Using and Storing Microfilm

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The International Institute of Municipal Clerks (IIMC) is devoted to advancing the professionalization of the Office of Municipal Clerk and improving the efficiency of municipal government. The IIMC provides its members with educational, conference, reference, research, and informational services designed to keep them informed of changes in the professional community.

The National Association of Government Archives and Records Administrators (NAGARA) is a professional association dedicated to the improvement of federal, state, and local government records and information management programs and the professional development of government records administrators and archivists.

The National Historical Publications and Records Commission (NHPRC), a statutory body affiliated with the National Archives and Records Administration (NARA), supports a wide range of activities to preserve, publish, and encourage the use of documentary sources, created in every medium ranging from quill pen to computer, relating to the history of the United States.

Preface

Like every organization, local governments create and maintain large quantities of records. Many of these records not only are of great value to the local government, but also are of concern and essential to the citizens of the community. Federal and state-mandated program requirements, changes in growth and development patterns, expanded service needs, the use of computers and other technologies for creating and using information, and the proliferation of copies in various formats, have all contributed to this enormous accumulation of records. Each publication is intended to make available to local governments the basic principles, policies, and guidelines that should be followed in establishing a sound records management program and in carrying out sound records management practices.

The series is intended for local officials, with limited resources, who lack formal records management or archival training but who have custodial responsibility for records. These local governments include townships, villages, cities, counties, school districts, and other local political subdivisions and special-purpose districts. Each of the following publications in the series includes a bibliography that refers to other reading for more detailed information and guidance.

Overview:

Starting a Records Management Program, The Daily Management of Records and Information, Making Your Records Management Program Successful, Managing Records on Limited Resources, Funding Your Records Management Project

Creation, Collection and Storage:

Identifying and Locating Your Records, Establishing Records Retention, The Selection and Development of Local Government Records Storage Facilities, Developing a Records Storage System

Preservation, Promotion, Use and Access:

Archives for Local Governments, Protecting Records, Using and Storing Microfilm

Care, Management, and Preservation of Electronic Records:

E-Mail Management, Selecting and Using Document Imaging Systems, Managing Electronic Records, Preparing for E-Discovery

Copies of these bulletins are available on the IIMC and NAGARA websites.
IIMC at www.iimc.com • www.nagara.org

Acknowledgements

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Ms. Wojcik participated in many grant projects funded by the National Historical Publications and Records Commission (NHPRC), including the SDSC Archivists' Workbench project, the Michigan RMA Pilot Project, the PERM Project, the PAT Project and the DCAPE Project. Ms. Wojcik was secretary to the Board of Directors of the National Association of Government Archives and Records Administrators (NAGARA) between 2003-2012.

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Greg Colton is a co-founder and president of Graphic Sciences, Inc. and has been involved in the document management industry since 1973. He is responsible for the company's overall business strategy and is directly responsible for supporting strategic client opportunities. He supports the sales staff on complex, large-scale conversion or system sales, and guides the development of new products and markets. In particular, Mr. Colton directs the company's digital imaging development efforts.

During his career, Mr. Colton has designed and implemented a variety of digital and micrographic imaging systems; for example, he was among the first in the country to utilize bar-code technology to reduce data entry requirements for microfilm computer-aided-retrieval systems. Mr. Colton has served on the faculty of the Davenport University, and has been guest lecturer at Wayne State University, Lansing Community College and Bowling Green State University. He is an active participant in key industry associations and has been a frequent speaker on information and image management issues.

He is a past-president and past-board member of the Michigan Chapter of the Association for Image and Information Management (AIIM). AIIM recently awarded him its Distinguished Service Citation and its Master of Information Technologies award. Currently Greg is the Secretary of the Mid-Michigan Chapter of ARMA International. Mr. Colton performed his undergraduate studies at Michigan State University and graduate studies at the University of Michigan.

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INTRODUCTION

What is Microfilm?

A micro image is an image that is too small to be seen by the naked eye. Microfilm has been actively used as a business tool and document recording media since the late 1920s[1]. Over time, microfilm has been used:

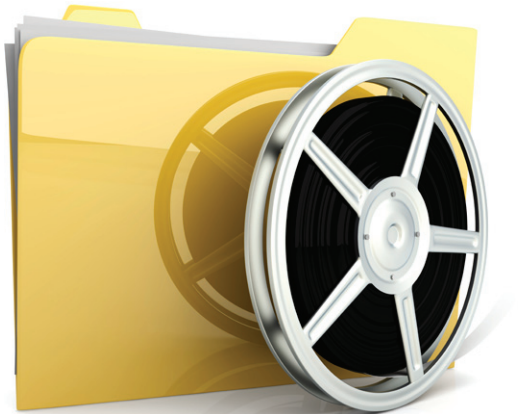
- to preserve and protect information that has long term or permanent value,
- to reduce physical space storage costs,
- as a low cost, high volume distribution media, and
- to reduce the dependency on voluminous computer reports.

