



# Fire recovery: a case study

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This talk is based on actual experience gained during recovery operations following a fire at the Washington National Records Center in Suitland, MD. It is designed to help you make decisions to mitigate damage and minimize loss.

According to the National Fire Prevention Association's 1997 publication #909, the deliberate setting of fires has been identified as the cause of most fires in libraries, archives and related cultural institutions during the past 50 years, accounting for up to 80 percent of all fires in these types of institutions. Fires can also result from natural disasters and construction and renovation projects. Previous speakers addressed fire prevention and suppression. This presentation focuses on what YOU can do in an emergency involving fire. We are brought together to share the knowledge and techniques that have emerged in the last 35 years to help respond to unexpected and devastating loss.



When an emergency strikes, YOU will face the responsibility of deciding which path to take to minimize loss. Temporarily imagine that you are in an emergency situation. Let's go through the steps YOU can take to minimize loss.





# Acknowledgements



These successful recovery results would not be possible without tremendous dedication and limitless hard work. The record center staff and their conservation allies deserve recognition for their efforts and ingenuity.



The usual reaction to an emergency, especially one involving fire, is often shock. Access was at first restricted by the fire marshals doing their job to make sure the fire was out and the building was safe. As soon as it was possible to enter the fire site,

the extent of damage was assessed.



There is much to do to mitigate damage within the first critical 48 hours. We designed a manual check-list to help guide the recovery through the first few hours of planning when chaos and devastation were likely present. Please look for it and other

useful guidelines in your packet. First, archivists considered whether the records or materials involved were unique or whether duplicates existed elsewhere. The relative priority of the damaged records and their media if duplicated or not part of permanent accessions, will affect decisions made about their recovery.



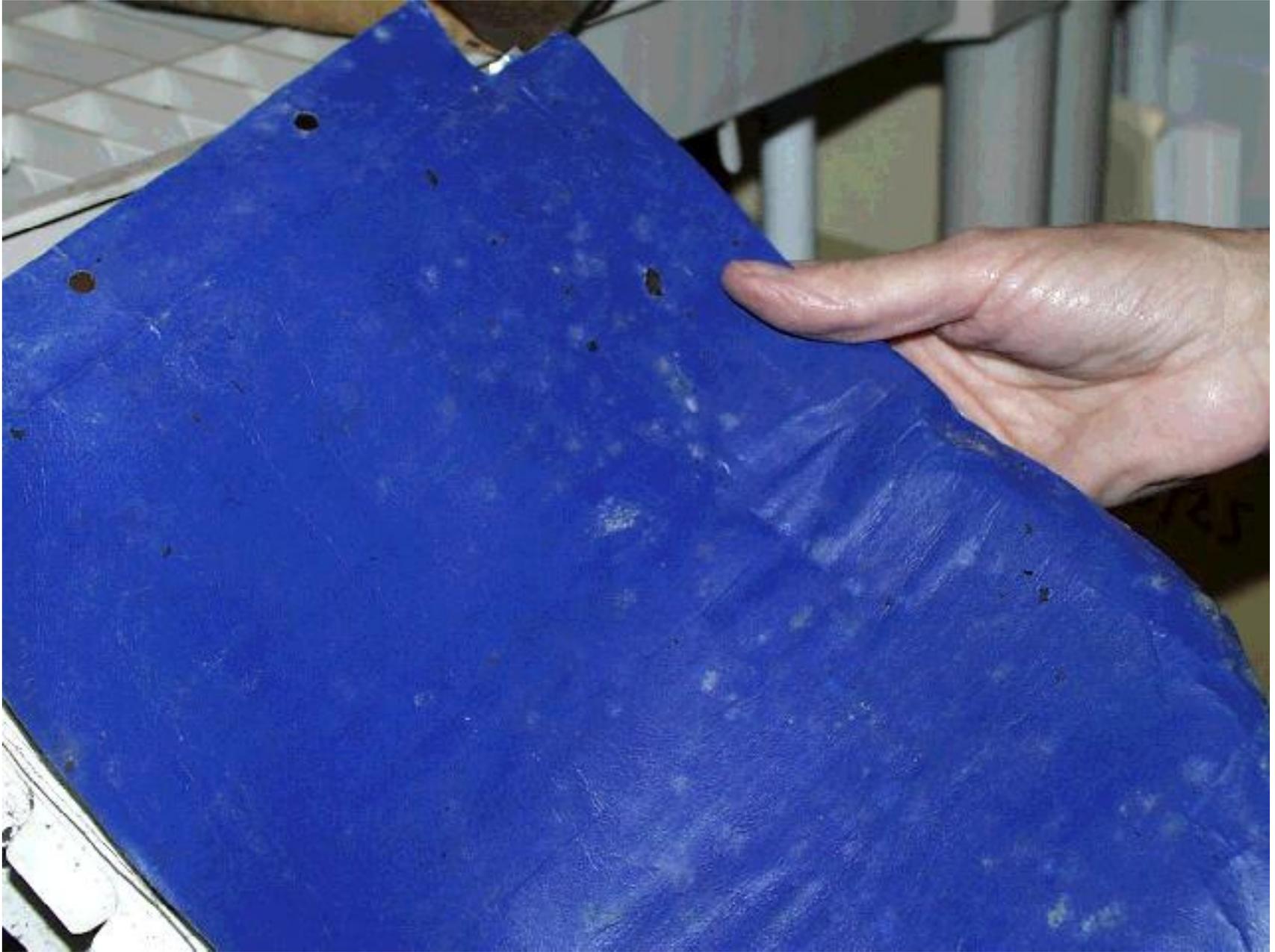
Simultaneously, knowing that the greatest threat to wet records is mold growth, we acted quickly to control the environment to avoid mold growth. Mold may appear after 48 hours. It is dangerous for several reasons: some people are sensitive to mold, some

are allergic to mold and some molds are toxic. Also mold deteriorates the material it is on. Fungal attack digests paper causing it to become soft and pulpy. It can also obliterate text and images and cause materials to stick together. If you see mold, follow your institution's protocol and /or consult with an industrial hygienist before proceeding with recovery.











Mold development may be unavoidable in some circumstances and if present will complicate recovery. Some records may not be saved. If mold develops, staff will need to wear personal protective equipment when handling contaminated records.



OFFICE 4415  
ARLINGTON, VIRGINIA

COAL CO., INC.  
PETITIONER

STATE DEPARTMENT  
OF INTERIOR  
BUREAU OF SURFACE MINING  
REGULATION AND ENFORCEMENT,  
RESPONDENT

MEMORANDUM FOR  
TEMPORARY RELIEF  
TRIAL MEMORANDUM

Comes B.C. Coal Company, Inc., and for its Application  
for Temporary Relief submits the following Memorandum.

