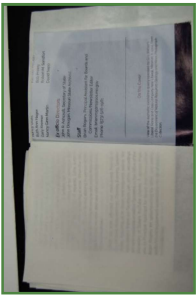


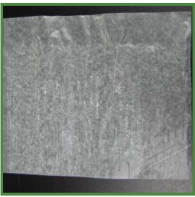
Conclussions and Recommendations

In this investigation, parchment paper was the best option for interleaving wet coated papers for air-drying, compared to the others tested. Booklets interleaved with parchment paper dried within 31 hours and incurred no additional damage from adhesion of the coating to the interleaves. Silicone release paper, while equally good at preventing damage, had a longer drying time (33 to 48 hours), is thicker, much more expensive, and has less availability. Five of the six booklets interleaved with wax paper and freezer paper did not dry within 72 hours and the ‘wet booklets’ had areas of coating adhesion to these interleaves.



When selecting interleaving materials for inclusion in an emergency response cache, parchment paper is recommended – the cheapest source appears to be in bulk purchase from a restaurant supply store. Silicone release paper would be a good second choice if it is easily obtained or available on hand. However, the drying time will be longer than for parchment paper

Wax paper is not an ideal choice, as it does not completely prevent damage to the coating and has a long drying time. If using wax paper, the interleaves should be removed once the coating is no longer ‘sticky’ to promote faster drying. Freezer paper is not suitable as an interleaving paper for air-drying as it inhibits the drying process too much.



Areas of further inquiry on this subject should include comparing brands of an interleaving material to establish whether this effects drying time or damage prevention. Materials testing (Oddy and P.A.T.) of both Quilon and silicone coated parchment paper would also be good to establish whether the chromium in the Quilon coating is a potential problem.



Slow Drying and Adhesion Photos: Wet Freezer Paper booklet (top), evening of Day 2, still drying from the edges inwards; Wax Paper (middle) and Freezer Paper (bottom), coating adhered to paper after drying. Freezer Paper image is edited to increase contrast between white paper and white coating.

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The Missouri State Archives were established in 1965 to house state records of permanent historical value. The holdings include: executive, legislative, and judicial records; records of state departments and agencies; land records; military records; state publications; photographic collections; microfilmed county and municipal records; and manuscript and reference collections. The earliest records date from 1770 – before the area became part of the United States.

<https://www.sos.mo.gov/records>

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An Evaluation of Interleaving Materials

for Air-drying Coated Papers during Emergency Response

JENNIE PHELPS, CONSERVATOR, MISSOURI STATE ARCHIVES, LOCAL RECORDS PROGRAM

Project Introduction

Following an emergency incident impacting a cultural heritage collection, conservators and other responders may need to air-dry paper based materials, including coated papers. Coated paper is coated or impregnated on one or both sides with a water sensitive material such as clay or gelatin. It is used to produce photographic prints, and for printing “glossy” magazines and books. If sheets of coated paper are allowed to air-dry without interleaving with a release paper, they often adhere to each other and cannot be separated without damage. Vacuum freeze-drying is recommended for coated paper items if they are wet or present in large numbers. However, if such items are only damp, or only a few are affected, interleaving with a release paper and air-drying may be the most appropriate choice for the situation.

Conservation literature (e.g. Long et al, 2006; Walsh, 2003) typically recommends freezer paper or waxed paper for interleaving coated papers during emergency incident response. However, Dadson (2012) recommends silicone release paper. While updating the Missouri State Archives emergency response plan, I decided to investigate the relative efficacy of these different materials so that we could choose the best material for our own emergency supplies and make better recommendations to others. This experiment was conducted the week of June 7, 2021.

Interleaving Materials



Wax Paper: a tissue weight paper coated (wet wax paper) or impregnated (dry wax paper) with a food safe wax. Wet wax paper is widely available at low cost in both consumer sized and bulk rolls and sometime as sheets as well. Melting points for the waxes used vary, but may be as low as 115° F (46° C) for varieties coated with paraffin.

Thickness (Reynolds Cut-Rite) — 1.5 mil; Cost/sq. ft. — \$0.02 to \$0.05

Freezer Paper: a heavier weight paper coated on one side with polyethylene or another food safe plastic. Widely available in both consumer and bulk sized rolls; costs slightly more than wax paper.

Thickness (Paper Maid) — 4 mil; Cost/sq. ft. — \$0.03 to \$0.08



Parchment Paper: a thin, highly calendared paper that has been

treated with acid to modify the fiber structure and is typically coated with silicone or Quilon (a non-stick coating, made primarily of isopropanol that contains a small amount of chromium). Availability for in person purchase varies, both silicone and Quilon coated versions are widely available online in both consumer and bulk quantities. Often sold in sheets sized for baking pans as well as rolls. The Quilon versions tend to be cheaper. The brand tested is coated with silicone.