While the fundamental principles of microfilming have remained consistent since its inception, the mechanical aspects of this media have evolved and continuously enhanced. Improvements in cameras, original and duplicating film(s) and processing techniques have made the entire process highly reliable, predictable and repeatable. Additionally, microfilm has existed long enough to benefit from very specific and demanding standards regarding its use, production and storage.

Perception of Microfilm

Today, record keepers enjoy various storage media options. Microfilm is perceived by those who don't understand its benefits to be antiquated and archaic when compared to newer technologies. As a result, the number of first time users of microfilm is diminishing. However, microfilm remains, and should be considered, an important and useful tool for record keepers. In fact, microfilm is still considered to be the ideal storage medium for the long-term and permanent preservation of records.

It may be observed, especially for local government audiences, that, as an archival baseline, microfilm is still the standard. Under certain circumstances, microfilm may be the most cost efficient and operationally effective record keeping solution available. For example, records with a very long retention period and low retrieval activity are good candidates, because microfilm protects records and reduces storage cost. However, record keepers should conduct their own cost-benefit analysis for each unique record series that they are considering for reformatting. Options explored in this technical bulletin may help you decide whether microfilm is right for your office.



Authentic Record Reproductions[2]

Selecting an appropriate record keeping system is like selecting the appropriate level of insurance for your home. Records with a greater value to the owner warrant a higher level of insurance. Records with lesser value may warrant less insurance. All records systems must possess four basic characteristics to be considered trustworthy. Records must have integrity and be authentic, reliable, and usable, regardless of their format and media. When properly produced, microfilm is an ideal tool for satisfying the attributes discussed in this section for authentic, reliable and usable records.

An *authentic* record is one that can be proven to be what it professes to be, to have been created or sent by the person claiming to have created or sent it, and to have been created or sent at that time. To ensure their authenticity, policies and procedures should document records creation, receipt, transmission, maintenance, and disposition. This will ensure that record creators are authorized and identified. Thereby, records will be protected against unauthorized addition, deletion, alteration, use, and concealment.

[1] http://en.wikipedia.org/wiki/Microform

[2] International Standards Organization (ISO) 15489-1:2001 – Information and Documentation – Records Management – Part 1 – General, section 7.2.2 – 7.2.5.

A *reliable* record is one whose contents can be trusted to be a full and accurate representation of the transactions, activities or facts to which they attest, and can be depended upon in the course of subsequent transactions or activities. Records should be created at the time of the transaction or incident to which they relate, or soon afterwards, by individuals who have direct knowledge of the facts or by instruments routinely used within the normal course of business to conduct the transaction.

The *integrity* of a record attests that it is complete and unaltered. A record must be protected against unauthorized alteration. Records management policies and procedures should specify what additions or annotations may be made to a record, under what circumstances additions or annotations may be authorized, and who is authorized to make them. Any authorized annotation, addition or deletion to a record should be explicitly indicated and traceable.

A *useable* record is one that can be located, retrieved, presented, and interpreted. It should remain directly connected to the business activity or transaction that produced it. Contextual information should remain linked to the record to help users understand the transactions that created and used the record. It should be possible to identify a record within the context of broader business activities and functions. Links between records that document a sequence of activities should be maintained. Records must be accessible for the duration of the retention period.

Record Keeping Options

Most modern offices are faced with a "do more with less" work environment that includes overcrowded file cabinets, and pressure from the customer to perform services in more convenient and efficient ways. Converting records to an alternative media is often suggested as a solution to these challenges. Unfortunately, investments are often made into new record keeping systems without sufficient analysis and planning which can, and often does, lead to the phrase no one wants to hear… "I thought this system would…" Anything following this phrase represents some level of disappointment. Identification of the source of the record keeping problem is key to a successful and cost effective solution. It is necessary to analyze the current business process, identify the current problem set and define the outcome objectives. It is only when these factors are clearly understood that a realistic, compliant and functional solution can be defined.

