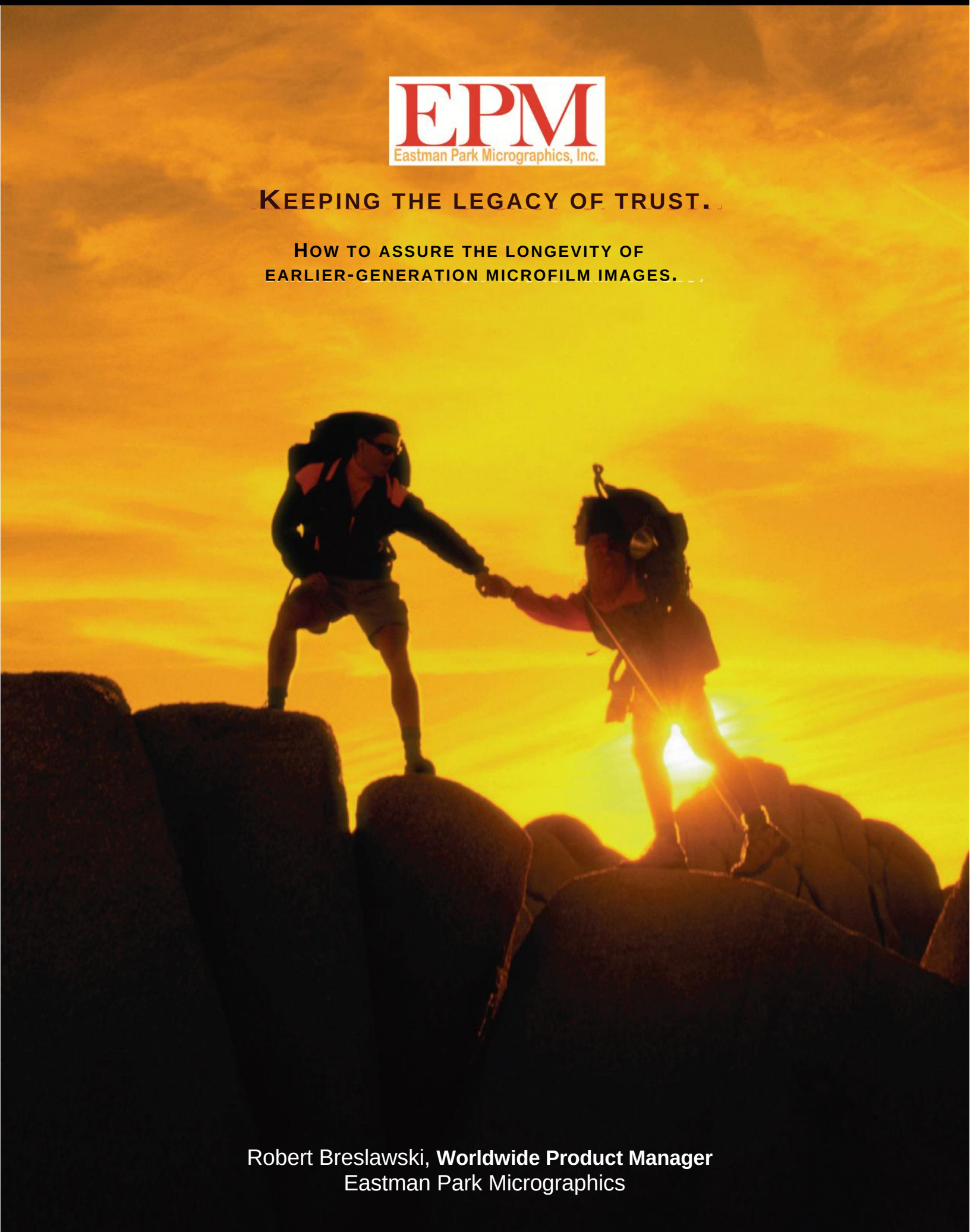


KEEPING THE LEGACY OF TRUST.

HOW TO ASSURE THE LONGEVITY OF EARLIER-GENERATION MICROFILM IMAGES.