INTRODUCTION

On May 27, 1987, Petitioner was issued Notice of  
Violation No. 87-81-224-001 (Exhibit 1). The Notice of  
Violation alleged Petitioner's failure to comply with  
Kentucky regulation 405 KAR 1:130. No Federal statute nor  
regulation was set forth in the Notice. The Notice of  
Violation was modified by the Respondent on July 23, 1987  
(Exhibit 2), the effect of which was an extension of the  
abatement period to August 26, 1987.

Prior to the issuance of this Notice of Violation, the  
Petitioner received a Partial Bond Release for the site from  
State Regulatory Authority on April 2, 1985 (Exhibit 3).  
Complete Release was received on December 9, 1986 (Exhibit





## Control the environment:

- Lower temperature to 65 degrees
- Lower R.H. to below 35% r
- Remove standing water

Immediately the records center facilities staff began to control the environment to prevent mold. Ideally, lower ambient temperature to 65 degrees or lower. Lower is better. Reduce relative humidity to 35% or lower.





Wet dry vacuums were used to collect standing water. Removing standing water required numerous attempts and was repeated as often as necessary. With a fire emergency, large amounts of standing water continued to seep out from under wet boxes and

shelves. Removing standing water reduces relative humidity. Wet/dry vacs have to be emptied frequently. Make sure they don't make things worse by spilling water or emptying them in inappropriate locations.



Large fans were quickly installed to move air around and therefore began drying wet records. But if you see or suspect mold, perhaps from a previous event, Do Not use fans which will only blow mold spores around.



Recovery experts were contracted to pipe in hot dry air to the affected environment.





## Identify affected records:

- Classified or privacy protected?
- Unbound paper?
- Coated/glossy paper?
- Maps/plans/oversized?
- Video or audio tapes

Next, records center staff assesses the extent and quantity of damage. Assessment helps to establish the nature and extent of problems and permits establishing priorities. We wanted to know whether the records were:

- Classified/privacy protected materials?
- Unbound paper?
- Coated/glossy paper?
- Maps, plans, oversized records?
- Photographs, film or electronic media?
- Video or audiotapes?
- Artifacts?
- Other special records or considerations?



## Identify damage:

- Damp or wet housing?
- Damp/wet records?
- Burnt or charred?
- Moldy/soiled/contaminated?



We identify the nature of damage to materials. This helped determine appropriate recovery responses. Here are some examples:  
- Damp or wet housing?

- Damp records
- Burnt or charred?
- Moldy?
- Soiled or contaminated?











## Case study:

- Air-dried on-site
- Frozen, desiccant air-dried on-site
- Frozen, vacuum dried off-site

Over the years, we have gained a body of emergency recovery experience. I will describe the methods and briefly tell you a little of how they worked.

At the records center, these three methods of recovery occurred simultaneously. Each method was appropriate for the specific type and quantity of records involved in the emergency recovery based upon the nature, quantity and condition of the damaged records, the availability of staff and space, as well as the legal sensitivity of the records.



1. One method involved a small holding of boxes of wet x-ray film. They needed immediate attention and could not be frozen and thus, could not leave the site.

2. A second and much larger group of wet, burned and privacy-protected records was quickly loaded onto three commercial refrigerator trucks and frozen. Subsequently, the records were desiccant air-dried on-site. 2,264 cubic feet boxes were treated.
3. The third method included five trucks of wet burnt records unclassified and non-privacy protected records. They were quickly frozen on-site and transported to a commercial vacuum freeze-dry recovery service off-site. 3,489 boxes were sent off-site to be freeze-dried.



To the degree possible, all records were identified recording general stack location or whatever information is available. The more intellectual control you have the easier it will be to prioritize the recovery and establish order when the records are

finally dry.

In the aftermath of a disaster, however, intellectual control is often difficult. At the very least, a clipboard, pen and paper were used to record stack, isle and shelf location.

We tried to proceed to recover records from the emergency site with efficiency, safety and careful planning. Jumping in too quickly to remove damaged records can be a hazard to staff and further damage the materials.



## Assemble recovery teams:

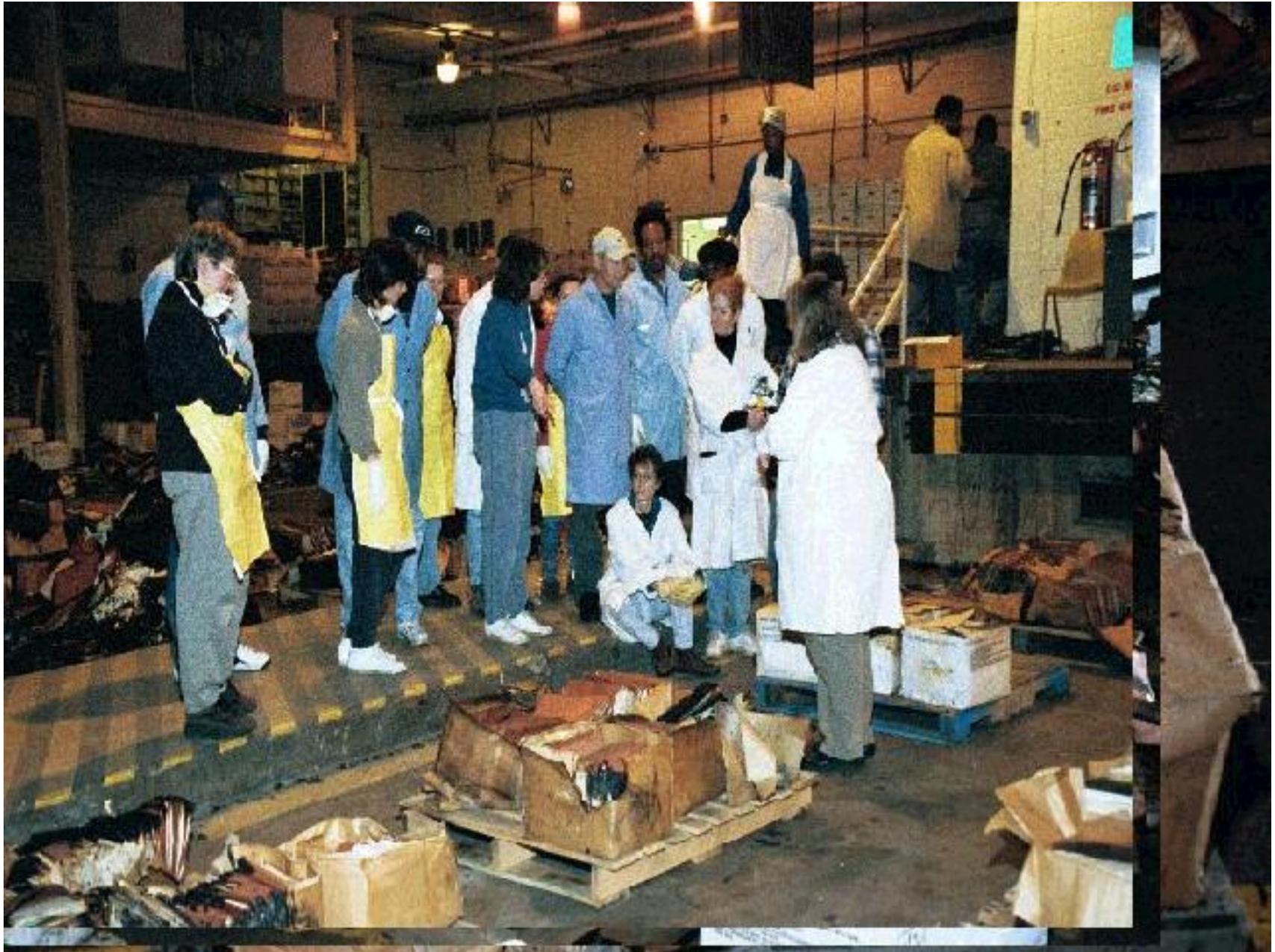
- Facilities manager
- Archivist
- Staff with recovery/preservation experience
- Staff with financial decision authority

