restoration contractors dealing with the contents of the rooms or buildings in which they are working, and, although many contractors have standardized operating procedures for pack-out or onsite cleaning of contents following a fire or water loss, many do not appreciate the range of contaminants that can be found on the contents. This ignorance puts their team members at risk, and the company, too, as returning contaminated items to a facility can be a substantial liability.

The first part of this article focused on the different types of contaminants that can impact contents, particularly those that damage soft goods. I introduced the concept of specialized laundry and discussed some studies that were conducted on contaminated soft goods that were cleaned using the Esporta system. This final part lays out specific precautions that cleaning and restoration contractors need to consider when dealing with contaminated contents. I have dubbed these precautions "The Dozen D's."

1. Defend workers involved in the cleaning process against contaminants
2. Develop content cleaning capabilities and programs
3. Determine if contents are contaminated
4. Decide on the cleaning location

5. Demarcate the items to be processed
6. Divide contents by porosity and contamination
7. Deduce appropriate cleaning methods
8. Deliver contents safely to the cleaning facility
9. Dedicate necessary time and resources
10. Decontaminate the contents through proper cleaning
11. Demonstrate that the contents are clean
12. Document the process and outcome

1. Defend workers involved in the cleaning process against contaminants

Of primary importance when an organization wants to deal with contaminated contents is the protection of the individuals who will be doing the work. Both American and Canadian worker safety rules require employers to assess expected hazards and provide appropriate training and personal protective equipment.

But defending workers against safety and health hazards is more than just following government mandates. It is taking a "Safety First" attitude from the beginning steps right through to the conclusion of each project. It is simplifying procedures whenever possible so that every job is approached in a consistent way. For example, many restoration contractors realize that there are numerous actual and potential hazards related to restoration projects regardless of whether they are the result of fire, water, sewage or specific contaminant like trauma residue, mold or asbestos. Therefore, they have borrowed an approach from the blood borne pathogens regulations and mandate the use of basic personal protective equipment such as gloves, smocks, safety glasses and filtering facepiece respirators for all technicians dealing with contents during any restoration work.

Appropriate employee training in such circumstances cannot be over emphasized. At a minimum, safety regulations require training in basic hazard avoidance and the appropriate use of personal protective equipment. If the services are going to branch out into the areas of trauma scene cleanup, processing of asbestos-contaminated materials, removal of lead dust contamination, or work with other regulated materials the general training has to be supplemented with mandated awareness training.

Medical evaluations of personnel are also an important defensive measure. The use of respiratory protection triggers an annual medical evaluation to ensure that respirator use is not going to aggravate some preexisting health condition. The blood borne pathogens standard requires certain inoculations for individuals who will be routinely exposed. While these initial inoculations are critical, so, too, are the mandated follow-up booster shots.

2. Develop content cleaning capabilities and programs

The most frequent mistake I encounter when assisting organizations with salvaging and decontamination of contaminated contents is the fact that they begin the work without appropriate planning programs in place.

Written procedures for crew members to follow are critical. Nevertheless, written procedures are useless if they require the use of equipment, engineering controls, or supplies that are not available to workers. Consideration must be given in the programs to ensure that critical equipment and supplies are available at field locations as well as the primary cleaning and storage center.

Critical planning is necessary to develop an appropriate flow for contaminated contents that may be moved from job sites to a central processing area. Some of the key questions (and recommendations) that help organizations develop appropriate content cleaning capabilities include:

