EMERGENCY MANAGEMENT

3-6 Emergency Salvage of Wet Books and Records

INTRODUCTION

Bound volumes and loose records are perhaps the longest-lived and most successful means of communicating information. As a result, they may be found in almost every institution. Over the course of their long and useful lives, these materials may suffer water damage from a variety of sources. Leaking pipes or roofs, flooded basements, and open windows are the most common, and most easily contained, of the small emergencies. Large events may include natural disasters such as hurricanes, flooding from heavy rains, water discharge at high pressure from fire hoses, and major construction accidents.

Whatever brings water in contact with your materials, the post-exposure recovery of books and records can be successful and cost-effective. Preparing staff and management ahead of time is the best way to achieve this. If recovery actions and decisions are delayed more than 48 hours, deterioration of materials accelerates, and recovery becomes a major undertaking; funds for recovery must be diverted from other projects, service is interrupted, and public relations suffer.

Successful disaster management consists of four elements: assessing and mitigating risks, writing a plan, the initial response to a disaster, and long-term recovery efforts. This leaflet will focus on response and recovery but will be a useful document in writing a disaster plan as well. For more information on disaster planning, consult the NEDCC Preservation Leaflet 03-03 *Emergency Planning* at https://nedcc.org/03-03-emergency-planning.

INITIAL RESPONSE

The initial response to a disaster can be very stressful. If your institution is unprepared, even a small water emergency can spiral out of control to become a disaster. The period of initial response is a time for assessing the situation, collecting recovery materials, arranging for supplies and vendors, stabilizing the facilities, and packing up collections. Mapping salvage priorities in advance saves valuable time by preventing the need for high-pressure decisions regarding what should be saved first. Advice from a preservation or conservation professional can be helpful in making these decisions, especially if rare books or unique materials are involved.

Stabilizing collections and facilities as soon as possible makes for the most successful recovery from a water disaster. The priorities should be to remove standing water, reduce and stabilize temperature and humidity, and isolate and protect dry collections. If environmental conditions are not addressed after an event, mold can begin to develop in as little as 48 hours (and spread rapidly thereafter). Once mold is established, it can be difficult to control and eradicate. It may cause problems in a facility for months or even years—even after the recovery effort is concluded.

Before beginning any response efforts, the water source must be identified. Water will almost never be clean and free of debris. What has contaminated the water? Is the contamination due to pipe corrosion? Is it mud and debris from a flood? Is it salt water? Is sewage involved**? If the water is sewage-contaminated, call in a professional recovery service immediately; do not deal with the salvage in-house**.

If the water is contaminated by rust, mud, or salt water, then rinse wet books and records before freezing. This will help to remove debris that can be difficult to clean after drying. If trained labor and time are both available, set up three or four bins of clean water. Holding books tightly closed, dip them gently in the water. Moving each book from bin to bin will expose them to successively cleaner water while removing much of the debris. Over time, switch the last two bins for the first two, replacing the dirtiest water (in the first two bins) with clean water. Make these the bins for final rinses. If records are mud-covered, rinse by supporting the records on a piece of Plexiglas or other rigid, inert support and rinse with a gentle stream of water from a hose or pitcher. Do not rinse items if the inks are soluble; freeze items with soluble inks immediately, leaving debris on the item.

RECOVERY

Several drying techniques can be used for books and records that have been water damaged. For most recovery efforts, no single approach will be sufficient to the full variety of materials damaged. The selection of techniques will depend on the

- degree of wetness.
- the physical characteristics of the materials affected.
- expected use and retention.
- available funds for recovery.

Select the technique that will minimize physical damage (cockling of paper, warping of covers, and distortion of the binding) and bleeding of soluble inks and colorants. In the case of a burst pipe (for example), some wet materials may be frozen and sent to a professional recovery company for vacuum freeze-drying, slightly wet materials may be air-dried, and the affected area isolated, while the building, furnishings, and damp materials are dried by commercial dehumidification.