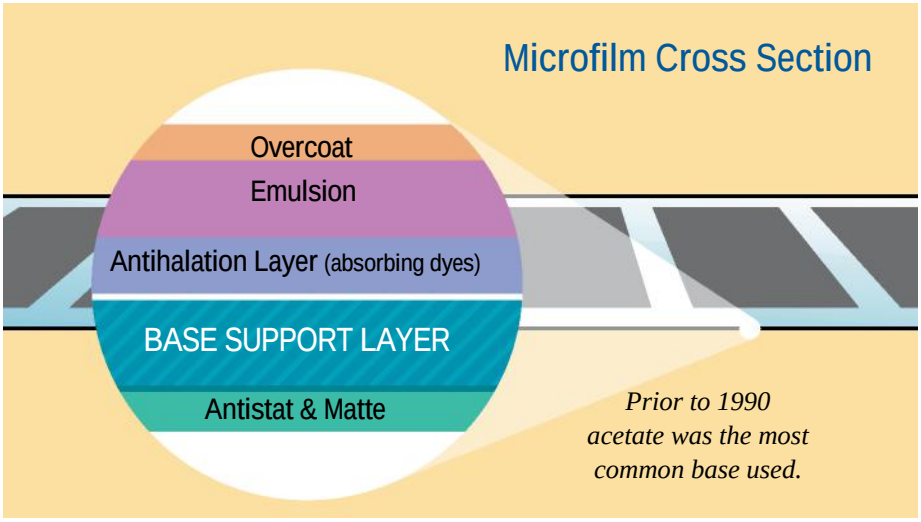
Robert Breslawski, **Worldwide Product Manager**
Eastman Park Micrographics

TAKE ACTION TO PRESERVE YOUR MICROFILM LIBRARIES—BEFORE TROUBLE HITS.

Archives maintained by businesses and government agencies have accumulated stores of microfilm dating as far back as the 1930's. Through the mid-1990's, many of these records were captured on a type of film with a minimum life expectancy of 10 when handled properly. However to storage in conditions of uncontrolled temperature and humidity, much of this film is at risk of premature failure due to a chemical reaction known as the "vinegar syndrome."

Eastman Park Micrographics (EPM) understands the need to preserve valuable documents such as rare books and manuscripts, contracts, medical records, and public records, including state archives and land titles. You can overcome the vinegar syndrome through prevention, correction, and conversion to current microfilm technology.

Education is the first step. This brochure will give you a quick overview of the vinegar syndrome and the easy steps you and a knowledgeable service provider can take to protect your microfilm.[1]



BACK TO FILM BASE-ICS.

As you probably know, any film is made up of layers. The gelatin emulsion is the photosensitive layer, with other layers added to reduce scratches, static, and internal reflection. The film base is the thickest element, with contemporary films running from 2.5 mil. to 7 mil. The base provides strength and dimensional stability to the other layers.

From the 1930's on, most films, including microfilm, were manufactured on a cellulose acetate base. This was a notable advance over the previous nitrocellulose, which was prone to spontaneous combustion. Hence the name "Safety Film," which appears on many acetate films. Beginning in the late 1970's, film manufacturers began migrating to a rugged polyester plastic base. These polyester-based films are extremely stable, offering a minimum life expectancy of 500 years when properly processed and stored.

Effects of Vinegar Syndrome

COOKING *ACET*ATE TO *ACETI*C ACID.