- How are the contents going to come into the facility? (A separate entrance is best. If that is not possible then special controls will have to be utilized during the pack out so that the contaminated contents arrive at the cleaning location in sealed containers with proper markings that note the cleaning station to which they should be delivered. The containers should also have clear markings that indicate the type of contamination on the objects so that cleaning staff utilizes the proper protective equipment and cautions.)
- Will contaminated contents have to be moved through clean areas to get to the cleaning station? (Designated travel paths should be clearly marked if contaminated contents must move past uncontaminated goods or areas. Secondary containment in the form of covered carts or bins is recommended in addition to properly sealed and labeled content containers.)
- What engineering controls will be installed to protect the operators of fixed equipment such as an Esporta wash system or ultrasonics tank? (Special consideration should be given to observing the airflow patterns in a building where cleaning is to occur. The optimum setup is to have a downdraft system at points where operators handle or load contaminated items. Such systems push clean air down past the operator and then collect it at their feet where it is exhausted or filtered before returning to the indoor air. Another approach is to have a ducted exhaust fan above the work station to remove contaminants. Although this protects the rest of the facility it may mean that the operator has to wear personal protective equipment as the contaminants would be pulled up from waist level across their breathing zone.)

- What containers will be used to transport potentially contaminated contents? (Hard sided containers work better than bags as there is less likelihood of leakage. If cardboard boxes are utilized sealable plastic bags or liners should also be part of the process.)
- Will sorting of items for specific cleaning procedures be done at the job site or at a central processing area at the cleaning facility? (Because of the variety of contents that can now be cleaned, different techniques such as specialized laundry, ultrasonic immersion, disassembly and cleaning with deionized water are often part of the same project. If possible, it is best to "tag and bag" items at a loss site with the proper information so that they can be containerized and directed to a specific cleaning station.)
- Which engineering controls are going to be utilized to minimize cross-contamination of both solid materials and airborne particles? (Isolation barriers, walk off mats, and HEPA filtered air scrubbers are some of the more common engineering controls employed to keep contaminated contents from negatively impacting the main facility. Because these are fixed locations, many organizations have opted for solid isolation barriers with doors rather than polyethylene plastic which demands frequent attention. If plastic isolation barriers are utilized they should be secured with mechanical fasteners such as Smart Seal strips rather than duct tape or other adhesives that degrade with time and temperature.)
- What types of contaminated contents are going to be accepted for processing? (Many insurance companies and individuals involved in a loss want to utilize organizations that can offer turn-key services. As such, it is often beneficial to cultivate professional working relationships with organizations that have complementary processes. For example, many restoration contractors that have laundry facilities work with specific dry cleaners to handle contents that cannot be suitably washed. In a similar fashion, mutually beneficial arrangements can be made with organizations that have ultrasonic cleaning equipment, expertise in cleaning electronics, and have invested in an Esporta wash system, etc. Contractors should also consider reaching out to licensed asbestos abatement professionals and lead remediation firms so that they can deal with the full range of hazards until they grow to the point where they can bring these specific capabilities in house.)
- How do we know when we have successfully completed cleaning contaminated contents? (It is imperative that every member of the organization that is handling contents knows what the specific ending criteria are for a particular contaminant before work begins. Even if part of the evaluation criteria is subjective, such as invisible stains or odors, crew member training in determining an acceptable endpoint is crucial so that contents are processed consistently. It is also important that the client be educated about the endpoint of the cleaning process so that they know what to expect once the work has been completed. See #11 of the Dozen D's for more details regarding this situation.)
- Should we utilize the services of a content restoration specialist to help us design and manage the content cleaning portion of our business? (There are a number of highly

qualified experts, such as the consulting group Total Contentz, that are dedicated to helping restoration contractors deal with contents effectively and efficiently. While the utilization of such experts involves an upfront cost the value that they bring to an organization committed to providing a wide range of services in this area can pay back the initial investment many times over in the form of more efficient work processes and effective marketing.)

3. Determine if contents are contaminated

To some, this third step may seem self-evident. Regardless of the type of loss there is some type of potential contamination. Separating the potential from the actual is the real difficulty. For example, what contaminants are involved? In a fire loss contents may have actual fire and heat damage, soot deposition, smoke odors, water saturation, and bacteria or mold growth if there was a delay in getting to the contents. There could be further complications if an asbestos-containing "popcorn" ceiling was brought down by the fire. Other concerns may involve lead residue from fire-damaged paints and plumbing fixtures, mercury from broken fluorescent bulbs, or PCB deposition from exploded ballasts or transformers.