While stabilizing the environment, sort and treat wet books and records and according to degree of wetness. To estimate the degree of wetness, keep these categories in mind:

- **Dry** materials are often overlooked in a disaster. Despite their dryness, these materials should still be removed from the affected area if environmental conditions are not or cannot be addressed immediately. Otherwise, they will still be vulnerable to mold growth.
- **Damp** materials are cool to the touch. Exposed to high humidity, they can sometimes be identified after the event by mold formation.
- **Slightly wet** materials exhibit staining from water on the pages and/or on the binding or folder, typically extending no more than one-half inch in from the edges. These areas will have been in immediate contact with water.
- **Wet** materials exhibit staining from water that extends more than one-half inch in from the edges, up to saturation.

It is important to understand that no drying method restores collections to their pre-damage condition. However, if stabilization and recovery occur quickly, the materials can often be dried and returned to the shelves with little discernible damage.

Air Drying

Air-drying is the most common in-house method of dealing with water-damaged books and records. Air-drying is best suited to small numbers (fewer than 100) of damp or slightly wet books and documents. Because it requires no special equipment, it is easy to think of as an inexpensive method of drying. However, air drying is labor intensive, occupies a great deal of space, diverts many hours of staff time to regularly monitor the process, and often results in a distorted finished product. Due to the time required and the potential for mold growth, air-drying is not an option for large-scale disasters. Nor is it an option for collections of books with coated paper (e.g. yearbooks, science journals). The rehabilitation costs after air drying tend to be greater than other methods because most bound materials require some further form of treatment (from pressing to full rebinding), while many documents may need flattening and rehousing.

An additional consequence of air-drying is the increased shelf space that will be required for collections when they are returned to the stacks. Depending upon how successfully wet materials are stabilized and dried, the average amount of additional shelf space required after drying is 20%.

Air Drying Records

Air-drying is most suitable for small numbers of records that are damp or slightly wet. If there are hundreds of single pages, or if the records are wet, professional dehumidification, freezing, or vacuum freeze-drying will be cost effective and result in a better end product. As noted, wet documents on coated, or shiny, paper must be frozen immediately. If they cannot be frozen, separate the sheets in the stack immediately to prevent adhesion. Again, care must be taken with water-soluble inks as well. Records with running or blurred inks should be frozen immediately to prevent further loss. After the items are frozen, contact a conservator for advice and assistance.

If air-drying is settled upon as the preferred salvage method, use the following steps. Note that wet paper is extremely fragile and easily torn or damaged: handle these materials gently.

1. Identify a clean, dry, secure space where the temperature and humidity can be controlled. Reduce the relative humidity as low as is possible to prevent mold and improve drying capabilities.

2. Keep air moving at all times by using fans in the drying area. This will accelerate the drying process and discourage mold growth. Aim fans to direct the airflow parallel to the drying records. IMPORTANT: Do not point the fans directly at the records.

3. Single leaves can be laid out on tables, floors, and other flat surfaces protected by plain white paper towels or clean, unprinted newsprint.

4. If wet records are printed on coated paper—and there is no means to freeze them—they must be separated from one another to prevent them from sticking. This process can be tedious and will require skill and patience. Place a piece of polyester film on the stack of records. Rub it down gently on the top sheet, and then slowly lift the film while peeling off the top sheet at a low angle. Hang the polyester film up to dry on a clothesline. As the document dries, it will separate from the surface of the film, so it must be monitored carefully. Before it falls, remove the coated paper and allow it to finish drying on a flat surface as described in step 3.

5. Once dry, records may be rehoused in clean folders and boxes, or they may be photocopied or reformatted in other ways. Dried records will always occupy more space than ones that have never been water damaged.

Air Drying Books

Air-drying is most appropriate for books that are only damp or slightly wet. Books that are wet — and especially books that are saturated — should be frozen and vacuum freeze-dried to minimize cockling of the pages and distortion of the text block and binding.

Remember that books containing coated paper should be frozen while still wet and then vacuum freeze-dried. Books with running or blurred inks or colorant must be frozen immediately to preserve the contents.

