



NATIONAL GALLERY OF ART

*Conservation Division*

11 April 2008

Conservators at the National Gallery of Art would like to share their experience with X-radiograph film preservation and encourage the digital project members to consider cold storage for the preservation of X-rays in their original format:

- 1) Recent research indicates that the greatest benefit for film preservation is cold or frozen storage. For example, the Photo Preservation Index on the IPI (Image Permanence Institute) website lists a Preservation Index of 34 years at 72F/50% and 6000 years at 5F/50% (household freezer temperature and interior RH within vapor-proof package). See [http://www.imagepermanenceinstitute.org/shtml\\_sub/dl\\_prescalc.asp](http://www.imagepermanenceinstitute.org/shtml_sub/dl_prescalc.asp)
- 2) Government Records Management Guidelines for X-rays (<http://www.archives.gov/records-mgmt/publications/managing-xray-films.html>) recommend a maximum temperature of 35F for acetate X-rays requiring storage for 51-100 years (preservation rather than short-term retention). X-rays post dating the introduction of polyester films for X-rays on U.S.-manufactured Kodak film (mid-1960s) do not require cold storage due to the stability of polyester. The AIC Code of Ethics requires preservation of conservation documentation.
- 3) 50+ year-old acetate films pre-dating 1960 (and earlier nitrates) already exhibit or are on the cusp of rapid autocatalytic deterioration. Films at this stage require cold storage to retard or halt film base degradation. This type of acetate degradation reactions occurs independently of enclosures (storage envelopes) and is evidenced by **warping, channeling or blistering of the film, vinegar odor**. Early nitrate X-rays (in U.S.-manufactured Kodak film prior to mid-1920s) will tend to have an acrid odor, amber discoloration, intense silvering, browning, brittleness, and gumminess in later stages.
- 4) Because all chemical deterioration is slowed in cold storage, the need to remove old but sturdy INTACT non-archival enclosures is minimized (especially if there is no evidence of silvering or staining of the film). IPI research found that there was little benefit to replacing sturdy intact old enclosures with new archival enclosures for materials going into cold storage. Enclosure- or pollution-induced damage is usually evidenced by image silvering, fading, and discoloration (overall, or prominently in area of seams). These reactions also are slowed in cold storage as are all temperature-based reactions.
- 5) Where old enclosures are causing image deterioration AND the items will be kept at room conditions, there is benefit to replacing harmful enclosures with buffered paper enclosures that are not photo-reactive to image silver (enclosures must pass ISO 18916 Photographic Activity Test and meet the specifications in ISO 18902 Photographic Filing Enclosures). **However, the films will continue to decay at room temperature.**
  - ISO Standard 18911 (Film Storage) specifies buffered paper enclosures and cold storage for acetate films.
  - ISO Standard 18911 and 18920 (Print Storage) both specify vapor-proof packaging for materials

going into cold or frozen storage that does not have RH control (freezers, simple vaults). ISO Standard 18911 mentions several types of vapor-proof packaging.

· IPI advises, and photograph conservators in recent years at Library of Congress, National Gallery of Art, National Archives, National Park Service, and Smithsonian Institution Archives have adopted the time- and cost-saving practice of not replacing the old, sturdy paper enclosures of materials that are going into cold storage. Staffing is too low, supply budgets are too small, to undertake these housing projects for large collections.

6) Conservators at National Gallery of Art, National Archives, and now National Park Service and Smithsonian Institution have used other types of vapor-proof packaging (Marvelseal, other metallized plastic, heavy-weight 8 mil polyethylene) with no adverse effects and much more cost-effective results. SI and NPS tested several of these materials / packaging layers and found best results with metallized plastics used in conjunction with an outer bag of 6 or 8 mil polyethylene. NPS will be presenting their test results at this month's AIC meeting.

7) An article in *Topics in Photographic Preservation*, Vol. 12, by Sarah S. Wagner provides cost estimates for different cold storage options (see attached pdf). Household freezers can be cost-effective for small-scale collections such as these.

8) Based on 5000 8x10-inch negatives, the cost of replacing enclosures (supplies and labor) could be \$17,000 (Government GS7 labor \$18.85 / hr without benefits; with 30% benefits \$24.51). Digitization of 5000 films could run \$159,000 (scan, file prep, and cataloging GS7/9, 300 scans / mo or 2 scans / hr).

9) In 2003-04, NGA undertook an X-ray preservation project for their ~15,000 14x17-inch films and 1,700 8x10-inch copy negatives: The supplies cost \$6725 including Marvelseal vapor-proof packages, folders and mat board for sandwiching packets of films within the vapor-proof packages, zipper-lock polyethylene bags, and five 20.3 Cubic Ft. household freezers. The freezers are located in a hallway near the conservation division.

Constance McCabe, Senior Photograph Conservator, National Gallery of Art  
Elizabeth Walmsley, Painting Conservator, National Gallery of Art  
Sarah S. Wagner, Samuel H. Kress Photograph Conservator, National Gallery of Art Library, and proprietor, Sarah S. Wagner LLC, Silver Spring, MD