

4.1—Response and Recovery Procedures

Table 1: Special Procedures for Specific Types of Damage

TYPE OF DAMAGE	PROCEDURE
Fire-Damaged Records	If a fire has occurred, the records will be both wet and brittle. Support can be provided by placing pieces of paper toweling or unprinted newsprint under charred materials before they are moved.
Muddy Records	<p>Do not attempt more than a minimal cleaning of wet records that are also muddy, unless there is a large quantity of clean running water and you have the time. Attempting to remove mud from wet paper records may force dirt farther into the paper if a rubbing action is used. Mud may be easier to remove when dry. Some tightly wound tapes may be able to be rinsed, as only the edges will be exposed to additional water.</p> <p>It may be possible to rinse mud off boxes or enclosures to make the drying process faster.</p>
Contaminated Records	<p>If records are contaminated, or you suspect that they may be, make sure all staff members use proper protective equipment and clean-up procedures. It is often best to leave this to trained operators under your supervision.</p> <p>A contractor who specializes in treatment of contaminated materials should always be consulted, as these records require special handling and treatment.</p>
Wet Records	<p>Should Records Be Kept Wet and Recovered by a Specialized Contractor?</p> <p>Some materials should be kept wet until they can be recovered by a contractor who specializes in the recovery of those materials. Some examples include microfilm, motion picture film, and hard drives from computers.</p> <p>With film-based media in particular—because there are so many photographic processes—unless you are sufficiently knowledgeable about photographic process identification, it is important to receive expert advice from a photographic conservator as soon as possible before determining how to proceed with the response.</p> <p>If the determination is made that the photographic process is stable enough:</p> <ul style="list-style-type: none"> • Place wet microfilm or motion picture film in plastic bags to keep it from drying before it can be handled by an experienced conservator or specialized contractor. • With guidance from a conservator, it may be possible to wash off mud or dirt under cold, clean, running water, and then seal the items in bags. <p>There are some photographic processes and other media that should never be exposed to water. Special care should be taken to keep them dry if they are important to the agency. Boxes with water-proof coating would be best for storing these records.</p>

TYPE OF DAMAGE	PROCEDURE
<p>Mold</p>	<p>Small Outbreaks</p> <p>Quarantine moldy records from unaffected records. They will need to be dried in a location that vents to the outside. The area where the moldy records were found will need to be thoroughly dried and cleaned to ensure that mold does not germinate elsewhere.</p> <p>Mold cannot be removed from wet or damp collections. Items must be completely dry before any attempt is made to remove mold. If using fans to dry the records, make sure the fans are not blowing directly on the materials or you will spread the mold spores. Point the fans at the ceiling.</p> <p>Records will have to be cleaned once the mold has dried. A HEPA-filtered vacuum and micro-hose kit may be used, but this is very labor-intensive and should be carried out in a fume hood to avoid exposing others to the fumes produced by the cleaning step. This works better than brushing records clean and keeps the mold spores from returning to the air. Vacuum through a screen if the item is fragile.</p> <p>Larger Outbreaks</p> <p>Quarantine and freeze the records. Placing the moldy items in an environment with a temperature below freezing will halt growth, but will not kill spores.</p> <p>The preferred method of drying is vacuum freeze drying, so as not to spread the dry mold spores.</p> <p>If the outbreak is too large for local staff to handle, call a contractor that specializes in mold remediation. Vacuum freeze drying, while expensive, is an effective method for eliminating most molds, and may be considered for records which have special value or are irreplaceable.</p> <p>Cleaning the Location Where Moldy Records Were Found</p> <p>Begin by cleaning the area with a high-efficiency particulate air (HEPA)-filtered vacuum. Then clean all surfaces—shelves, floors, walls, ceilings, and windows—with an anti-fungal or anti-bacterial solution, including bleach.</p> <p>Ducts for air circulation and air conditioning will also need to be assessed and monitored for the presence of mold. If molds persist, the ducts may need to be replaced.</p>