Team leaders met with team members at a time when all can be present to discuss procedures. We met at least once a day or as often as procedures change.

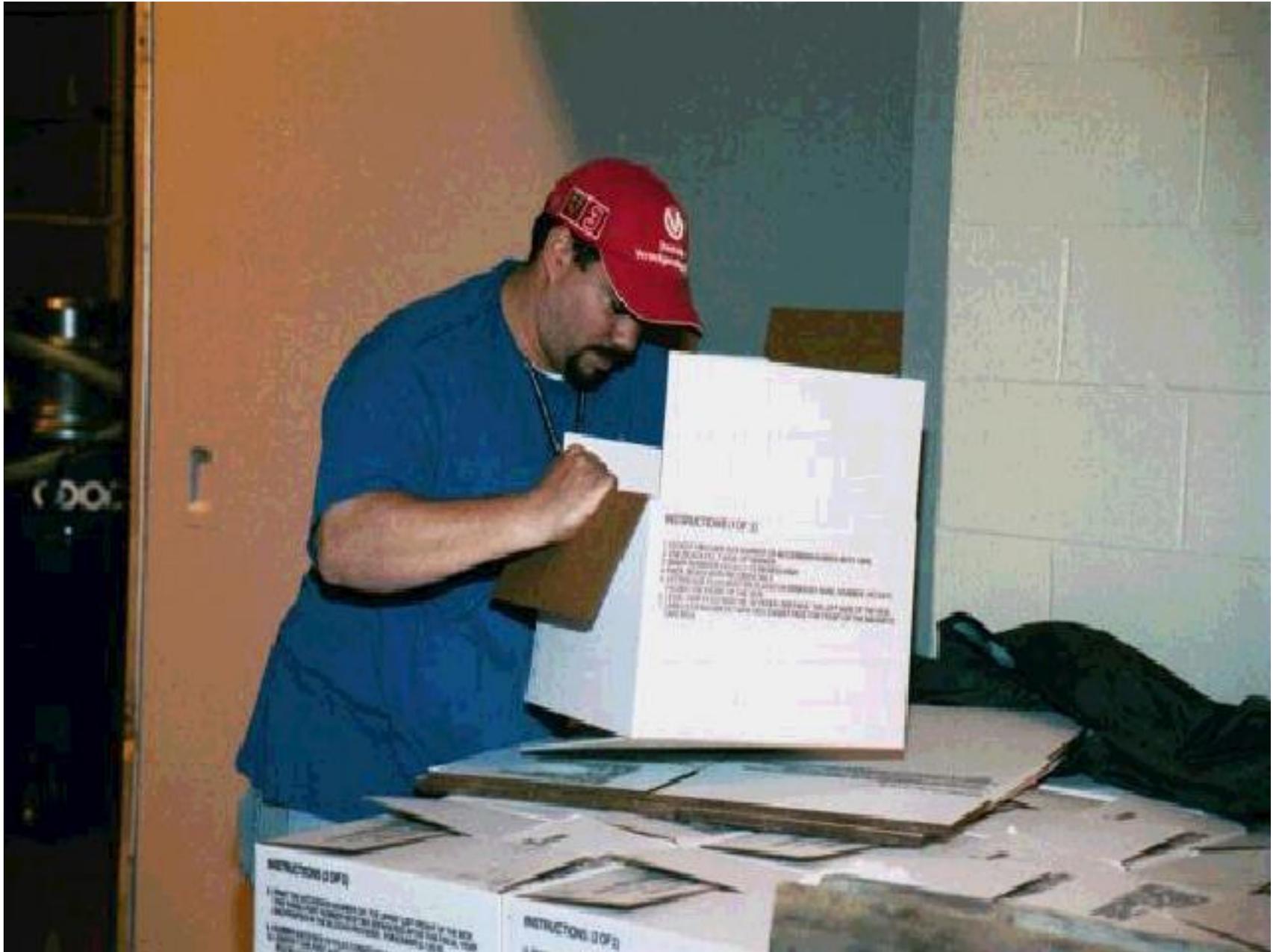
The records center staff took the necessary time to set up workstations outside the emergency location for a landing site. Having ALL supplies needed at the recovery site before recovery began was extremely helpful. We highly recommend having a large supply of permanent markers for box or container identification, a variety of sizes of personal protective equipment, and plenty new or usable dry containers.













Team leaders scheduled regular breaks and recognized the stressful nature of recovery work.



## Air drying on-site

Procedure--Air Drying: The critical decision whether records can be safely and successfully air-dried in-house is determined by the availability of staff and space to lay out all records and begin drying them within 48 hours. We have found that one cubic foot

of wet records requires at least one 3 foot by 8 foot table space to dry.



At the records center, several boxes of x-ray film were air-dried by the photo conservator and her team. Using the drying chamber at ambient temperature and R.H., x-rays were removed from their sleeves. Both paper sleeve and film were laid out on clean dry

blotters on drying racks. When dried, x-rays were returned to the dry sleeves and boxed in clean dry boxes.

