

Floods, Fire, Mold, and Bugs: Disasters in Archives

A burst pipe or a hastily discarded cigarette can wreak havoc in archives, damaging or destroying records that are literally

irreplaceable. Emergencies

in archives like floods, fires, mold or pest infestations, as well as security breaches and criminal acts like burglaries, often cannot be prevented or predicted, but a small amount of thoughtful

planning can limit the severity of their effects.

This article addresses tasks aimed at preventing or limiting disasters and increasing security in general, and suggests certain reaction and recovery efforts once a problem or a disaster has occurred.

In this article we discuss three common archives disasters: water damage, fire damage, and pest infestation. For more information about responding to other potential problems, consult some of the resources listed below.

Major vs. Minor emergencies

Minor emergencies, generally, include those where only a small number of items are damaged, and those in which A.A. service workers and/or building management can be expected to contain the emergency and deal with the crisis without on-site assistance from disaster response experts and/or salvage professionals. The techniques described below generally are applicable to minor emergencies only.

Major emergencies may be defined as events in which 1) anything threatening to life or health occurs, 2) large numbers of documents or other materials are damaged, 3) very valuable materials are damaged, or 4) anything criminal, such as a break-in or burglary, occurs. If a major emergency occurs, you will likely have to call on emergency services personnel and/or professional disaster response companies, some of which are listed below, to assist in recovery efforts.

Plan Ahead

There are certain simple ways to plan ahead to help you be ready for an emergency:

- Create a current list of the telephone numbers of those A.A. service workers who would have to be called immediately in case of an archives disaster.

- Include also the local phone numbers for police, the building manager or landlord, the gas and electric company, fire department, a nearby hardware store, etc.
- Keep copies of this list in your home or car, so you will have a copy at hand when you need it.
- Keep paper copies of your archives index, inventory, or shelf list in your home or car.
- Make sure that only a few people have keys to the archives. Keep track of all keys, and change the locks if keys disappear.
- Plan ahead for a secure off-site location in which to temporarily store the collections, should a disaster occur.
- Each time you visit the archives, when you arrive, check the room for potential problems: water-damaged ceiling tiles or other signs of water leaks, exposed wiring, evidence of rodents or other pests, obstruction of AC or heating vents, etc.
- When you leave the archives, make sure fans and lights are off, close and reshelve all the boxes you've been working with, etc.
- Purchase supplies that will help with disaster response, label them well, and store them in the building where the archives are stored.



This book was destroyed by insects, one of a number of threats facing archival holdings.



Flood waters in 1997 inundated this storage room at a Records Centre of the Archives of Ontario in Canada, causing irreparable damage.

PHOTO USED WITH PERMISSION OF THE ARCHIVES OF ONTARIO.

Supply List for Disaster Recovery

Primary Supply List: Have a supply of these items on-hand, and know where they are:

Plastic sheeting/tarps	Mops
Rubber/cloth gloves	Tools
Plastic tubs and buckets	Trashcans
First aid kits	Plastic trash bags
Flashlights	Boxes
Brooms	Milk crates
Ladders	Fire extinguisher

Secondary Supply List: May be necessary depending on the disaster event:

Fishing Line/Clothesline	Squeegees
Plastic clothespins	Work lights/Utility lights
Soft brushes	Cleaners
Pallets	Masks/Respirators
Fans	Hard hats
Dehumidifiers	Generators

Prioritize for Recovery and Evacuation

Establishing priorities is never a simple task, but it is imperative to identify important collections before a disaster so that they can be protected or removed in a timely manner during or after a disaster. Trying to make selection decisions in the course of an emergency will almost certainly result in misjudgments and the loss of critical time.

In addition to prioritizing, it is highly recommended to duplicate vital records and relocate them off-site. Copying important records periodically and keeping them in remote storage is one of the best ways to prepare for a disaster.

Ranking Collections for Evacuation — The following are some considerations to keep in mind when prioritizing collections:

- Inability to replace – do duplicates exist?
- Value in supporting the mission of the archives.
- Fragility of the medium, e.g. film or magnetic tape.
- Monetary value.
- Kind of disaster or length of exposure time (for example, a film-based collection exposed to fire or high heat would be a low priority because most would be unsalvageable anyway).

Mark Top Priority Items for Removal — Marking items before a disaster occurs will make for quicker and easier removal of materials from the disaster site. Special acid-free flags for books, or color stickers for manuscript boxes, with different colors signifying the relative importance of the item, could significantly speed their evacuation. But don't create a permanent mark on an archival item.