Table 2: Special Procedures for Specific Types of Records

TYPE OF RECORD	PROCEDURE
<p>Paper—Large or Oversized Paper (Maps, Architectural or Engineering Drawings)</p>	<ul style="list-style-type: none"> • Large or oversized paper records often require two people to safely handle and transport them, and will require a secondary support (the original drawer, a tray, or spun-bond polyester). • If the record is rolled or folded, make sure there is enough space on the table to accommodate the record when it is unrolled or unfolded. • Rolled paper can be vacuum freeze dried successfully.
<p>Paper—Coated Papers</p>	<ul style="list-style-type: none"> • Coated paper such as magazines or journals stick together, or “block,” and must be dried immediately to prevent damage. They must not be allowed to have their surfaces in contact with one another during drying. Architectural linen is coated with starch which acts as an adhesive when wet. • If the pages are stuck together, or “blocked,” place the record in a freezer and vacuum freeze dry. • If the pages are not stuck or blocked, gently place pre-cut pieces of spun-bond polyester fabric between the pages. <ul style="list-style-type: none"> – Allow air to circulate, and wait until record is completely dry to remove interleaving material (the absorbent material placed between leaves of paper to hasten drying; interleaving material should be thin, absorbent, ink-free, and acid-free).
<p>Paper—Encapsulated and Shrink-Wrapped Records</p>	<p>Although exterior housings such as encapsulation and shrink-wrap do slow the intrusion of water, encapsulated or shrink-wrapped records are not protected from water damage. If the records do become wet, it is possible to successfully vacuum freeze dry the encapsulation record.</p> <p>If you are planning to air dry the records, the exterior housing must be removed:</p> <ul style="list-style-type: none"> • Using scissors, cut through the encapsulation bond or weld on all sides of the record. If the plastic sheet is clean, it can be re-used to support the wet record while it is carried to the drying site.
<p>Paper—Loose Paper or Paper Held Together with Fasteners</p>	<p>Steps to take when handling loose pages or paper held together with fasteners:</p> <ul style="list-style-type: none"> • Remove outer paper or paperboard folders and/or record jackets. If they contain valuable identification information, place the folders near their contents to dry. • In some cases, it may not be prudent or possible to remove fasteners, but when it is possible, removing them will hasten drying and prevent corrosive rust from forming on the records.

TYPE OF RECORD	PROCEDURE
<p>Paper—Loose Paper or Paper Held Together with Fasteners (continued)</p>	<ul style="list-style-type: none"> • To prevent tearing when moving older and fragile paper, use supports such as sheets of polyester film, nylon screening, or spun-bond polyester. Modern printer papers contain fillers which give the paper wet-strength even when they are wet or saturated with water. It is important to recognize the difference and act according to the paper's needs for support. • Arrange paper records individually, if possible, or in small stacks of 1–5 records each. Turn records over frequently to increase exposure to the air. • Do not re-box records until they are completely dry.
<p>Paper—Bound Volumes</p>	<p>It is preferable to freeze and vacuum freeze dry bound volumes quickly because this will help minimize the danger of distortion.</p> <p>Bound volumes can also be successfully air dried, but will require attention to ensure that the spine area of the book is completely dry before the book is returned to a location without air circulation and with high humidity; book spines and covers are highly susceptible to mold.</p> <p><i>Small Bound Volumes</i></p> <p>Small bound volumes with rigid covers which are only partially wet can be dried by standing them upright:</p> <ul style="list-style-type: none"> • Place the book upright and hold it open with blotter pieces to allow increased air circulation and to expose the tightly bound spine to air. • If the book covers are sturdy enough, fan the pages open and interleave with small pieces of pre-cut blotter paper placed close to the spine. • Invert books to even the stress on the binding, rotating books upside-down to right-side-up while drying. • Remove the blotters when the book is dry. <p><i>Large or Ledger-Bound Volumes</i></p> <p>Large or ledger volumes may need to be dried flat and open if their weight does not allow them to stand upright and open. This includes bound volumes with soft covers that are not sturdy enough to stand upright.</p> <ul style="list-style-type: none"> • If the pages are damp but not totally wet, fan them open. • Otherwise, interleave pages with blotter paper, clean newsprint, or spun-bond polyester to wick moisture away from the paper. • Turn the pages frequently and change the absorbent paper. • Spun-bond polyester does not absorb water, and does not need to be changed if it is clean. It can be re-used.