To some, considering all the potential sources of contamination may sound like overkill for a straightforward loss. Unfortunately, our society is increasingly litigious and restoration contractors are not immune from the bite of an attorney. In one case where we provided technical information, the plumber involved in a restoration project was successfully sued for $152,000. This award was intended to cover the cost of cleaning asbestos from an entire house after the plumber broke up less than two dozen floor tiles in order to install a new floor drain. Because of the concern of cross-contamination of asbestos fibers from the damaged tiles, sampling was conducted throughout the structure. Of 17 dust samples asbestos was only recovered on one – and in minute quantities!

A large number of restoration contractors are also unfamiliar with the fact that lead is still used in many plastic and vinyl items, in addition to being a component of older paints. Lead is still added to some plastics as a stabilizer, mostly by foreign manufacturers. Continued exposure to sunlight causes this plastic to break down or "chalk", leaving a fine lead dust on the surface. This lead contamination is most pronounced in mini-blinds and computer cables, with some mini-blind dust found with levels of lead up to 66,000 micrograms per square foot (ug/ft^2), or 1,400 times the EPA allowable limit for dust on floors! These products pose a real risk for workers handling contents as one industry survey found lead in 23 out of 27 computer cables tested and that after handling the cords for ten seconds the skin on the hands and fingers also tested positive for lead.

Once the suspected contaminants are identified it is important to consider how the contents became contaminated (*e.g.*, immersion, deposition, cross-contamination, etc.). Such information is invaluable in determining proper cleaning processes.

The level or concentration of contamination is also a key question. Items near the source of the fire or the floor drain where a backflow occurred may have obvious signs of contamination. What about items in other rooms or on other floors? Evaluating the travel patterns of first responders and the initial salvage efforts by the owners can give more clues to determining how many contents have to be addressed. Don't forget that a proper response may involve segregation of items so that contents with minimal contamination or those with potential for contamination are treated on site while the more significantly impacted items are subjected to more rigorous decontamination.

4. Decide on the cleaning location

Like most aspects of content cleaning, deciding on a cleaning location is determined by a number of variables. If cleaning is to be conducted on-site what engineering controls will be necessary? Do the conditions of the building and the weather permit such work in a manner that provides for the safety of the workers and supports high quality work? For example, very cold temperatures minimize the effectiveness of wet cleaning and put workers at risk of hypothermia. Projects where the utilities have been cut and portable power must be provided often suffer reductions in both efficiency and quality because many temporary power sources limit the use of electric equipment such as HEPA vacuums which have to be balanced with providing heat and light.

Another alternative is to move the contents to a separate location such as a warehouse, storage unit, trailer, or on-site container like those provided by POD. Such an arrangement can be very effective for large losses where multiple rooms of contents are being processed. For small to medium size losses such as apartments, single family homes and small commercial shops the rental cost as well as the soft cost of double handling of the contents make on-site decontamination or cleaning at a permanent facility more feasible.

That brings us to the third option, processing the contaminated contents at a shop or permanent cleaning facility. As discussed in items 1 and 2, special engineering controls and procedures are necessary if you are going to bring contaminated contents into your existing facility. While such changes constitute a significant upgrade, in many cases the reality is that most restoration contractors are already bringing contaminated materials into their workplaces without proper controls.

5. Demarcate the items to be processed

Regardless of whether contents are going to be processed on site, at a separate location, or at a permanent cleaning facility, having a system to track each item and proper records to support the

system is the centerpiece of proper processing for both contaminated and uncontaminated contents. A wide variety of inventory control systems are available from an assortment of suppliers. Most use barcodes and photos along with customized software to speed up the process. It is beyond the scope of this article to lay out the specifics of various inventory control systems that have been developed specifically for dealing with contents, but it is my opinion that restoration contractors are much better served by reviewing the existing programs and purchasing one than trying to develop their own from scratch.