First Steps to Stabilize the Situation

While all emergencies are different, the following list contains some suggested first steps to think about when you discover a disaster in your archives:

- Arrange security for the building or area.
- Ensure, by consulting with emergency services personnel or facilities crews, that there is no danger of a gas leak, and that there has been no contamination by sewage, toxic chemicals, or asbestos.
- Mold can be extremely toxic to humans. If the presence of mold is suspected, provide masks or respirators for all who enter the storage facility. (Note that it takes 48-72 hours after a flood for mold to develop.)
- Determine what resources are needed for salvage: labor (volunteers, facilities or security staff, custodial staff); work space; supplies and equipment; freezer space, if necessary; professional disaster recovery assistance.
- Document all stages of response photographically and with a written journal. Use a video camera and/or digital camera to film damaged areas.
- If boxes are taken off the shelf in order, keep a record of that order.
- Avoid stacking cardboard boxes more than 3 high, as they may collapse, especially if damp.
- Whenever possible, use pallets, pallet movers, and fork lifts.
- Handle objects only with rubber gloves.

Water Damage

The most common emergency in archives involves water. Almost all archives emergencies will involve some kind of water damage: burst pipes, roof leaks, sprinkler system malfunctions, fire response, and storm damage to roofs or windows. It's advisable to find out if the building where the archives are stored is coded as a flood plain.

Because mold and mildew may begin to develop within 48 hours, knowing how to respond appropriately to water damage is very important. Above all, common sense and a calm and thoughtful approach are the best response. All materials (film, sound recordings, books, manuscripts, photographs, etc.) are very fragile when wet and require extreme care in handling.

- The electricity may need to be turned off in affected areas. Consult with the power company and facilities management before entering a flooded area. Use caution in flooded areas that might contain electrical cables, exposed wiring, circuit-breaker boxes, etc.
- Diminish the potential for mold growth by reducing the temperature and humidity to the lowest levels possible, and by promoting air circulation using fans. All paper-based materials will mildew in air within 48 hours if the temperature is above 65° Fahrenheit, and relative humidity is above 65%.
- Switch off, divert, or sandbag the water source, and/or cover places where water is entering.

- If water is coming from overhead, as with a burst pipe, cover the affected items with plastic sheeting to prevent further damage. Do not place items on the floor.
- Move collections from lower to higher shelves if water is rising.
- Plan for mud removal, if necessary: get a hose and find a source of clean water for rinsing, remembering that the mud may be contaminated.
- Raise objects out of water.

Step-by-Step Recovery/ Packing Procedures

When you're ready to begin the recovery and salvage process, study the condition of the collections carefully and note your priority materials for removal. Think about dividing the materials into rough categories, such as: 1) items requiring immediate attention, 2) those which are stable and can wait for further attention, and 3) those which are a total loss.

It is important to remember that for some materials, such as current literature and pamphlets, replacement is usually less expensive than salvage and restoration. For this reason, don't freeze or spend a great deal of time working to recover materials which could just as easily be replaced.

Recovery of Wet Materials — First of all, materials in archival boxes often fare relatively well in flooding situa-



PHOTO USED WITH PERMISSION OF THE NORTH CAROLINA STATE ARCHIVES.

With mold a critical threat following water damage, archivists at the North Carolina State Archives work to air-dry wet documents in the wake of Hurricane Isabel in 2003.

tions, because the boxes are made of porous board stock which can be expected to absorb most of the water, protecting the contents inside. This would not be the case, of course, if the boxes were completely immersed under water for any length of time. During recovery, the contents of each box should be carefully inspected and the box replaced if it is water-saturated.

Many techniques are available for water removal, some of which are listed below. Their practicality and success depend on a variety of factors.

a. Air Drying — Air-drying is labor-intensive and requires a great deal of space, but it is effective and *inexpensive*. It is the most suitable method for small numbers of damp or slightly wet books and documents. It also offers security, as it can be done on-site and materials can be watched. Materials can be frozen until a decision on whether to air dry is made. Air-drying should be performed only in a stable environment to inhibit the growth of mold. Cool and dry is the ideal environment for air-drying.

b. Freezing — The most generally accepted method of stabilizing water-damaged library and archival materials before they are dried is by freezing and storing at low temperatures. This buys time in which to plan and organize the steps needed to dry the material and to prepare a rehabilitation site and the building for return of the collections after drying. Freezing provides the means for storing water damaged material safely and for an indefinite period of time in a physical condition similar to the condition they were found in, preventing further deterioration by water and mold while awaiting treatment.