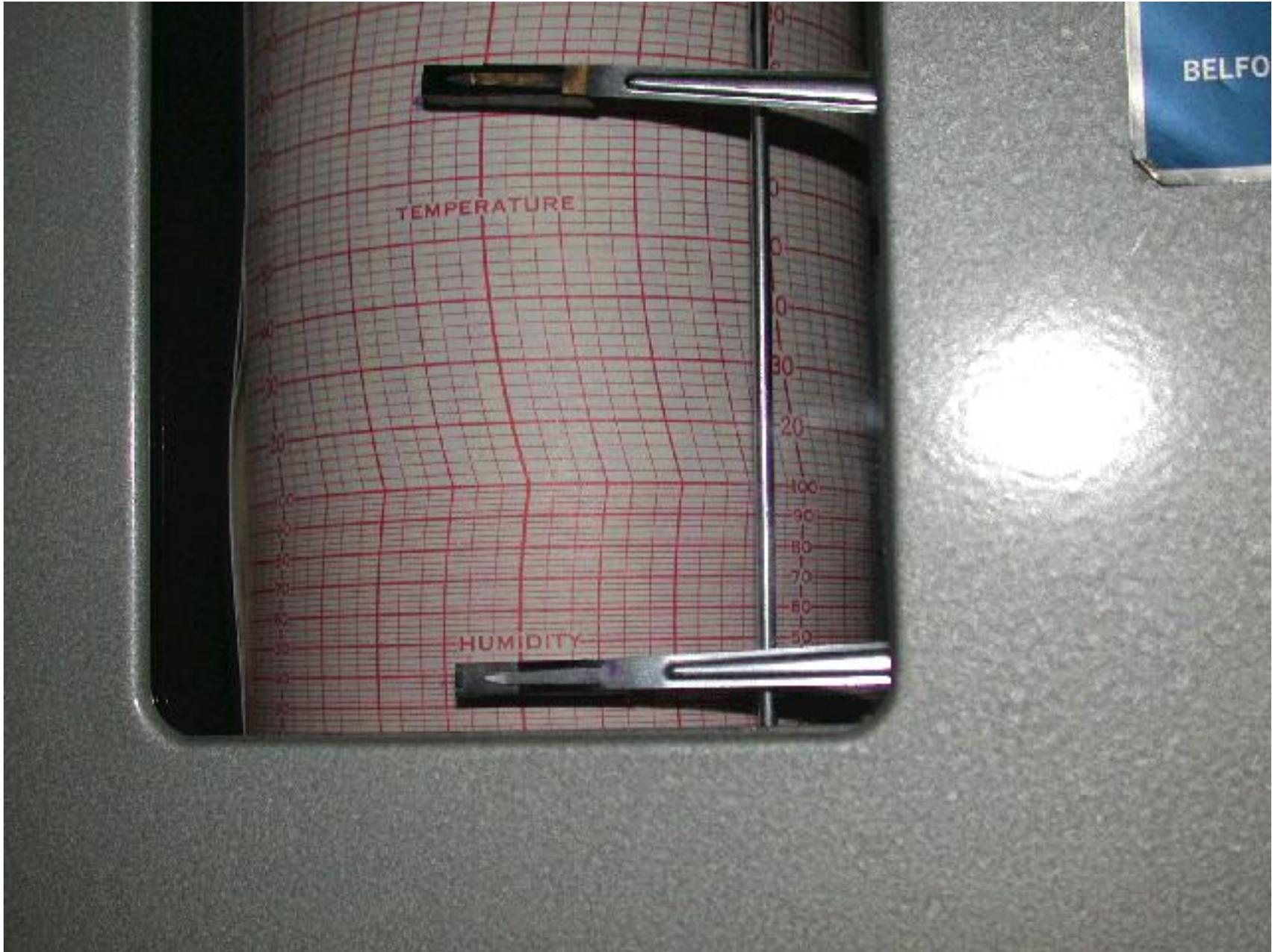
Results: Air Drying

- Air or hand dried paper is less likely to distort or gain loft during drying than methods which use hot low humidity air.
- Physical custody and intellectual control are enhanced when records are air- dried on-site by institutional staff.



# Freezing records

Procedure--Freezing: As you have seen, the records center's emergency involved a large quantities of fire and water damaged records.



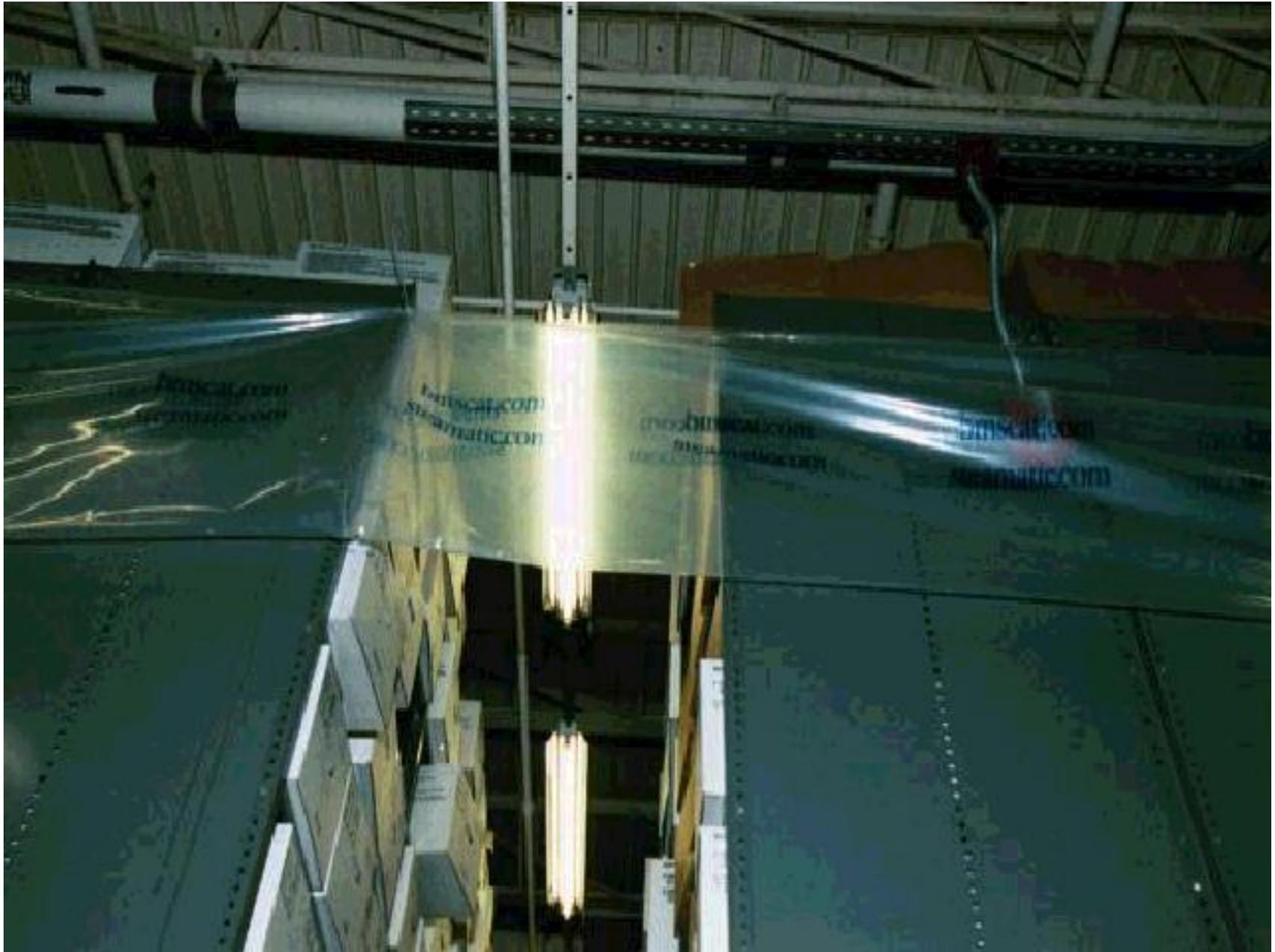
During negotiations and contract review with the recovery service provider, environmental controls began.