1. Identify a clean, dry, secure space where the temperature and humidity can be controlled. Reduce the relative humidity as low as you can to prevent mold and improve drying capabilities.

2. Keep the air moving at all times using fans in the drying area. This will accelerate the drying process and discourage mold growth. Aim fans to direct the airflow parallel to the drying volumes. IMPORTANT: Do not aim the fans directly at the books.

3. If the book is damp or the edges of the book are only slightly wet, stand the book on end and fan it open slightly in a space with good air circulation, but again, do not aim fans directly at the books. To minimize distortion of the edges of the text block, place volumes in a press, or press under a board with a weight just before drying is complete. Paper- or cloth-covered bricks work well for weights.

4. If the book is slightly wet, interleave white paper towels (or clean, unprinted newsprint) approximately every 16 pages, starting from the back of the book, turning pages carefully. Do not interleave too much or the spine will become concave, and the volume distorted. A good rule of thumb is to insert no more than one-third of the number of text pages. Complete the interleaving by placing clean blotter paper inside the front and back covers. Stand or prop the book up to accommodate airflow. Change the interleaving and absorbent paper frequently. Turn the book from head to tail each time it is interleaved. When the book is damp, proceed as in step 3.

5. Dampness will persist in the book for some time (in the gutter, along the spine, and in the cover boards). Due to their thickness, the boards retain moisture much longer; mold is often found between the boards and flyleaves if the book is not allowed to dry completely. Check for mold growth frequently while books are drying.

6. When books are dry but still cool to the touch, they should be closed, laid flat on a table or other horizontal surface, gently formed into their original shape, and placed in a press or held in place with a board and weight. Press overnight and set up to dry during the day and repeat until books are dry. Make sure books are not returned to the shelves until thoroughly dry. Books with even some dampness can provide an environment for mold to develop, particularly along the gutter margin.

7. If you can establish an air-conditioned room capable of maintaining a constant relative humidity of 25% – 35% and temperature between 50° and 65°F, books with only wet edges can be dried successfully in approximately two weeks without interleaving. As stated earlier, exceptions are books printed on coated paper and those with water-sensitive media.

Dehumidification

Drying by dehumidification with large, commercial desiccant systems allows for drying damp (not wet) collections, equipment, and furnishings while those collections are left in place. Temperature and humidity are carefully controlled to specifications. This drying method has the advantage of leaving

damp collections in place on the shelves and in storage containers, eliminating the costly step of removal to a freezer or vacuum chamber. It is not recommended for coated papers or water-sensitive inks and pigments. The number of items that can be treated with dehumidification is limited only by the equipment and expertise of the company called in to install it. Dehumidification is most often used in conjunction with other drying methods and for stabilizing the building and environment. Home dehumidifiers are not strong enough to reduce a building's humidity and thus are not a viable option. This process is best accomplished by a vendor.

Freezer Drying and Vacuum Freeze-Drying

Books and records that are damp or slightly wet may be dried quite successfully in a frost-free or blast freezer. Leather and parchment/vellum bindings can be dried in this manner as well, if they are properly restrained. Expect this method to take anywhere from several weeks to many months, depending upon the temperature of the freezer and the extent of water damage.

Wet books and records as well as materials with water-sensitive inks and coated paper can be vacuum freeze-dried by a recovery vendor. See NEDCC Preservation Leaflet 03-12 *Freezing and Drying Wet Books and Records* for more information about both freezer drying and vacuum freeze-drying: https://nedcc.org/03-12-freezing-drying.

Freezing will cause more harm than water for some commonly held non-book materials. Do **not** freeze the following:

- Audio, video, and computer tapes – Air dry if just the outermost foot or two of tape is damp, or keep them wet until they can be sent to a professional recovery company.
- CDs and DVDs – Air dry in a single layer; rinse first if the water was dirty or salty.
- Ambrotypes, daguerreotypes, or tintypes – see NEDCC Preservation Leaflet 03-07 *Emergency Salvage of Wet Photographs* for guidance: https://nedcc.org/03-07-wet-photos.