Freezing is not a drying method, nor can it be expected to kill mold spores, but it is highly effective in controlling mold growth by inducing a dormant state in the spores. If mold-damaged material is frozen it is important that the drying method chosen must prevent mold spore activity during the drying process. For this reason it is important to segregate such material during removal and packing operations.

c. Vacuum Freeze-Drying — Vacuum freeze-drying is the safest and most successful salvage method for paper, although it is also the most *expensive*. Materials must be frozen when they are placed in a sublimation chamber. This type of chamber operates under high vacuum and applied heat. During the process, the ice sublimates, turns directly into water vapor without becoming liquid. The vapor is like a dense fog and migrates to a cold panel in the chamber and returns to ice.

d. Vacuum Drying — Vacuum drying differs from vacuum freeze-drying in that wet materials are placed in a chamber that pulls the moisture by means of a vacuum. If frozen materials are vacuum-dried, most of the water will pass through the liquid state before vaporizing. As a result, water soluble inks and dyes are more likely to bleed.

Materials dried by either vacuum method will not look like new. They will show signs of swelling and distortion, and tidelines may be present. See list of vendors below to learn more about these techniques.

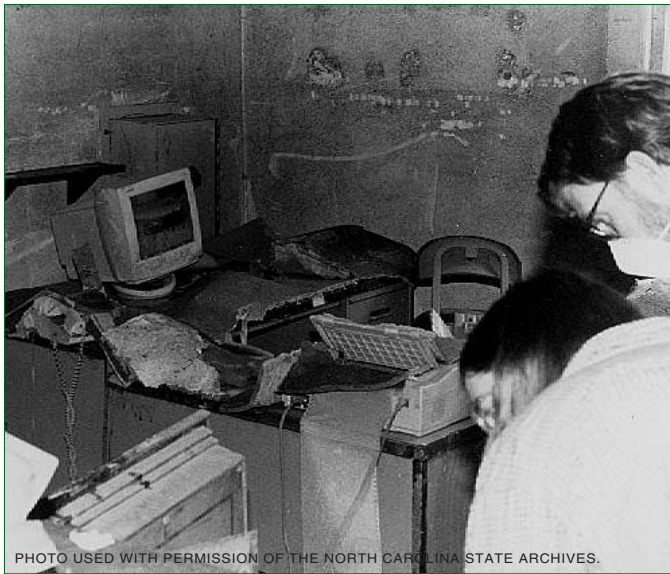


PHOTO USED WITH PERMISSION OF THE NORTH CAROLINA STATE ARCHIVES.

Salvage operations begin in the North Carolina State Archives after Hurricane Floyd in 1999.

Recovery by Item Type

Response to water damage varies depending on what kind of item it is. Below is a brief summary of how to deal with various kinds of media found in archives.

Documents / Manuscripts — Either freeze or air dry within 48 hours. If they are to be frozen, interleave stacks of documents with blotter paper or paper towels, and pack snugly in plastic milk crates. Be careful not to smear or blot soluble inks.

If only a small number of items are affected, you may attempt to air dry the documents in-house. Do not separate stacks of wet documents, as paper tears easily when wet. Carefully remove from boxes in stacks. Place on paper towels and direct fan at wet material. As manuscripts on top begin to dry, separate from stack. Partially dry single manuscripts can be hung on a line to dry using plastic clothespins, or laid flat individually or in stacks less than 1/8" high on paper towels or drying racks.

Books — If books are thoroughly wet, in quantities too large to deal with each book individually, they should be packed for freezing. Pack books snugly in plastic milk crates, spine down.

If only a few books are wet or damp, you may attempt to dry the books in-house. Put newspapers or paper towels on a table. Interleave every ten pages of each book with paper towel. Stand book upright; fan book open if possible, but do not force it. Never force books open or closed. Turn a fan directly on the book. Change paper towel when it becomes saturated.

Books with coated (slick, glossy) paper should be treated more carefully and quickly, as these are more susceptible to complete loss. If these books are allowed to dry closed, the pages will permanently bond together. If a book with coated paper is only damp and the decision is made to air dry the volume, be sure to interleave each page of these books with

blotting paper. Otherwise freeze the item within 6 hours.