To review, here are the steps the record center took to control the environment. These steps are important whether you plan in-house recovery or use an outside service:

- Wet dry vacuums removed standing water.
- Large fans were installed to circulate air
- Warm dry air was piped into the stacks







Physical recovery included:



Aisles and access to aisles were cleared.  
A human chain was set up to move heavy wet material out of the stacks.

Carts were used to move wet records to a dry environment.

Semi-wet boxes were not replaced. Saturated boxes were replaced with dry boxes.





Identification was crucial. It was accomplished by writing on the outside of boxes or containers with permanent markers, or if the original containers were gone, a note taker used a clip-board and individual sheets of paper to record stack location, aisle and

shelf. This identification was kept with records and transferred to new dry containers.







If records were very wet, clean dry boxes were lined with thin plastic bags prior to freezing to prevent wetting box. Bagged and boxed records were frozen within 48 hours.



Freezing is a stabilization technique to prevent mold growth. Freezing buys time to assess recovery options. The contractor recovery service manager contacted and arranged for delivery of large capacity commercial refrigerator trucks to

be driven to the site. Thermostats were set to 30 degrees.

Refrigerator truck temperature controls were set to 30 degrees.

If more than one drying option is used, carefully choreograph loading freezer trucks to insure you know which records are inside individual trucks. For example, maintain documentation, inventories and databases of holdings. This is very important because it will help you to track locations of records you wish to salvage first. This case involved about 6,000 boxes.



Records were sorted, identified to the extent possible, boxed and quickly stacked three high on wooden or plastic pallets to allow wet records to freeze quickly. By the end of the second day after the fire, all records not air-dried were frozen. A large and

energetic group of NARA volunteers, archivists and conservators worked together to achieve this goal.













# Desiccant air drying on-site

Procedure--Desiccant Air-Drying:

A large portion of fire and water damaged records could not leave the site, and the decision was made to use a commercial

recovery service to provide equipment and in-house staff to operate a desiccant drying chamber.





A chamber to dry the wet and burnt records was constructed using PVC pipes and commercially available plastic shelf units. Conditions in the chamber are hot, approximately 80 degrees Fahrenheit and very dry, relative humidity was in the mid-teens of

less. Ambient air is dehumidified and desiccated by a process similar to the use of silica gel and is forced around the wet records. Here is a very effective homemade version of a data logger.