In addition to a coding and tracking system other basics are sometimes overlooked. Having the proper packing materials and boxes of uniform size makes it easier to treat each loss the same way. Segregating the contents into lots for packing and processing has many benefits. The primary advantage comes after the contents have been decontaminated. Having contents in identifiable batches protects the contractor from having to re-clean every item if some representative samples collected from the processed materials fail to meet the agreed upon post-cleaning criteria.

The value of the batch system is further enhanced if separate sealed areas or containers are used for each batch. This also allows for better control of environmental conditions throughout the process. Remember, even the cleanest items will support bacteria and mold growth under the right conditions.

6. Divide contents by porosity and contamination

The sixth "D" in our process is to divide. After assessing the scope of the loss, determining the types of contamination and preparing an inventory system to use at the project site, the contents need to be divided by porosity and type/level of contamination.

Are the contents porous, semi-porous, non-porous, or mixed? Does the loss involve clean water or gray/black water? Is the amount of contamination heavy or light? Has anyone done a thorough assessment of the loss, particularly the contents? Often this task is left up to the cleaning/pack-out contractor as a close examination of every item is usually not done, even by an inspector. In addition, many inspectors do not address microscopic contamination by deposition that is not visible to the naked eye.

Since sorting and inventory are the main tasks at this step in the operation, many successful contractors use a two-step process that involves a "red, yellow, green" approach as well as a simple chart. A gross determination is done as part of the initial response where items with visible contamination or in the immediate vicinity of the loss are flagged as at-risk or red items. They are stacked or packed separately and marked for decontamination. Items that are close to the loss, but not in the same room or area, are designated as caution or yellow. These items are separated and later given a thorough evaluation to determine if they are contaminated and which

cleaning process would be most appropriate. Items that do not appear to have visual contamination and are geographically separated from the areas of loss are treated as uncontaminated or green items. They are still subjected to additional evaluation to ensure that the visual assessment is correct and are generally the first items that can be returned to the client.

7. Deduce appropriate cleaning methods

Given enough technical information, deducing which cleaning methods are best for each class of contents should be a fairly simple effort – or is it? The variety of methods available means that there can be more than one right answer. The goal is not just picking a process that works, but matching cleaning methods with end goals and setup considerations. This also involves consideration of the overall cost effectiveness of a particular cleaning process, including deliberation on transportation (more on this later).

For example, contractors are often faced with making a decision about whether clothes or other impacted contents should be washed or dry cleaned. And now they should consider specialized laundry systems such as Esporta, as well. The cleaning method selected will not only depend on the type of contents and the type of contaminants but also the contractor's capabilities and partnership arrangements. Another key consideration is whether one system or cleaning process can be used for a wide variety of items. The savings in soft costs of sending all contents to a single site for cleaning can make a real difference in the ultimate success of a project through lower transportation costs and coordination efforts.

A word of caution is necessary, however, in regards to certain classes of contaminated contents. Sending artwork, photographs, musical instruments, high end electronics like big screen televisions, oriental rugs, and critical documents to companies that specialize in those items is definitely worth the extra effort involved as the value of such goods and the risk of damage from improper cleaning places a significant risk on the contractor who offers one stop shopping.

8. Deliver contents safely to the cleaning facility

Discussions about delivery always involve tracking and chain of custody issues. Digital photos of the loss site and each individual item coupled with a bar code labeling system can be linked to specialized software that accelerates the pack-out process without creating inventory control nightmares.

Contaminated contents require additional transportation efforts such as dedicated closed containers (*e.g.*, rolling laundry or Rubbermaid bins) to minimize the spread of cross contamination. Even transport vehicles should be scrutinized and selected based on easily cleanable interior surfaces or those outfitted with temporary polyethylene sheeting protection. Some contractors have instituted a process of vehicle decontamination following the transport of contaminated items using technology like the Biomist system on regular vehicle interiors.

