



Conserve O Gram

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Caring For Cellulose Nitrate Film

What is Cellulose Nitrate Film?

Cellulose nitrate (nitrate) refers to a family of transparent, light, flexible, and easy to handle film supports used for motion picture film and still photographic negatives. This material was most common between about 1910-1950. Nitrate can hold a black-and-white negative or positive still photographic image. It was also used as the base for black-and-white or color motion picture film negative or positive images. Paper-based photographs are never nitrate. If deteriorated, nitrate may be yellowed, tan colored, stained, bleached, sticky, brittle, blistered, pungent-smelling, or powdery, depending upon the stage of deterioration. Specific tests, described in the *Museum Handbook*, Part I, Appendix R: Curatorial Care of Photographic Collections, have been developed to identify nitrate. During the 20th century, amateur and professional photographers used cellulose nitrate more frequently than any other film support to hold the emulsions of their negative and motion picture film images.

The Problems of Nitrate

Unless stored at a very low temperature, cellulose nitrate motion picture and still photographic film self-destructs at an unpredictable rate over time. As it deteriorates, nitrate gives off acidic by-products (nitric oxide, nitrogen dioxide). These acidic gases are deep lung irritants. Repeated exposure may cause eye irritation, rashes and sores on the face and skin,

vertigo, nausea, headaches, swollen glands, and respiratory irritation. By-products from nitrate film also damage surrounding museum materials, causing embrittlement of paper and film and cumulative damage to many organic materials and metals. Deteriorated nitrate film is highly flammable and can burn under water. Once ignited, nitrate fires are almost impossible to put out. The toxic gases produced by burning nitrate are lethal. **Do not** store nitrate film in general museum, archival, or office spaces.

Most collections of motion picture and still film from 1910-1950s contain nitrate. The primary method of preserving nitrate is to duplicate the original material onto safety film before it reaches deterioration stage 3 (see below). For guidance, see *Conserve O Grams*:

- 19/10 "Reformatting for Preservation and Access: Prioritizing Materials for Duplication."
- 19/11 "Preservation Reformatting: Selecting a Copy Technology."
- 19/12 "Contracting for Reformatting of Photographs."
- 19/13 "Preservation Reformatting: Inspection of Copy Photographs."

For information on shipping nitrate film for duplication, and disposal of original images following duplication, see *Conserve O Grams* 2/20 "Handling and Shipping Cellulose Nitrate Film" and 2/22 "Disposal of Cellulose Nitrate Film."

See the *Museum Handbook*, Part I, Appendix M: Curatorial Care of Cellulose Nitrate Film, for guidance on identifying, duplicating, and managing these collections. This *Conserve O Gram (COG)* provides summary guidance on how to house and handle nitrate materials in a safe and effective manner while minimizing the health risks inherent in these collections.

To Care for Your Nitrate Do This...	Don't Do This...
<p>Housing/Storage of Nitrate Negatives, Transparencies, Motion Picture Film, X-Ray film, and Microfilm</p> <ul style="list-style-type: none"> Store nitrate in cold dark storage in a vault or frost free freezer at <40° F (<4.4 ° C), 20-30% RH. For every 10° F rise in temperature the deterioration rate doubles. Isolate nitrate from other items, as it gives off damaging acidic gases; then warn your fire department about the nitrate. Replace nitrate negatives and film in general storage with acid-free separation sheets that indicate their new location. Rehouse negatives in new buffered paper four-flap envelopes or L-weld sleeves that meet ANSI IT9.2 specifications; then place within an archival box in a Ziplock bag in a frost-free freezer. Put a humidity indicator label inside the bag. Place nitrate motion picture film in perforated film cans to allow gases to escape. Transfer all old information to the new housing. Program for duplication funds immediately. 	<ul style="list-style-type: none"> Don't allow smoking, an open flame or high heat near nitrate. Don't house nitrate freezers in your museum storage area, as cold storage doesn't eliminate all fume build-up. Don't dispose of undeteriorated nitrate until duplicates are produced that pass inspection. See COGs 19/13 and 2/22. Don't keep nitrate negatives with a flowing or powdery image surface; instead dispose of them as hazardous material after deaccessioning. See COG 2/22. Don't dispose of nitrate in the trash. Don't house nitrate in plastic.
<p>When setting up your nitrate work space:</p> <ul style="list-style-type: none"> Set up a work area in a cool, well-ventilated space far from office areas and collections. Gather necessary equipment, supplies, and tools before you begin. These include: goggles; nitrile gloves; rolls of unprinted newsprint; washable smocks; work tables and chairs. Individuals especially sensitive to nitrate may want to use a specially-fitted, rated breathing apparatus (see COG 2/13). If workspace ventilation is not good, obtain a large fan. Position the fan so the airflow blows directly on you and towards an air intake valve to push fumes away. 	<ul style="list-style-type: none"> Don't neglect to wash your work surface daily with a solution of 1-teaspoon baking soda to one pint of water to neutralize the acid build-up from the nitrate. Don't ever work with nitrate in a hot, stuffy room or near any source of sparks, or high temperature. Don't let your cold-storage nitrate get disorganized. Browsing through the freezer to look for items can impact the film life.