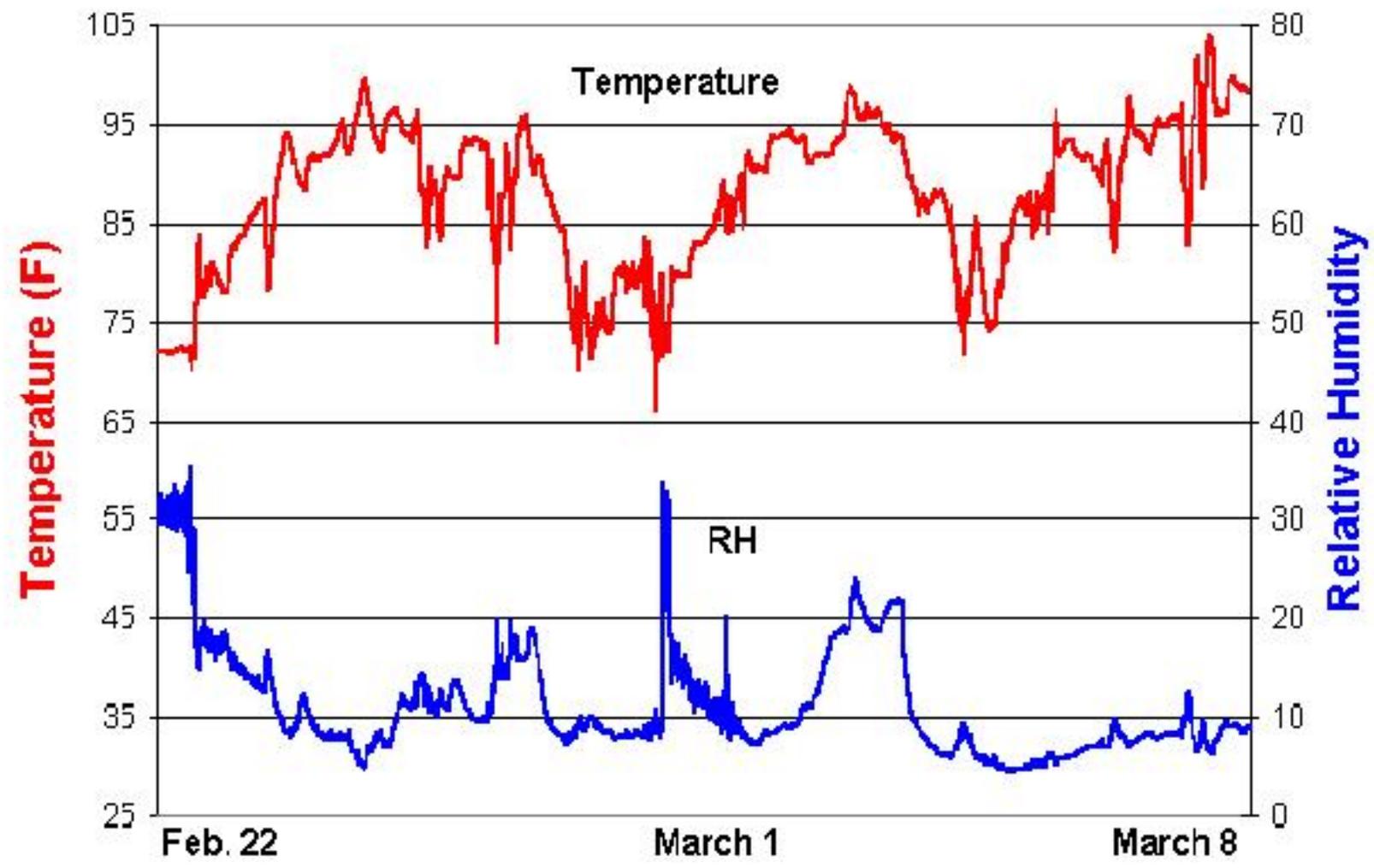


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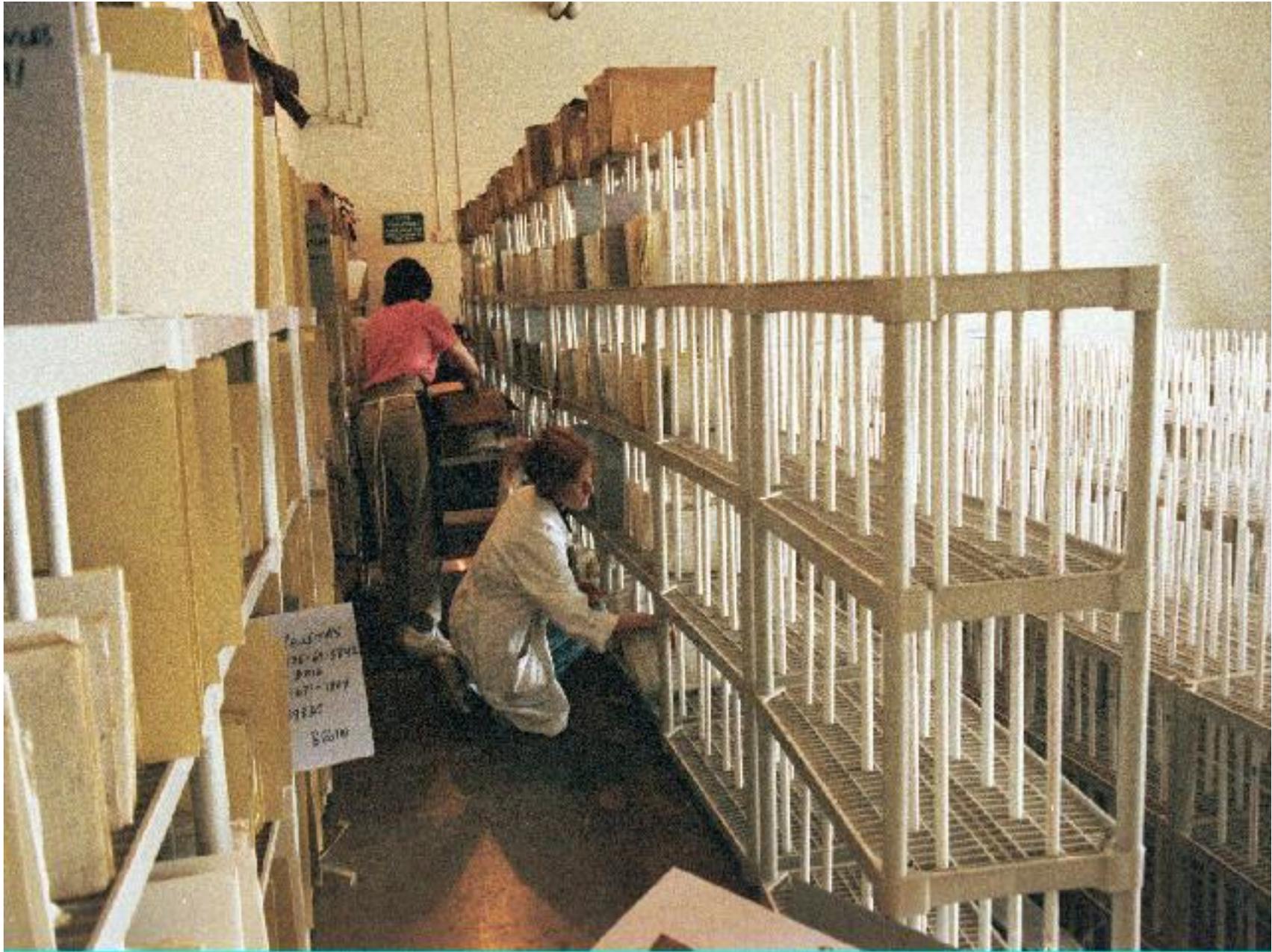


# T and RH of Drying Chamber at Suitland

For the 13 Day Period Friday, Feb. 22 to Thursday, March 7, 2002







At first, conservators provided training and guidance, later oversight only.



Batches of boxed frozen records were removed from the truck, allowed to thaw inside the chamber and spread out to dry on plastic shelving. Pre-cut pieces of acid-free corrugated board were used as supports. Standing paper records in the slots with grain

direction up reduces curling.













Before reboxing we made sure all records were completely dry.  
We used a moisture meter developed for measuring the moisture content of paper if possible. Remember cold temperatures may