TYPE OF RECORD	PROCEDURE
<p>Photographs</p>	<p>Photographs, both negatives and prints, involve such a wide variety of material types, and such a long history of technological innovation, that it is difficult to give general advice on the recovery of photographic materials. If the photographs in your office are valuable to your agency, it is best to have the advice of a conservator or expert, because they have the requisite knowledge of photographic history and preservation.</p> <ul style="list-style-type: none"> • Photographs, just like coated paper will stick together, or “block,” and therefore must be dried immediately to prevent damage. • Do not allow their surfaces to come in contact with one another during drying. • If the photos are stuck together or blocked, do not try to separate them. Contact a conservator for advice. • Photographs can normally be successfully vacuum freeze dried. Do not vacuum freeze dry glass plate and cased photographs. • When air drying, photographs must be dried under restraint or they will curl and distort. • Photographs are made up of more than one layer, and each layer dries at a different speed. This causes them to curl as they dry, which is why you need to apply pressure to keep them flat. • It is very difficult to correct this problem. • If air drying: <ul style="list-style-type: none"> – If the surface is not cracked or flaking, and the photographs have soot or mud on the surface, you may be able to rinse them in a tray of cool, clear water while they are still wet. – Dry photographs image side up on clean blotters for at least one hour. – If the emulsion or surface of the photograph is sticky or tacky to the touch, it will need to be interleaved between sheets of spun-bond polyester to prevent disturbance of the surface during drying. – Place the polyester and photographs between blotters to create a stack. – Put a flat sheet of Plexiglas™ or other heavy-weight flat material on top of the stack. – Suitable weights include telephone books or bricks wrapped in plastic to add additional pressure.

TYPE OF RECORD	PROCEDURE
CDs and DVDs	<p>All types of disks are composed of several layers. Of these, the metal reflective layer is probably the most important and the most vulnerable to physical damage. Normally, this layer is covered by a very thin protective coating.</p> <p>The metal reflective layer is usually unaffected by water unless it has been soaking for a week or longer.</p> <p>If time and resources permit, immediate response can save the information on the disks.</p> <ul style="list-style-type: none"> • Remove the disk from its case or cartridge. Cases that are not damaged can be thoroughly cleaned with water or soap and water and re-used. Damaged ones should be discarded. • Rinse the disk in clean room-temperature tap water and then in distilled water. • If any residue remains, using distilled water, gently wipe the disk surface with a wet, soft cotton tissue—not paper towels, as they are too abrasive. • Wipe in a radial direction, not a circular direction, to remove the water. Follow this wiping with another rinse in clean, distilled water. • After rinsing, gently blot off any excess water with a soft, lint-free tissue to prevent water spots during drying. <p>The best chance of avoiding damage is to limit the time a disk is wet. Therefore, it is best to recover disks immediately. If immediate recovery is impossible, rinse the disks in distilled water and store them in their cases in cool clean water until they can be recovered. If the disks need to be transported, they can be sealed in zip-lock bags immersed in cool or cold water in a portable cooler.</p>
Computer Hard Drives	<p>Modern information carriers such as computer hard drives and electronic media also require immediate attention to ensure recovery.</p> <p>Computer hard drives have a large number of components, some of which are metal and susceptible to rust and oxidation; others are soft plastics and materials susceptible to mold.</p> <ul style="list-style-type: none"> • Remove hard drives from computers. • Send hard drives to a contractor as soon as possible for recovery. • Keep hard drives wet, sealed in plastic, and do not let them dry out
Magnetic Tapes	<p>Tapes are constructed of layers of water-resistant materials. Although water will not cause these layers to swell and break up (as would the layers in a photograph), tapes can still be damaged. Both the tape and the binder layer may be susceptible to degradation when exposed to water. A properly wound tape is less susceptible to water damage than a loosely wound tape.</p>