The same precautions need to be taken with storage vaults, using specific ones with appropriate protection for transport of contaminated goods, and cleaning them before they are returned to regular service. A number of contractors have sped up the cleaning process by painting the inside of their wooden vaults with anti-microbial coatings.

9. Dedicate necessary time and resources

This "D" may seem self-explanatory, but it is surprising how many contractors don't dedicate enough time and resources to implementing the detailed plan that they developed. They underestimate the manpower, equipment, supplies, and oversight necessary to process large quantities of household or commercial goods under difficult field conditions. Before taking on a project with contaminated contents look at your current capabilities, workload, and partnerships and ask: "Do we have the staff, equipment and supplies to do it right?"

10. Decontaminate the contents through proper cleaning

You have a plan and have chosen the perfect combination of appropriate methods to decontaminate the contents; now it is time to execute. The adrenaline is flowing and real work is about to begin. It is at this stage that a reality check is in order. Have you answered the three basic questions crucial to all such projects and communicated those answers to your crew?

- WHY are we cleaning?
- WHAT is it we're trying to remove?
- How do we prove that it is WORKING?

Now is the time to double check and ensure that you have done a thorough assessment and are not cleaning items that are more efficiently replaced. Confirm that you know the hazards your team is facing and are prepared to deal with them. And make sure that everyone involved knows your ending criteria before you start the project so that they can all work with a purpose in mind.

This is also a great time to make sure that you are operating within government and industry guidelines. For some contaminants such as visible mold on porous materials, cleaning rather than disposal is still considered to be outside the standard of care. In a similar fashion, treatment (as opposed to cleaning) using processes such as ultraviolet germicidal irradiation (UVGI), ozone, chlorine dioxide, hydroxyl-radicals, and other non-traditional methods is not wise, despite aggressive sales pitches.

11. Demonstrate that the contents are clean

There are a number of steps that can be used to confirm that you accomplished the task of appropriately cleaning contaminated soft goods. At a minimum this process involves a detailed,

thorough visual inspection by the contractor. However, since many of the contaminants that we've discussed throughout this series of articles are microscopic in nature, a visual inspection may not be enough. Even an olfactory inspection – a fancy term for the sniff test – may not be good enough as residual biological contamination such as viruses and bacteria could be present on an item without producing an odor strong enough to be detected by smell.

In such cases, some form of sampling is necessary. When cleaning contents, the contractor has the choice of performing in-house sampling, utilizing the services of an independent third party, or both. The size and scope of the project, as well as the region of the country where the work is being done, are the primary factors in determining whether post-cleaning sampling should be done in-house or by a skilled consultant. Regardless of who does the sampling, the cleaning and restoration contractor must understand the criteria that will be used to evaluate the samples *before* the cleaning begins. If a third party is going to be used this may pose some difficulties since the consultant may not have been chosen at the time the work begins, or they may be reluctant to share their methodology for determining if the contents have been returned to a pre-loss condition. Beware! Generally, the reluctance of a consultant to share specific details regarding their criteria for evaluating cleaning projects means that they probably don't even have an objective measuring stick but prefer to fly by the seat of their pants based on their "experience". Such an approach is a recipe for disaster since the contractor can be held to a floating standard after the work has been completed.

Most restoration professionals know that having a clear scope of work with a defined endpoint has a whole range of benefits, including improved project efficiency, reduced liability, smoother project close-out, and fewer callbacks. But without the comfort of federal or state regulations to guide remediation efforts, when can a contractor say that contents are clean? In such work environments it is critical for contractors to understand the importance of doing *something*. Research the areas into which you are expanding and follow the consensus points in the standard of care. Choose an independently developed comparison criteria and be consistent with internal project evaluation. Develop internal procedures that use a multi-step process including a thorough visual inspection, appropriate post-remediation quality control sampling by the contractor and, if necessary, verification inspection and sampling by a third party. One example of an independent guideline for determining if sewage-contaminated contents are properly cleaned has been published in a number of industry journals under the title *Baxter/Pinto Guidelines for Verification of Water Restoration Effectiveness*. (A copy can be found at the website www.wondermakers.com, Education→Articles.)