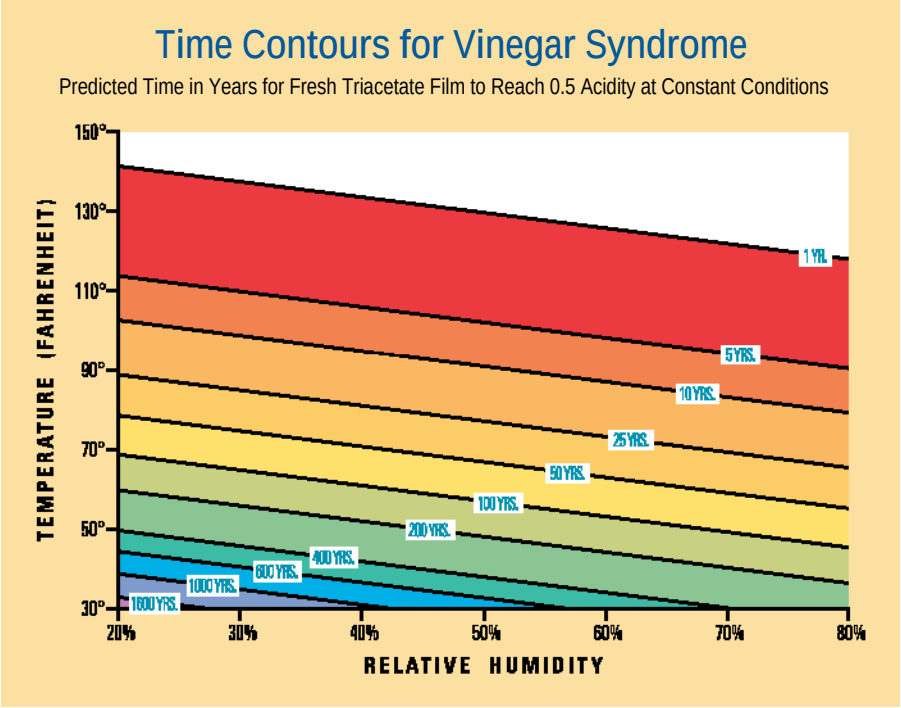
The problem with acetate film is that the acetyl groups that make up the cellulose acetate chain can detach in the presence of moisture, heat, and acids. They combine with water to form acetic acid, the compound that gives vinegar its familiar taste and odor. In fact, one study estimates that a typical 1000-ft. can of 35 mm movie film can generate the equivalent of 250 teaspoonful's of household vinegar.[2]

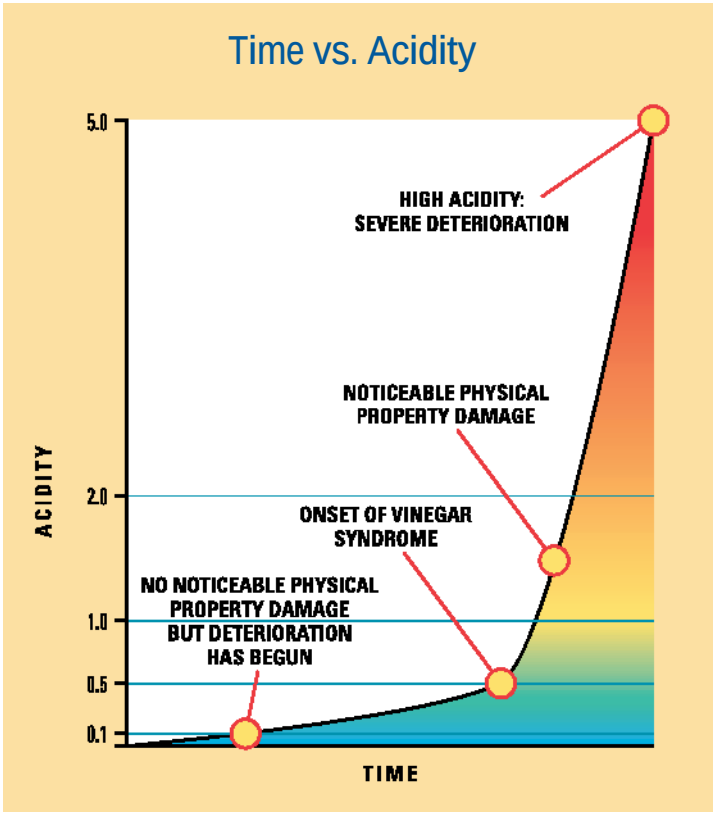
The film base loses its dimensional stability and becomes brittle, resulting in curling, shrinking, and buckling of the film layers. Any and all of these conditions can degrade or destroy images on the emulsion layer.

THE IMPORTANCE OF YOUR STORAGE ENVIRONMENT.

Notice the mention previously of moisture and heat as factors in vinegar syndrome. The “Time Contours” chart[3] shows how heat and humidity can affect life expectancy, varying from centuries to mere years. Basically, cooler and drier is the way to go.

But even if your film has always been stored under controlled conditions, any time out of the vault—for instance, in a warm, humid office environment for research—can accelerate the decomposition process exponentially.





A CHAIN REACTION WAITING FOR A TRIGGER.