TYPE OF RECORD	PROCEDURE
Magnetic Tapes (continued)	<ul style="list-style-type: none"> • Magnetic tape recovery should be a high priority if the tapes are valuable to your agency. • Do not play or rewind a tape that is wet. • Consideration should be given to sending the magnetic tapes to a contractor who specializes in recovery of magnetic tape. • Initial response steps, if air drying: <ul style="list-style-type: none"> – Drain any excess water out of the cassette or off the reel of tape. The cassette gate, if present, may be flipped open to allow water to drain. – If the tape is wet with seawater or contaminated water, rinse the tightly wound tape with cool, clean water. – For reel-to-reel tapes, wipe the wound surfaces with a wet or damp soft, lint-free cloth. – For cassette tapes, shake as much excess moisture out of the cassette housing as possible, and stand the tape vertically with the empty hub on the bottom for air drying. – Allow the tape to acclimatize to the new environment for at least two days before any further treatment.

Additional Tips on Handling Damaged Records

- Some water-soluble inks will bleed; freeze as quickly as possible to minimize damage and vacuum freeze dry.
- Air dry records indoors if possible. Sunlight and heat may dry certain materials too quickly, particularly bound volumes or artifacts made with wood, causing splitting, warping, and buckling.
- Documents, books, photographs, and special media are extremely fragile when wet. They tear easily and require caution when being handled. Always consider providing a secondary support to prevent more physical damage.
- When mud or soot is present, with guidance you may be able to rinse off some of the particulate in cool, clean water, but do not scrub the surface.
- Many plastics will swell and soften when they are wet. Sensitive surfaces, including wet photographs or electronic media such as CDs or DVDs, must be handled with care to avoid scratching the surface.
- While exterior housings such as folders, encapsulation, or shrink-wrapping may slow the seepage of water into the records, they will not prevent water damage and must be removed to allow air drying.

4.2—Sample Records Emergency After-Action Report

Types of Incidents to Be Assessed

1. Any incident in which the Records Emergency Action Plan is activated
2. Incidents which, while not resulting in use of the emergency plan, offer an opportunity to examine safety hazards, risks to records, security vulnerabilities, etc. (an assessment may be requested by the branch or program involved, or by an office head or the agency administrator)

System of Emergency Assessment

1. The Action Team should undertake a records emergency response assessment as soon as feasible after the situation is brought under control, but no more than 30 days after the event. The Action Team may solicit assessments from other involved parties.
2. The attached checklist of questions (see next page) is to be used as a guide or reminder in preparing the assessment; respond to the questions that are relevant to the event and your involvement in it.
3. The assessment may be done by individuals or collectively for an amalgamated report at the discretion of the Action Team leader.
4. The Action Team leader reviews assessments submitted by each program or branch, and prepares a final report on the emergency response and lessons learned within 30 days of receipt of the assessments.
5. The Action Team leader creates a permanent file of all documents relating to the recovery, including the assessments.

Records Emergency Response Assessment Checklist

Facility:	
Date of Incident:	Response Dates:
Quantity of Records Affected:	Cubic Feet:
Assessment Completed by:	Date:
1. Cause	
What were the major contributing factors?	
Additional comments:	
2. Notification	
Were you given timely notice of the emergency?	
Of your assigned role?	
Was the Records Emergency Action Team system activated?	
How were you notified and by whom?	
Were you given accurate and adequate information?	
How can notification procedures be improved?	
Additional comments:	

3. Communication

What methods of communication were used: telephones, runners, radios, beepers, other?

If a manager or supervisor, did you receive a radio or other communication device?

Did you use it?

Were the communications effective?

Additional comments:

4. Records Recovery performed by (respond to all that apply)

- In-house Staff (complete section 4)
- Contractor Services (complete sections 4 and 5)

Did the damage mitigation procedures and salvage operations reduce or prevent water damage, fire damage, etc.?

How could these operations be improved?

Were conservation efforts well-coordinated and prioritized?

Were adequate personnel available?

Were agency and contractor personnel effectively deployed?

Were movement of records and temporary storage arrangements well-planned and well-handled?