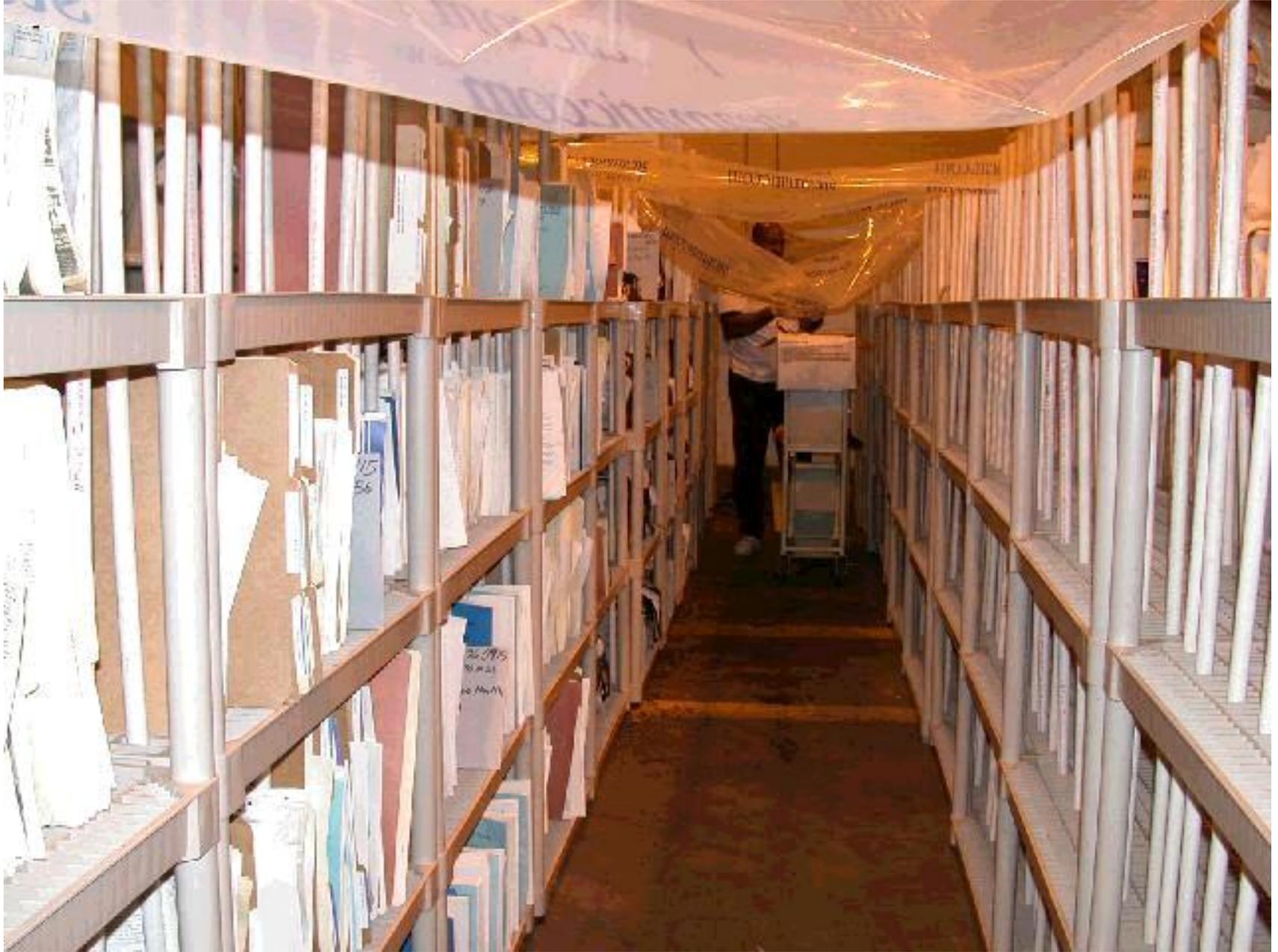
give an artificially low reading. Dry paper should NOT feel cool to the touch. We require a reading of 7 % moisture content to indicate when paper is dry enough to rebox. A word of warning: Don't take more records off the truck than you can process in the chamber. Select only what is manageable by the allotted staff and time.















ACCESSION NUMBER  
059-80  
0051

AGENCY BOX NUMBER  
126

PASSPORT  
W

Alonso, M  
Alper, M  
FRONT

ACCESSION NUMBER  
059-80  
0051

AGENCY BOX NUMBER  
125

PASSPORT  
W

A10  
Alonso, K  
FRONT

ACCESSION NUMBER  
059-80  
0051

AGENCY BOX NUMBER  
128

PASSPORT  
W

A11  
Alper, S  
FRONT

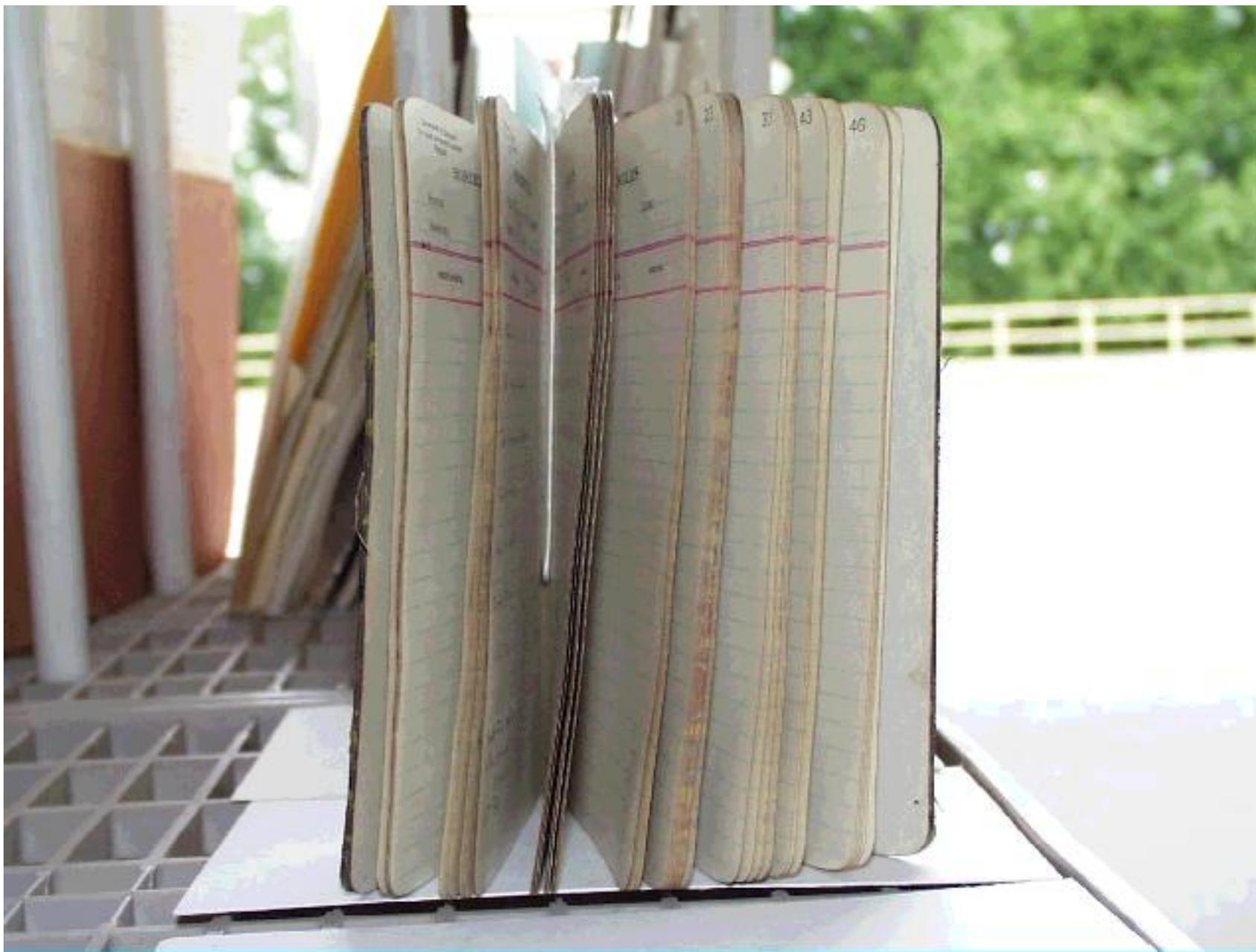


Mold growth may be unavoidable particularly if you have large quantities of wet records that can not be frozen quickly enough. If you discover mold, you have several options.

- If you have a conservator on staff she can dry the records and work in a fume hood to remove the mold. This is the preferred and safest procedure.
- If you do not have a staff conservator you must isolate the affected records. Bag the moldy records and refreeze them to buy time to consider other options.
- This is what we did several summers ago when we discovered mold.