Thickness (COLIBYOU) — 2 mil; Cost/sq. ft. — \$0.02 (bulk) to \$0.11 (consumer)

Silicone Release Paper: a heavier weight paper coated or impregnated with silicone. Usually available only from specialty suppliers (art and conservation) and often quite expensive.

Thickness (Seal Release) — 4 mil; Cost/sq. ft. — \$0.12 (Talas) to \$1.48 (Seal/Beinfeng)



Evaluation Criteria

The interleaving materials were evaluated based on the following criteria:

- How well a particular material prevented damage to the coated paper used for testing;
- Drying time (in whole hours), lower drying times were preferred in order to minimize response time – if booklet dried overnight a range was recorded (e.g. 9-24 hours or 33-48 hours);
- Thickness of the paper in mils, thinner paper is preferable for interleaving books, as it minimizes stress on the spine from interleaving every page;
- Cost per square foot, lower cost preferred – range based on current prices in May 2021;
- Availability for purchase, wider availability and shorter acquisition times preferred – considered in person, online, consumer quantities and bulk.

Preparation

Sixteen (16) booklets were made from copies of a recent Missouri State Archives newsletter. By chance, the issue used had an article about the Agents of Decay!

Interleaving sheets were cut to slightly larger than the pages of the booklets from each of the four options identified. The interleaving options (L to R): Wax paper, parchment paper, freezer paper, and silicone release paper.

The heavier papers strongly retained the curvature of the roll they were cut from, which made interleaving a bit more difficult, but not so much as to disqualify these options from consideration.

Staging the Emergency

Fifteen of the booklets were exposed overnight to one of three degrees of moisture to simulate various water emergencies. Left – immersion in water (Wet) and upright on wet towel (Partially Wet); Right – humidification using a GoreTex sandwich, of wet blotter, GoreTex — membrane up, booklets, and Mylar (Damp).

Interleaving

The Partially Wet and Damp booklets were interleaved after removal from their exposure environment. With the Wet booklets, the coating proved to be extremely unstable – during interleaving of the Wet/ Wax Paper booklet the coating came off on my hands and the table and the pages of the booklet were severely wrinkled. Because of this the remaining Wet booklets were interleaved in the water, which greatly reduced the damage from the process.

Air-Drying for Recovery



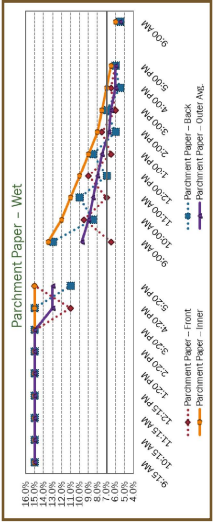
and center every hour during work hours using a Delmhorst PA-2 moisture meter with E–19 type electrodes. Booklets were considered dry when all measurements were consistently ≤ 7% moisture content.



Notes on the Graphs

The measurement range of the Delmhorst PA-2 meter is 4-14% moisture content. Readings that exceeded that limit were recorded as >14% and graphed as 15% moisture content.

The moisture content of the Front and Back covers of the booklets fluctuated from being turned. For the sake of clarity in the combined graphs, the average moisture content of the covers is shown in the Results graphs.



Carter County Flood April – May 2017

At the county seat of Van Buren, the Current River rose over 30 feet in about 38 hours. The river finally crested more than 17 feet above flood stage and 8 feet above the previous record flood crest that occurred in March 1904. All of the county offices were inundated. Local Records assisted with the records recovery. While most materials were vacuum freeze dried, some records, urgently needed for county business, were air dried locally.



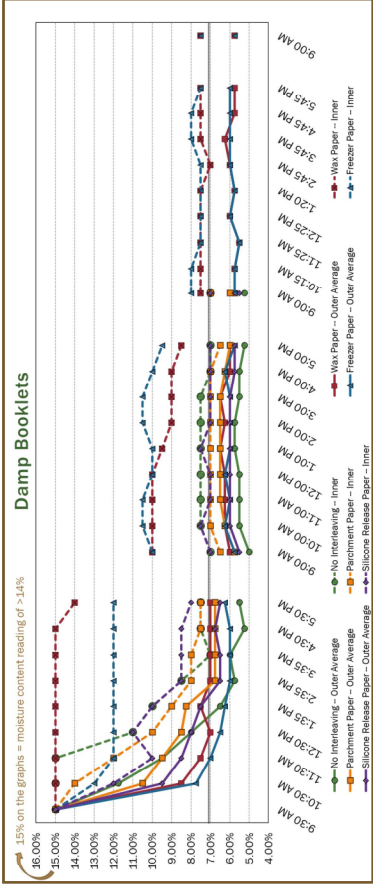
Climate change is likely to increase the number of extreme weather and flooding events, leading to more record breaking floods impacting cultural heritage collections and requiring emergency response from conservators. Flood photos courtesy Pauline Peterman (Carter County Recorder of Deeds).