What kinds of specialized preservation tools and supplies were needed that were not available?
Were they obtained subsequently?
Did the delay play a significant role in the outcome of the incident?
Were damage to records and movement of records documented in a timely manner?
Were photos taken?
Was the incident videotaped?
Additional comments:
5. Contractor Performance
Name of contractor (if more than one contractor was hired, duplicate this table as needed):
Performance overall: Excellent_____ Satisfactory_____ Unsatisfactory_____
Timeliness of contractor response: Excellent_____ Satisfactory_____ Unsatisfactory_____
Actions performed by contractor:
Would recommend using this service again: Yes_____ No_____ Perhaps_____
Additional comments:

6. Security
Were operations effective?
Were communications clear and concise?
Were communications timely?
Were events documented?
Were appropriate security personnel assigned to assist?
How can procedures be improved?
Were the security and safety of staff and other visitors properly considered at the outset of the event?
Were an adequate number of security personnel available?
Were security personnel effectively deployed?
Did security personnel use safe methods and equipment?
Was security of records, buildings, and grounds maintained?
Additional comments:

7. Facilities

Was the appropriate pool of equipment and supplies established?

Were adequate facilities personnel available and did they have requisite knowledge of facility systems (electrical, gas and water cut-offs, HVAC system capabilities, emergency back-up systems, etc.)?

Were facilities personnel well-deployed?

Did facilities personnel use safe methods and equipment?

What kinds of equipment or supplies were needed that were not available? Were they obtained? Did the delay play a significant role in the outcome of the incident?

Did all equipment operate properly?

Additional comments:

8. Media Relations

Were the media contacted?

Did the media contact the agency?

Did the staff in contact with the media give only the appropriate information?

How can contact with the media be improved?

Additional comments:

9. Action Checklists

Did you use an action checklist?

Which list(s) did you use?

Were they useful?

How can they be improved?

Additional comments:

10. Unexpected Contingencies

Were records emergency procurement procedures efficient and responsive?

Were there any special circumstances or serious unexpected problems?

Were they handled appropriately?

What other problems could have arisen?

How could they have been handled?

Additional comments:

11. Overall Effectiveness of Records Emergency Action Plan

Was a records emergency declared and did someone take charge?

Was a chain of command established, clearly understood, and followed?

Were duties delegated to the appropriate people and the necessary adjustments made?

Were major decisions and activities documented?

Additional comments:

12. Recommendations and Conclusions

How could the incident have been avoided?

Damage lessened?

What policies and procedures need reevaluation?

What specific lessons were learned?

Additional comments:

13. Recommendations for Future Actions

Date and location of incident	<input type="checkbox"/> Date: <input type="checkbox"/> Location: Bldg: _____ Floor: _____ Room: _____
Type of incident	<input type="checkbox"/> Water—clean <input type="checkbox"/> Water—gray <input type="checkbox"/> Water—black <input type="checkbox"/> Fire <input type="checkbox"/> Mold <input type="checkbox"/> Pest infestation <input type="checkbox"/> Contamination <input type="checkbox"/> Other: _____
Source of problem	
Areas affected	
Types of materials affected and amount	Quantity (include units, e.g., boxes, cubic feet, linear feet, items) <input type="checkbox"/> Bound volumes _____ <input type="checkbox"/> Unbound paper _____ <input type="checkbox"/> Maps, plans, oversized records _____ <input type="checkbox"/> Photos/film/electronic media _____ <input type="checkbox"/> Magnetic tapes, CDs _____ <input type="checkbox"/> Artifacts _____ <input type="checkbox"/> Microforms _____ <input type="checkbox"/> Other—please specify: _____ _____

Recovery methods		Material Treated & Volume	Reason
	<input type="checkbox"/> Air drying in-house <input type="checkbox"/> Air drying contractor <input type="checkbox"/> Freezing in-house <input type="checkbox"/> Freezing contractor <input type="checkbox"/> Vacuum freeze drying	<hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/>
		Material Treated & Volume	Reason
	<input type="checkbox"/> Replacement <input type="checkbox"/> Discarded <input type="checkbox"/> Other in-house <input type="checkbox"/> Other contractor	<hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/>

Agency staff involved	Name & Unit	Role	Dates
Contractor(s)	Name	Work Performed	Dates
Notes/comments			

4.4—Common Drying Methods

Air Drying

Air drying involves drying records at room temperature. Typically materials are spread out on, or interleaved with, absorbent papers. In some instances, materials may be dried under restraint in a stack of weighted blotters.