Since a fume hood was not available, conservators worked outside on a sunny summer day and wore protective equipment and gently brushed the light mold growth from dry documents.



Bound volumes were fanned open, small splints of very thin corrugated board were placed close to the spine approximately every  $\frac{1}{4}$  inch and the books allowed to dry.

During the latest fire recovery no evidence of mold growth was detected.

Results-Desiccant Drying, Again Kathy Ludwig's research evaluates drying method pros and cons

- Physical custody is maintained during on-site desiccant drying.
- Mold growth is generally prevented by low relative humidity.
- Expansion or increased loft does occur compared to air or vacuum freeze- drying. Kathy Ludwig will present current research comparing various drying methods.
- Intellectual control is enhanced if a single team member is responsible for his or her area.
- A large drying chamber such as the one used by the record center is very labor intensive. To maintain well functioning drying equipment requires expert professional services.



# Vacuum Freeze-Drying

- Unclassified
- Non-privacy-protected records
- Off-site location

Procedure-Vacuum Freeze Drying: for unclassified, non-privacy protected records off-site vacuum freeze-drying was the preferred recovery option.

- Two boxes, one semi-wet and one very wet were selected as test samples. Each was filled with paper-based records. Various types of photographic images were attached to the documents.
- The records were sent by overnight airfreight to the off-site facility, dried and returned by air.
- A paper conservator evaluated the first two boxes. The test results were good.







Subsequently, frozen records were rearranged and consolidated from boxes stacked three to five high stacks on pallets. This is possible because once frozen, the damp boxes will no longer crush. Loads from five trucks were compressed into three trucks.

Pallets were stretch wrapped and transported to the commercial recovery site.

During the freeze vacuum drying process, water is sublimed from the liquid state to a vapor. Thus, there is less ink bleeding and planar distortion compared to air or desiccant drying.



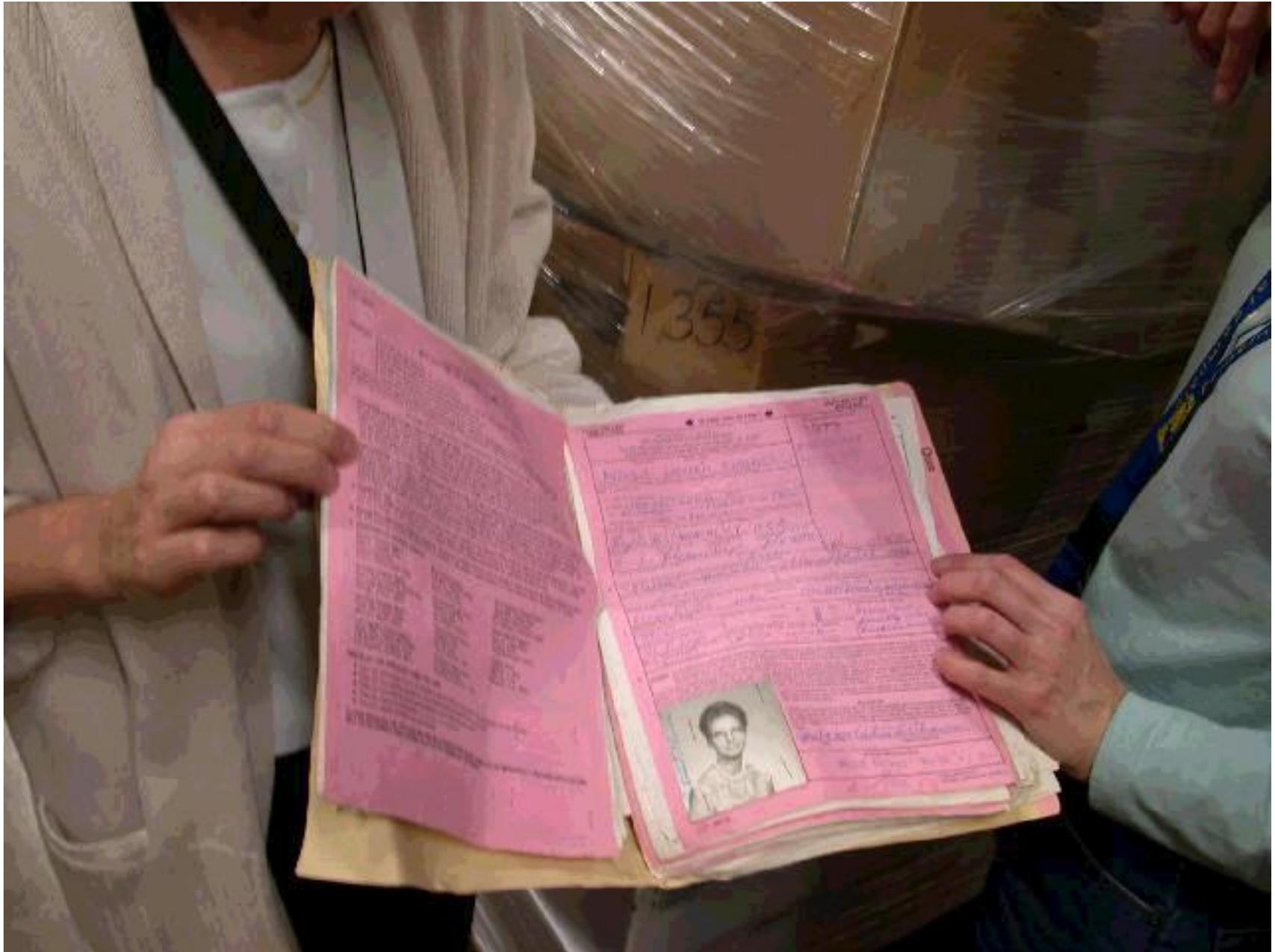
Results-Vacuum Freeze Drying:

- Although inks had already bled during the first few minutes after the fire, bleeding was halted.

- Swelling had occurred initially when the paper was first wet, however, distortion after drying was minimal.
- Most paper-based records looked essentially the same after drying.
- Photographs and paper were not blocked or stuck together.
- Two large shipments have been returned from the off-site drying facility and the results are very good.
- Although there is still identification work to do, burnt, charred and water damaged records are back on new shelves. This is not, however, the end of the preservation story. If requested by a researcher, these records will require some kind of conservation intervention to make them safe to handle. Options include sleeving in polyester or they may be photocopied. A label could be put on the outside of the box of charred or fragile burnt records stating that they may not be accessed until they receive conservation attention.













# Post recovery treatment

- Sleeve in polyester
- Photocopy
- Label outside of boxes: conservation needed before handling

Schedule a post-recovery review.  
- What worked?

- What didn't?
- What you can do better?