Photographic Prints — Either freeze or air dry within 48 hours. Thoroughly wet black and white photographs can stay immersed in tubs of clean water for several hours until they are to be frozen, or can be packed wet, wrapped in plastic bags, into crates or boxes to be frozen. Color photographs often contain dyes that may diffuse after immersion in water, so these should be removed from water and frozen immediately. Be careful never to touch the emulsion with bare hands.

If only a small number of items are affected, you may attempt to air dry the photographs in-house: Keep prints in order. Separate the prints from the sleeve or folder to prevent sticking and transfer of marking inks to photograph. It is crucial to record any identifying information from sleeve or folder. If possible, keep the sleeve with the print. Remove mud and debris, if necessary, in clean, cold water, using a soft brush and a light touch. Hang on lines to dry using small plastic clothespins, or dry emulsion-side-up in a single layer on paper towels or blotting paper. Change this blotting paper frequently to keep it from becoming saturated with water. Do not let photographs dry into contact with other objects (e.g. do not stack them). Avoid touching the image side of prints and negatives. Dry prints first, before negatives.

Microfilm, Microfiche, Slides, and Negatives — These formats can be notoriously difficult to restore after a disaster. Preservation assistance is necessary within the first 6 to 10 hours. Do not dry or freeze these materials. The objective here is to prevent the material from drying out on its own, and to maintain the existing level of wetness.

- If dry, keep it dry.
- If damp, pack with moist paper towels to maintain humidity.
- If wet, keep immersed in cold clean water.

Arrange for professional drying or reprocessing. Clean only if absolutely necessary, in cold water. Do not remove from any paper containers if containers provide identification information. Secure microfilm labels to containers with rubber bands. For older negatives, the recovery rate after water damage is quite low.

Videotapes, Cassettes, and Other Magnetic Tapes — Determine whether duplicate copies are available, and consider possible replacement of wet tapes as this may be less expensive and time-consuming than drying. Magnetic tapes are not as vulnerable to water damage as paper or photographs, or leather used in the bindings of books. The main risk is mold. If the ambient temperature can be kept low, wet magnetic tapes do not need immediate attention. Older tapes should receive attention before newer tapes, as they are more susceptible to water damage. Similarly, cellulose acetate base tapes should receive attention before polyester base tapes.

If the water is clean, tapes can safely be kept submerged for several days. If the water is dirty or salty, the tapes should be rinsed in clean water and kept wet. Do not allow the tapes to dry, as contaminants in the water will be more difficult to remove if they dry onto the tape. For transferring to a professional salvage company, keep the tapes either submerged in water or wet in plastic bags, and pack vertically in plastic milk crates. Do not freeze or subject tapes to extreme tem-

peratures, and do not touch the magnetic media. If only a few tapes are wet, they can be unrolled and spread out to air dry.

Computer Media — Consider the possibility of replacement instead of drying. *Generally, the more high tech the media, the more likely it is that the data will be completely lost in any kind of disaster.* If professional drying is to be used, floppy disks, optical disks, and tapes should be kept wet, and immediately placed in plastic bags then packed vertically in milk crates, or kept in tubs of cold, clean water. For all computer tapes and disks, do not freeze, and do not touch magnetic media.

CDs, DVDs, and LP records (albums, phonograph records) — Compact discs (CDs, CD-ROMS) and DVDs should be removed from their jewel cases and wiped dry with a clean, soft, untreated cloth (such as cheese cloth). They should be wiped very gently from the center hub toward the outside edge. According to Kodak, “the motion should be in a radial direction (like the spokes of a wagon wheel), not in a circumferential direction (around the circle). If a scratch is created by the cleaning process, it will do the least damage cutting across the track of pits and lands, rather than along it.” Be careful not to disturb any paper labels on the disc. Place the disc on paper towels or soft cloth to air dry paper labels. Do not use any solvents, as these may mark the disc or remove the label.

If the recording is on tape, see Videotapes, Cassettes, and Other Magnetic Tapes above.

Vinyl disks should be treated similarly to compact discs, except that they should instead be wiped around the circumference, rather than radially. Any wet paper disk jackets should be freeze-dried or vacuum-dried (air drying would probably result in the development of mold inside the jacket).