12. Document the process and outcome

Our final D is the one that many contractors find most onerous: documentation. But documentation does not have to be difficult. Most of the necessary information is probably

already being collected and just needs to be properly organized as part of the project file. Typical items of documentation when handling contaminated contents include:

- Before and after photographs
- Work logs
- Detailed visual inspection reports
- Sample results
- Complete reports, including signatures, related to third party verification

Conclusion: Cleaning Contaminated Contents is a Process with Multiple Steps

With the advent of new equipment and processes for cleaning contaminated soft goods restoration contractors and consultants are now in a position to offer fact-based advice following traumatic situations like floods, sewage backflows, and even fires. Still, overcoming obstacles while saving both dollars and valuable memories requires careful planning and adherence to rigorous standards during a post-decontamination evaluation.

From a project management standpoint cleaning and restoration contractors must ensure that setup, equipment, personal protective equipment, and work practices all mesh together into an effective process that protects both workers and the recovered items. No amount of cost savings is worth a worker's short-term injury or long-term illness. Therefore, developing a detailed processing plan before a project begins is crucial.

Developing such a plan allows an experienced consultant or contractor to lay out detailed, measurable objectives for the project. Since there are currently no federal, state, or provincial mandates for evaluating the effectiveness of cleaned contents, communication of an objective endpoint to all involved parties is key to a successful outcome. In short, know your endpoint before you begin.

To ensure that all parties understand the goals of the project, cleaning and restoration professionals should get written confirmation that the client agrees to the plan. Safety and health professionals should also work with restoration contractors to understand their capabilities so that as a team they can choose decontamination techniques that will achieve the objectives. In this way, the military adage "plan your work, work your plan" can be made a reality.

After using good judgment in a cooperative approach to selecting an appropriate cleaning process it is the responsibility of both the consultant and the contractor to use both laboratory and field methods to verify the effectiveness of the work. In larger cases it makes sense to utilize an objective third party to document the entire process as well as the outcomes. With billions of dollars at stake and new technologies like the Esporta Wash System to assist with the cleaning of sewage-contaminated contents, restoration, cleaning, and insurance professionals can take the

lead in protecting individuals while helping to return a sense of normalcy to the lives of individuals traumatized by substantial losses. This is truly a win-win situation.

NOTES

1. Cost estimates were compiled from two sources. Fire/smoke damage figures are from the 2005 NFPA estimate of direct damage from fires. 20% of the total for fire damage was assigned to contents for an estimate of approximately $2.0 billion. Water/flood damage estimates are from the 2003 U.S. National Weather Service report with 30% of the total estimate for loss assigned to contents (*i.e.*, $0.7 billion). Note that different years were used to compile the total since 2005 is the latest year for which NFPA estimates are available, but that was the year of hurricanes Katrina and Rita, which skewed the estimate of flood damaged contents substantially higher. As such, 2003 figures for flood damage were matched with the 2005 fire damage figures to produce a cost average for a more "normal" year. The proportion of the damage estimates assigned to contents (*i.e.*, 20% for fires and 30% for floods) is based on discussions with a number of industry experts who concur that, in general, costs for structural damage as compared to contents are more extensive in fires than in floods.
2. See *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report; Building Performance Observations, Recommendations, and Technical Guidance* released in July 2006 as FEMA publication #549 for details regarding the types and levels of contaminants identified in flooded houses.
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

About the Author

Michael A. Pinto *currently serves as Chief Executive Officer of Wonder Makers Environmental, Inc. He has more than 30 years of safety and environmental experience from jobs in the private*

sector, the non-profit arena, and regulatory agencies. Michael is the author of five books, including Fungal Contamination: A Comprehensive Guide for Remediation, over 150 published articles, and 18 commercial training programs. He can be reached at map@wondermakers.com.

This article was published as a four-part series in the May, June, July, and August 2009 issues of *Cleaning and Restoration* magazine.