While improper storage sets the stage for disaster, acid plays the starring role. It actually acts as a catalyst to start the reaction that converts acetyl groups to acetic acid. Past a pH of 0.5, the reaction accelerates, as shown in the “Time vs. Acidity” chart.[4] Symptoms worsen. As the pH exceeds 2.0, the odor intensifies, film begins shrinking and buckling, and plasticizer is exuded from film layers.

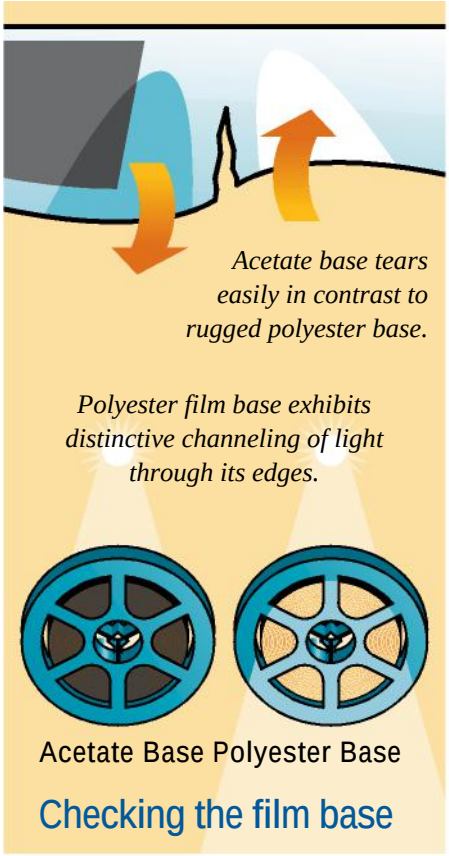
Unless caught in the early stages, the accumulation of acetic acid will reach a point of no return at which nothing can be done.

FORTUNATELY, THERE’S PLENTY YOU CAN DO TO ARREST THE ONSET OF THE VINEGAR SYNDROME AND RECOVER DAMAGED MICROFILM.

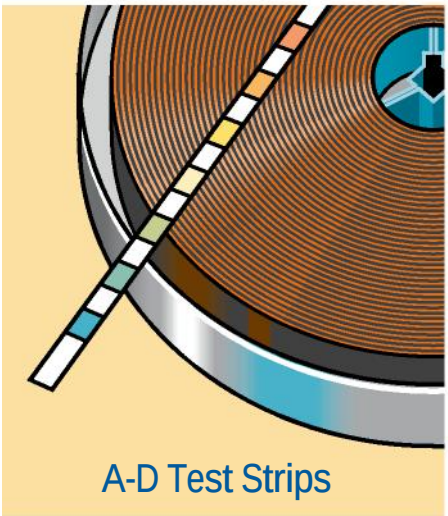
AN OUNCE OF EARLY DETECTION IS WORTH A POUND OF REMEDY.

Vinegar syndrome doesn't have to undermine your microfilm collection. With a few simple, relatively inexpensive steps, you can take action now to prevent future problems.

The steps described here will help you evaluate your microfilm, isolate suspect microfilm, and consider your options. You can apply these procedures to sample rolls, a section of your library, or all of your microfilm. In any case, experts from EPM or your service provider can help you analyze your situation in greater depth.



Checking the film base


A-D Test Strips

CHECK YOUR BASE.

Is your film on acetate or polyester base—or both? Generally, any film made after 1995 is probably on modern polyester base and thus immune to vinegar syndrome. If you're not sure, two simple tests can tell you.

First, try tearing a leader strip at right angles to the film edge. Acetate base will tear easily, while polyester is virtually impossible to tear.

Second, perform a visual check for light piping—polyester film's ability to channel light at right angles to its surface—will further confirm the base type.

FOLLOW YOUR NOSE.

As you check through your acetate-base film, the distinctive odor of vinegar will alert you to the presence of tainted film. This film requires immediate action. Isolate it and contact your service provider to determine level of degradation. Special handling and storage conditions are required to maintain degraded film for transfer

polyester.

MAINTAIN A VIGILANT EYE.

Film that doesn't exhibit any odor should be monitored by using A-D test rips that measure acid accumulation. These are placed inside film boxes cans and checked periodically for quantitative measure of the accumulation of acetic acid.