Results

Damp Booklets: All of the damp booklets dried without any damage or apparent change to the coating.

Parchment paper, silicone release paper, and no interleaving all produced acceptable results, with the booklets drying in 31 hours or less. The booklet interleaved with parchment paper had the shortest drying time, reaching ≤7% moisture content throughout during the first overnight (between 9 and 24 hours drying time). It was also the most consistently dried, with the least difference between the moisture content of the inner and outer pages.

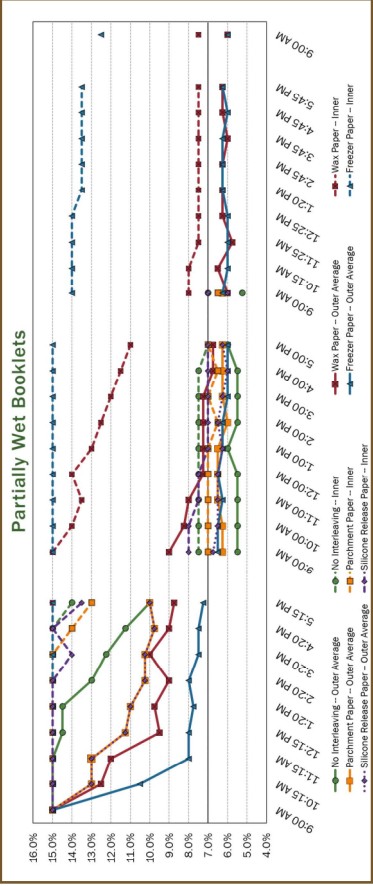
The booklets interleaved with wax paper and freezer paper failed to dry completely within 72 hours, although they did come close. These relatively impermeable materials appear to have inhibited drying, so removing the interleaves at the end of the second day would likely produce complete drying within 48 hours without any risk of damage.



Partially Wet Booklets: Damage to all the partially wet booklets was similar, including tidelines, planar distortion, changes to the texture and gloss of the coating, and minor loss of media/coating on the spines and near the edges of the booklets. Some of the booklets had wrinkles and/or small areas of coating loss.

The parchment paper and silicone release paper had similar drying profiles, although the parchment paper was faster (9 to 24 hours drying time) than the silicone release paper (28 hours drying time). Parchment paper also resulted in a more consistently dried booklet.

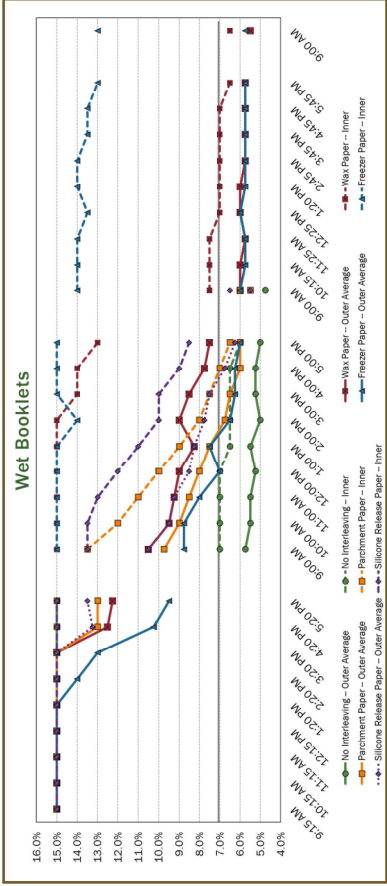
The inner pages of the booklet interleaved with wax paper came close to drying within 72 hours, remaining just above 7% for all of the third day. The inner pages of the freezer paper booklet, however, were still wet at the end of the test period. The outer pages of these two booklets dried much faster – indicating that the relative impermeability of these interleaving papers accelerated the drying of the outer pages, while slowing the drying of the inner pages.



Wet Booklets: The wet booklets sustained major damage, primarily from the 15 hour immersion and interleaving process.

Flakes of the coating were present in the ‘flood’ water and more detached during interleaving. The additional planar

distortion of the wax paper booklet from interleaving is most likely what allowed it to dry completely during the third day of the test. Additional flakes of the coating detached from all the booklets during every moisture content measuring session. While the bits of coating found stuck to the parchment paper and silicone release paper were concentrated along the spine and appeared to be detached fragments that had collected there, the wax paper and freezer paper interleaves had areas of adhered coating that directly corresponded to areas of damage on the adjacent pages.



Drying times for the wet booklets were longer than for the partially wet booklets, but followed similar drying profiles for each type of interleaving material. Again parchment paper (31 hours) was faster than silicone release paper (33-48 hours). The inner pages of the freezer paper booklet did not dry within the test period.