CENTER FOR JEWISH HISTORY

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Preservation Newsletter--April 2018

Cellulose nitrate film

Cellulose nitrate is an early form of film stock: the plastic support that carries the image layer in photographic negatives [flat and roll film], motion picture film, and x-ray film. Cellulose nitrate was in continual use from the earliest days of film up until the middle of the 20th century. If your collection includes 35mm motion picture film or photographic film [flat or roll] created before 1950, you almost certainly have cellulose nitrate in your collection.

Why this matters…

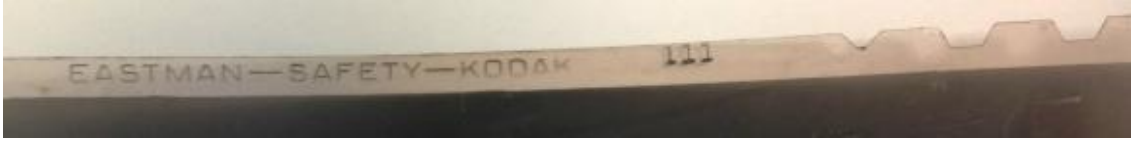
The earliest use of cellulose nitrate was not as a film base*, but as an explosive called guncotton*! A more stable form was developed by Kodak in the 1880's and it became the standard for plastic film for almost a century. Unfortunately, even the relatively stabilized form continued to be highly flammable and was even known to self-ignite, resulting in numerous fatal cinema fires during the early 20th century. This chemical instability continues to pose a danger to our collections in the form of speedily deteriorating nitrate materials, off-gassing that hastens the deterioration of nearby materials, and the additional risk of catastrophic fire in the stacks.

Aging cellulose nitrate shrinks, eventually to the point where it is unusable. As the film breaks down, it gives off nitric oxide, nitrogen dioxide, and other gases that yellow the film base, yellow and soften gelatin, and oxidize the image. Later, the base cockles, becoming brittle and then sticky, then disintegrating completely. The inevitable deterioration is usually gradual, but elevated temperatures and humidity speed it greatly.

When it deteriorates, nitrate base film makes a kind of pressure cooker if stored in a film can, especially if the can is taped shut. If the gases can't escape, heat builds up and spontaneous combustion can occur. The fumes from cellulose nitrate fires are toxic, and the fire cannot be extinguished by normal methods—immersed in water, smothered under sand, in a room where the oxygen is replaced by Halon—it will continue to burn until all material is exhausted.

Identifying nitrate film

All 35mm motion picture and still film made before 1950 that is **NOT** marked "Safety" in the margins should be considered nitrate-based in the absence of chemical testing.



Additional identifying characteristics include:

- Yellowing
- Stickiness
- cockling
- Sour (but not vinegar) smell
- Image fading
- the presence of brown powder in the container

What can I do to protect my collection?

First and most importantly, you should have a record of all your film-based collections materials that identifies materials suspected of being nitrate and notes the location of those suspect materials in the stacks. Nitrate poses a risk to our staff and any first responders who come as a result of a disaster—we must know where the dangers are located!

- Do not store flammable liquids anywhere near film collections
- Suspected flat film should be housed individually in paper sleeves and vented boxes; suspected roll film should be stored in paper boxes, not metal canisters.
- Never allow nitrate film to be stored in areas where temperatures go above 90 degrees Fahrenheit.
- Inspect film collections regularly every 6 months and weed out films that have deteriorated beyond restoration.

Ideally, nitrate film should be removed from our storage areas. High value film should be reformatted and stored off-site in a cold storage vault in compliance with NFPA-40 (https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=40). Film that has little value or is readily available elsewhere should be disposed of in accordance with EPA guidelines.

The Center for Jewish History wants to help you protect your collections! If you suspect that you may be holding cellulose nitrate film-based collections, let us know right away. We can help you to manage the risk to other collections materials, identify and triage suspect materials, and determine ongoing storage and funding needs. Please don't hesitate to ask for help dealing with this extremely challenging format!

And now for your scary viewing pleasure:

Film Archivist Geoffrey L. Rayle demonstrates the flammability of old nitrate film stock as compared to modern safety film by setting an old nitrate movie trailer on fire. Recorded - 1AM, 27 October 2009: https://www.youtube.com/watch?v=7mZDt8vYMBw

The Werner J. and Gisella Levi Cahnman Preservation Laboratory