Special packets of a desiccant material called a "molecular sieve" can be added to film containers. These will absorb moisture and acetic acid to stabilize two of the factors that contribute to the vinegar syndrome. While molecular sieves help prevent degradation in film that is not already degrading, it is no substitute for proper storage. Ongoing monitoring and replacement are also required.

CONVERT THE FILM FOR GOOD.

The best way to deal with acetate microfilm that exhibits signs of vinegar syndrome is to duplicate it onto film made with polyester base. Indeed, if testing shows high acidity levels or visual inspection shows curling and shrinking, duplication is the only course of action open to you.

When duplicating film you have some options. You can make multiple copies, change the polarity of the images, or even scan the images to digital media. Proper processing and storage should result in a life expectancy measured in centuries. You can fulfill your archival mission while eliminating future costs and liability by taking action now.

CONGRATULATIONS. YOU ARE ON YOUR WAY TO PRESERVING A VIRTUALLY PERMANENT TREASURE OF INFORMATION THAT CAN BE ACCESSED AT ANY TIME IN THE FUTURE.

FIND THE RIGHT SERVICE PROVIDER.

Not just any lab can duplicate acetate film that is showing signs of degradation. Special equipment and handling are required. To help assure yourself of successful conversions, check for the following items in any lab's response to your RFP.

IMAGE QUALITY.
YOUR LAB SHOULD:

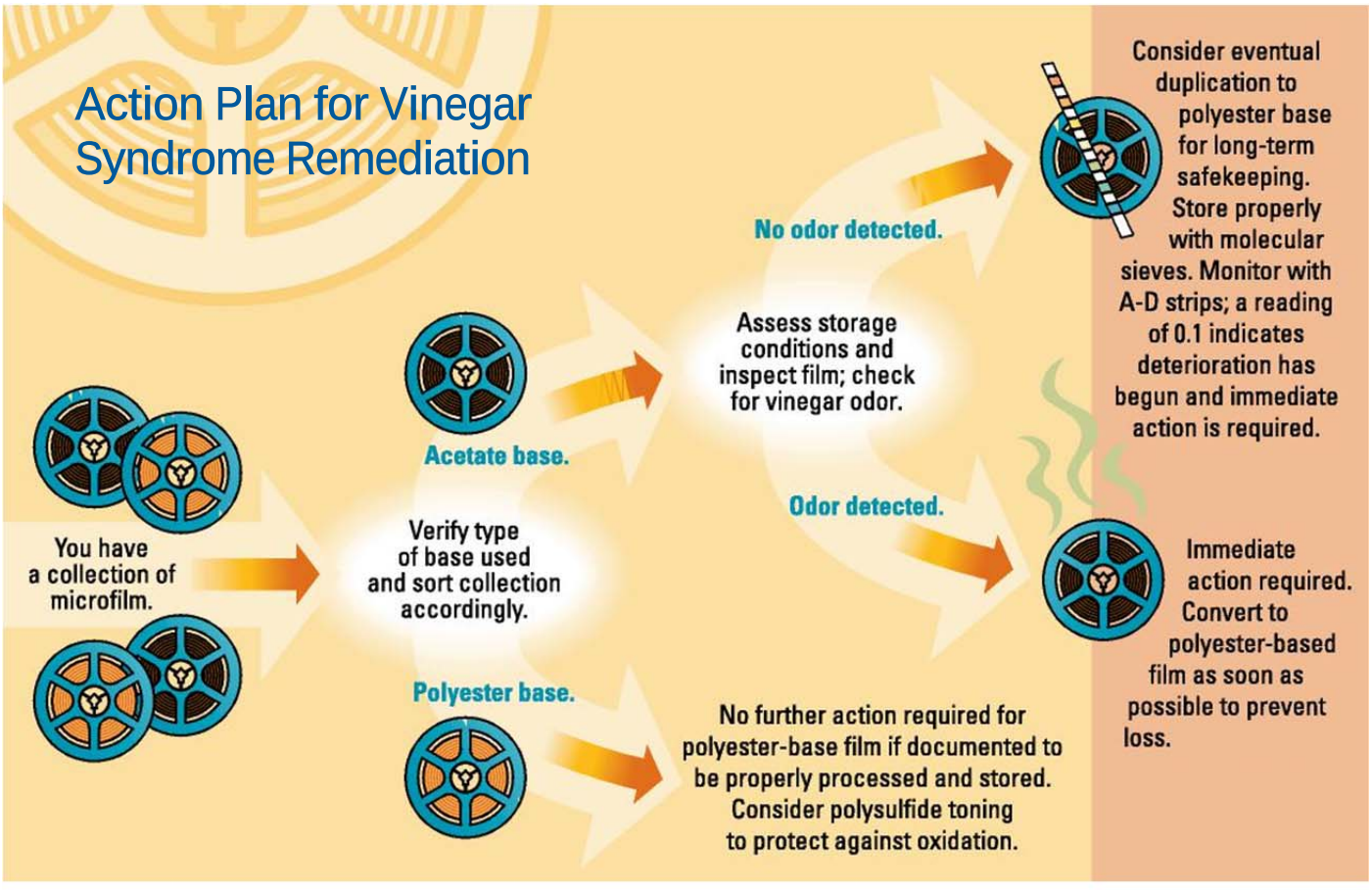
- Provide duplication samples of your deteriorating film
- Hold test target levels between generations
- Offer consistent contrast/tone scale reproduction
- Guarantee appropriate density reproduction from image to image/ roll to roll
- Produce scratch-free film