Vacuum Thermal-Drying

It is possible to dry non-unique books and records—when materials are only slightly wet or wet—in a vacuum thermal-drying chamber. This process removes the water from the materials in the solid state, through the liquid, to the gaseous state. Because this process occurs in cycles, it introduces considerable distortion, and items will require flattening or rebinding. The freezing and heating cycle can result in a series of "tidelines" as well. IMPORTANT: This method is not recommended unless the materials have a short retention period.

CONCLUSION

Every cultural institution has collections of books and records, whether they are themselves historic—or for reference or administrative purposes. Creating an emergency preparedness and response plan before disaster strikes is the essential first step to successfully salvaging collections damaged by water or other disasters. (See NEDCC Preservation Leaflet 03-04 *Worksheet for Outlining an Emergency Response Plan* https://nedcc.org/03-04-response-plan.) Adding the skills and knowledge to salvage collection materials, as well as the knowledge to know when and who to call, will ensure even more collection items can be saved. Steps like these minimize damage to collections and make financial sense over the long and useful life of printed or paper-based material.

Further Reading

Connecting to Collections. (2013). *Salvage at a Glance*. http://www.connectingtocollections.org/wp-content/uploads/2013/03/10-Salvage-at-a-Glance.doc

Foundation for Advancement in Conservation. (2005). *Emergency Response and Salvage Wheel*. https://store.culturalheritage.org/site/index.php?app=ecom&ns=prodshow&ref=FAIC-1

Foundation for Advancement in Conservation. (2006). *Field Guide to Emergency Response* (videos of salvage techniques). https://www.youtube.com/playlist?list=PLH0WXCtI2noiqtbY6nN11P-qKbf04lp7t

Library of Congress Preservation Directorate. (n.d.). *Emergency Management: Response and Recovery.* https://www.loc.gov/preservation/emergprep/recovery.html

Library of Congress Preservation Directorate. (n.d.). *Risk Management: Insurance Valuation.* http://www.loc.gov/preservation/emergprep/insurancevaluation.html

Minnesota Historical Society. (n.d.). *Disaster Response and Recovery Resources.*https://mnhs.gitlab.io/archive/conservation/www.mnhs.org/preserve/conservation/floodresponse.html

National Center for Preservation Technology and Training. (2020, November). *Saving Wet Books After a Flood.* https://www.nps.gov/subjects/ncptt/upload/Preservation-in-Practice_Wet-Books_Nov2020.pdf

Newnham, M. (2005, September 19). *Disaster Recovery for Films in Flooded Areas*. AMIA Hurricane Relief. http://amia.typepad.com/home_movie_recovery/

Northeast Document Conservation Center. (n.d.). *24/7 Collections Emergency Hotline.* https://www.nedcc.org/emergency

Northeast Document Conservation Center. (2024, November 4). *Ask A Conservator Day 2024: How to Interleave a Bound Volume.* https://youtu.be/jtufRJaYqDA?feature=shared

U.S. National Archives and Records Administration. (2022). *Disaster Response and Recovery.* http://www.archives.gov/preservation/disaster-response/

U.S. National Archives and Records Administration. (2019). *Records Emergencies.* https://www.archives.gov/preservation/records-emergency

U.S. National Archives and Records Administration. (2018, August). Section 8: Records Disaster Mitigation and Recovery. In *Essential Records Guide.* https://www.archives.gov/files/records-mgmt/essential-records/essential-records-guide.pdf

Walsh, Betty. (2005). Salvage Operations for Water Damaged Archival Collections: A Second Glance. *WAAC Newsletter,* 27(3), 19-31. https://cool.culturalheritage.org/waac/wn/wn27/wn27-3/wn27-307.pdf

Acknowledgements

Original version © 2007 by Northeast Document Conservation Center. Updated and revised by Alyssa Magnone (2023).