Fire Prevention and Response

Even with a small fire, use caution and get help. If you decide to use an extinguisher to fight the fire, remember to stand back about 8 feet, pull out the pin, and *aim low*, at the base of the fire. Not only will this put the fire out more quickly and effectively, it will also aid in cleaning up the extinguishant once the fire is out. This kind of dry-chemical spray is slightly acidic in the presence of moisture, and can be corrosive. In addition, when heated, it becomes slightly gummy, adhering to heated materials. Aiming high would dramatically spread the extinguishing agent, causing more widespread contamination and more problems in clean-up.

In addition, clean-up will be affected by whether the powder



Charred files after a courthouse fire in Mississippi County, Missouri.



PHOTO USED WITH PERMISSION OF THE ARCHIVES OF ONTARIO.

Avoid stacking cardboard boxes more than three high to keep them from collapsing should they become wet. Shown here is a water-damaged box at the Archives of Ontario.

stays dry (making cleaning easier) or whether it is mixed with water from sprinklers or firemen’s hoses (increasing the potential for corrosion). Experts recommend using a HEPA-filtered vacuum for clean-up.

Collections Recovery after a Fire — After a fire, materials may appear to be undamaged if they are unburned. However, the high temperatures can cause serious damage to items even if they were far from the fire (melted adhesives or plastics, distortion of textblocks, melting of films and tapes). Check and carefully handle all materials on-site. Salvage of burned or smoke-damaged materials is always problematic and may be impossible, but check with a conservator or a salvage company before discarding, as sometimes recovery is possible.

- Damaged photographs, manuscripts or art can be supported on strong paper or cardboard to prevent further damage or loss.
- If the only damage to books and papers is soot on the outside, it may be possible to remove most of it with a chemical sponge (see below for a supplier to purchase these). These sponges can be cut down to fit the cleaner’s hand and can be washed and reused several times. To clean a book with a chemical sponge, hold tightly closed and use a gentle stroking motion in one direction sway from the spine toward the fore edge on the head and tail, and the same kind of technique on the fore edge, spine and covers.

Continue wiping until no more soot or debris can be removed without damaging the surface area. Soot may also be removed by wiping damaged material with a clean, dry cloth. If stains are stubborn, a conservator may need to apply solvents.

- Charcoal and/or baking soda can be used to deodorize fire-damaged materials. Place charcoal briquettes and/or bowls of baking soda in the area to absorb the odor. If a small number of books are affected, the books and charcoal may be placed inside a closed box or other enclosure. Wait two or three days or until the smell can no longer be detected.
- Charred edges of texts can be trimmed, if necessary, making texts usable.

Pest Infestation

A different kind of problem in archives is that of insects or other pests infesting an archives collection. Many bugs find the stuff of archives to be very tasty—they feed on paper, bookcloth, leather book bindings, adhesives, and other elements commonly found in libraries and archives. Just a few silverfish, book lice, termites, or cockroaches can cause terrible damage to collections, and this damage is irreversible.

Mice and other rodents will destroy an archives collection as well, tearing books and paper to make their nests. They also gnaw through wiring, potentially causing a fire.

An archivist must always be vigilant to prevent these infestations. Pests prefer warm, damp, dark, poorly ventilated areas, so one of the easiest ways to keep them out is to keep

your archives space clean and climate-controlled. Using a pest control service regularly is generally a good idea, although you should ask about the more gentle pesticides that are safe for use in archives. In the long run though, a harsh pesticide is preferable over a terrible bug problem.

It's a good idea to invest in a few adhesive pest traps – these are simple and cheap – and place them in the corners of your archives room. This way you can monitor your insect population and better determine if you have a potential problem.



PHOTO USED WITH PERMISSION OF THE MISSOURI STATE ARCHIVES.

Bugs feed on paper, bookcloth, leather book bindings, and adhesives. Shown here is what termites did to documents at the Missouri State Archives

Bibliography / Further Resources for Disaster Response

Note: *This list has been provided for reference only. It does not imply endorsement nor approval of the General Service Office Archives.*

Web Resources

Conservation OnLine: <http://palimpsest.stanford.edu/bytopic/disasters/> (disaster resources); <http://palimpsest.stanford.edu/bytopic/disasters/plans/> (index to other institutions' online disaster plans)

“Disaster Preparedness and Recovery: Selected Bibliography,” SOLINET (Southeastern Library Network), [various dates]. <http://www.solinet.net/emplibfile/disasbib.pdf>

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Print Resources

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