PROCESS QUALITY CONTROL.
YOUR LAB SHOULD:

- Specify the quality control procedures and sample control procedures used
- Describe the inspection process/ reporting and the passing criteria
- Specify processes and control used to ensure quality reproduction repeatability
- Be a current member in the EPM INFOGUARD Quality Monitoring Program
- Perform methylene blue testing every time it runs your work Specify storage conditions for film held at the lab's site
- Provide polysulfide toning treatment (to resist oxidation)
- Provide molecular sieves (to control moisture)
- Provide a processing audit trail which will enable the lab to trace and quarantine their work in the event of a failed methylene blue test or polysulfide toning test

EXTRA SERVICES.
YOU MAY WANT TO ASK FOR:

- Expert consulting services
- Film scanning to create digital images
- OCR processing



EPM: WORKING TO HELP YOU GET THE FULL VALUE OF YOUR MICROFILM—NOW AND INTO THE FUTURE.

Combating the degradation of film due to the vinegar syndrome is just one aspect of preservation. Because your primary goal is to preserve the irreplaceable image content carried on the film, the careful implementation of a conversion plan by a qualified lab is crucial. Proper photographic tone reproduction and maximum fine line detail retention are required to ensure that the historical information captured so carefully in the past will still be available for future generations. By following international standards for processing, quality assurance testing, and storage conditions, your media life expectancy can be measured in centuries.

The Image Permanence Institute's 24-page *"IPI Storage Guide for Acetate Film"* is an excellent reference for anyone wishing to know more about acetate film preservation, contact:

Image Permanence Institute
Rochester Institute of Technology
70 Lomb Memorial Drive
Rochester, NY 14623-5604

Protect your film against oxidation.

Microfilm—whether on polyester or acetate base—is subject to attack by pollutants and naturally occurring chemicals that can oxidize the silver in the emulsion. This is visible as small spots that can degrade the readability of images. A simple procedure called polysulfide toning changes the film's processed silver to silver sulfide, which is much more resistant to humidity and oxidation.

See the EPM website for additional publications, including: *Storage and Preservation and Use of Brown Toner to Extend the life of Microfilm* using the link below.

The following sites are just a sample of the additional information about vinegar syndrome and remedial measures on the web:

Eastman Park Micrographics:
http://www.epminc.com/support/microfilm/source-document-microfilms

Association des Cinémathèques Européennes:
http://www.ace-film.de/english/cont04d01.htm

CBC (Canada Archives):
http://archives.cbc.ca/info/281g_en224.shtml

Image Permanence Institute (IPI) homepage:
https://www.imagepermanenceinstitute.org/imaging/ad-strips

Kodak reference on molecular sieves:
http://www.kodak.com/US/en/motion/support/technical/vinegar.shtml

1. *In this brochure, the generic "microfilm" includes 16 and 35 mm roll microfilm and microfiche, all of which were manufactured on acetate base.*
2. "IPI Storage Guide for Acetate Film," *pg 10, © 1993 Image Permanence Institute*
3. *Adapted from ibid, pg 6*
4. *Adapted from ibid, pg 13*

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