<p>When Working with Nitrate:</p> <ul style="list-style-type: none"> Maintain a log of who works with nitrate and when. Document any problems in the space including odors, discomfort, or ill effects noticed. Work on a surface that is either easily washable or use layers of clean non-printed newsprint paper which can be ripped off and disposed of at the end of the day. Wear nitrile gloves and a long-sleeved washable smock as protection when working with nitrate. If you notice any odor or experience irritation, wear a fitted, rated breathing apparatus (see <i>COG 2/13</i>) and goggles. Wash your smock at least weekly with a mild soap and water. Inspect nitrate monthly (even when stored in a frost-free refrigerator). 	<ul style="list-style-type: none"> Don't continue working with nitrate if you experience any health problems including breathing, skin, or eye problems. Stop immediately and contact the park safety officer and your doctor. Don't touch your eyes, hair, or skin with a contaminated gloved hand. Don't wear contact lenses while working with nitrate, as gases may build up under your lenses causing eye injury.
<p>When Preparing to Pack Nitrate for Reformatting:</p> <ul style="list-style-type: none"> Select your nitrate for duplication. See <i>COG 19/10</i>. Use highly buffered housing materials with a high calcium carbonate reserve as they can soak up the acidic gases. Document the materials by inventorying them and filling out a loan form. Prohibit the vendor from reusing nitrate-contaminated storage materials and placing nitrates and duplicates next to each other. Ensure that the vendor will use a duplication system with a scanning laser or cathode ray tube rather than a hot quartz iodine bulb enlarger. 	<ul style="list-style-type: none"> Don't automatically reformat everything. Don't wait until you're ready to ship the material to begin inventorying & housing it. Don't attempt to ship or reformat nitrate that has a flowing (soft and slipping) or powdery image area. Deaccession it and dispose of it as hazardous waste. Don't allow reformatting using a standard modern enlarger with a quartz iodine bulb, as it's too hot.
<p>After Reformatting:</p> <ul style="list-style-type: none"> Determine if copies passed inspection (see <i>COG 19/13</i>). If the copies don't pass inspection, reformat them again. If the copies pass inspection, dispose of the original nitrate as hazardous waste (see <i>COG 2/22</i>) unless the nitrate has artifactual, intrinsic, evidential, or associational value (see below). If the nitrate is not deteriorated and has artifactual, intrinsic, evidential, or associational value (see <i>MH-II</i>, Appendix D), place the nitrate in well-ventilated cold storage in accordance with <i>NFPA 40: Standard for the Storage and Handling of Cellulose Nitrate Film</i>. Nitrate, even stored in freezers, poses fire and health risks, so store off-site. See <i>Conserve O Gram 2/22</i> for additional information. 	<ul style="list-style-type: none"> Don't dispose of nitrate automatically after copying it. Don't place deteriorated nitrate in cold storage. Don't place nitrate in cold storage permanently without monthly inspecting it for deterioration and arranging to reformat it; otherwise you are simply putting off dealing with a serious problem that will get worse.

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