Air drying is a tried and true method most familiar to many, has been proven through many experiences, and provides the greatest control over the drying process. It provides security and privacy controls if done in-house, and allows separation of materials that require special handling, such as photographs, coated paper, parchment, magnetic media, etc. It also provides for the direct monitoring of the original order and intellectual control of materials, but may result in problems if the materials become disarranged outside of their containers. This method therefore requires a meticulous system for tracking items during the drying process. It is also labor-, space-, and materials-intensive, particularly in terms of the absorbent paper used.

Air drying can be made more efficient with the addition of drier air. The current choices for adding drier air include increasing air circulation with a fan or hiring a contractor to bring in equipment that provides heated, extremely dry air.

Air Drying with Added Heat (Desiccant or Dehumidification Drying)

Materials are dried by pumping cycles of moist air out of a chamber or space and introducing dried (desiccated or dehumidified) air with relative humidity (or moisture content) lower than fifteen percent. One potential problem with this is that air temperatures are usually in the range of 80°–100° F, which can dry paper records too much, resulting in distortion, increased volume, and re-boxing problems.

This method is often cited in the literature as giving excellent results for damp collections, and it allows access to the materials during the drying process, if that is required. It can be performed onsite with equipment rented from a contractor or by employing in-house staff or professionals from the drying service. Items can also be sent directly to the contractor for service. Drying is complete within several days, depending on how wet the items were originally.

Vacuum Freeze Drying

Vacuum freeze drying is almost always recommended for most incidents involving records in boxes, where the quantities are large and the records are of varying levels of wetness. The records will generally be frozen first for transport to the facility, and held in storage in a freezer until the drying process is carried out.

These facilities are all contractor-owned. Contractors dry the materials using a very strong vacuum to lower the pressure while the temperature is held below freezing. Cycles of controlled heat may be used on the shelving. This process sublimates the frozen water; this means that the water passes from a frozen state to a vaporous state without passing through a liquid phase. The items remain frozen throughout the drying process.

Vacuum freeze drying can be performed off-site at a contractor's facility or onsite in mobile vacuum freeze drying chambers. The mobile chambers are smaller than the fixed-site ones, since the walls of the chamber have to be strong enough to withstand the low pressure of the vacuum. On-site drying is more expensive than drying records at the contractor's facility.

Among the advantages of vacuum freeze drying, the procedure:

- Minimizes the feathering and bleeding of soluble media
- Allows coated materials to dry without blocking
- Results in minimal distortion to the records
- Does not require the removal of encapsulations or polyester sleeves from records before drying
- Allows records to be dried in their original containers, thus reducing risk of disruption of original order

The process is performed at the drying facility because of the weight of the structure needed to create a chamber where the pressure can be lowered significantly. Drying time depends on the wetness of the materials, but for each volume of material that fits into the chamber, the drying time is normally less than two weeks.

If records need to be used frequently, the agency will need to indicate to the contractor the order in which to process the records. There may be additional costs for gaining access to the records while they are with the contractor.

Vacuum Thermal Drying

Vacuum thermal drying is similar to vacuum freeze drying in the kind of chamber used, but different in that cycles of warm to hot air are used. Vacuum thermal drying is a cost-effective option for temporary records or archival materials of low intrinsic value. The procedure distorts paper considerably, causes coated records to block, and exacerbates the feathering and bleeding of soluble inks. The drying time is usually less than that for vacuum freeze drying, but also depends on initial wetness.

Most vacuum-drying facilities no longer use this method because of the problems discussed above.

Thermal Vacuum Freeze Drying

Another method is thermal vacuum freeze drying. This technique is similar to vacuum freeze drying in that a vacuum is used, but controlled heat is applied to vaporize the water, and this method also has a patented procedure to compress the materials into shape. It is more expensive per cubic foot than vacuum freeze drying.

Freeze Drying

Freeze drying is a very slow technique. Records are packed in permeable containers and kept in a cold storage vault for months. Over time, moisture sublimates out of the records in the same way that food gets freezer burn. This is a slow process that will dry damp and partially wet records, but the records are inaccessible for a long period of time and the energy used to keep them frozen is very expensive.