For records currently created in paper there are four basic choices for problem resolution. Choices include: 1) retaining the paper, perhaps in a different way or location, 2) re-designing the business process to eliminate the creation of paper, 3) converting to microfilm, or 4) converting to digital image. A fifth choice could include a combination of technologies in order to take full advantage of the benefits of all. Record keepers will need to conduct their own analysis to determine which of these choices best meets their own needs and resources.

Paper

Typically the least expensive of the choices, paper filing systems, require no conversion costs. Paper is a reliable long-term storage media that requires no special equipment to view. Paper filing systems are culturally accepted and they have established standards for filing and destruction. Paper is easy to interfile, to redact (protects confidential information), and to modify.

Unfortunately, paper filing systems have no built-in disaster recovery mechanism. More fundamentally disturbing is their greater risk of misfiled and lost documents. Paper filing systems can become voluminous, and are not cost effective to duplicate or distribute. Access may be mediated through a single user.

Records retained in paper formats should have short retention periods, and low retrieval levels, or have very long retention periods and possess historical or intrinsic value, including:

Long term

- Maps (with color or layers)
- Photographs
- Architectural drawings (with color or handwriting)
- Articles of Incorporation

Short-term

- General correspondence
- Administrative subject files
- Budget development records
- Freedom of Information/public access requests

Business Process Re-design

Automating a business process to eliminate the need for paper can be of great benefit. The result of this effort should create a full understanding of the business process, as well as identify inefficiencies and redundancies. Identifying areas where information can be captured electronically may eliminate the need for paper creation or retention, and reduce staff time for managing the paper filing systems.

A business re-design is an opportunity to reconsider record keeping practices, since it will often identify problems that could be alleviated. Examples of potential findings include:

- Areas where electronic records are printed and filed unnecessarily
- Records that can be captured and retained electronically
- Records that no longer serve a business purpose and can be eliminated
- Opportunities for automating business processes (workflow)
- Opportunities for re-defining record keeping procedures
- Automated routines (software) that can be built or purchased to handle records more effectively
- Opportunities for the re-allocation of existing staff
- Need for organizational changes
- Information sharing opportunities between departments or other government entities
- Opportunities for improved customer service

Microfilm

Microfilm systems offer many advantages over paper and are typically overlooked as a viable alternative in today's office environment. Microfilm systems are less voluminous than paper and satisfy the requirements of long-term storage. Microfilm systems require relatively low maintenance and can be easily replicated. They provide a mechanism for disaster recovery, and have established standards for creation, use and storage. However, microfilm systems require specific equipment to view and print the records, and they are not ideal for records that require decentralized access or multiple simultaneous users.

Records that may be well-suited for conversion to microfilm (either in addition to, or in replacement of, the paper) are often voluminous. They may have long retention periods, need to be accessed from a central location, require a mechanism of disaster recovery, or have historical value. Examples include:

- Deeds, easements, encroachments, rights-of-way
- Vital records (birth, death, marriage, divorce)
- Criminal records
- Licensing files
- Court records
- Board and commission minutes and agenda materials
- Drawings and maps
- Annual financial ledgers

Digital Imaging (digitization)

The benefits of imaging reside primarily in the access and distribution of active information. Benefits of good imaging systems include:

- high density storage
- decentralized, multiple user access
- rapid retrieval
- ease of distribution
- ease of updating and duplicating

Potential users of imaging systems often confuse their records retention requirements with their retrieval needs. Retrieval and retention are two separate and distinct issues. Imaging systems are not likely to be cost justified purely on the basis of storage space reduction. Although imaging systems have other inherent benefits, they are primarily designed to provide rapid retrieval and distribution for very active documents. Ensuring the long-term accessibility and usability of records stored as digital images are dependent on how digital imaging systems are

designed, implemented, managed, and migrated. A common misperception is that imaged records will be available as long as the physical media used to store the images last. Although this may be the case for paper and microfilm, imaging systems have limited stability, and depend on particular hardware and software configurations. Due to rapid pace of technology change, there is a high risk that a single set of imaging components will not be able to satisfy retention and access requirements for any public record, especially long term and permanent records.

Any office that is considering digital imaging needs to be aware that maintaining records exclusively in electronic formats requires a serious and ongoing commitment of financial and human resources. This commitment is often overlooked, misunderstood, and/or underestimated, but it is an undeniable fact that must be planned for the life of the record. This commitment includes:

- Routine and/or required software and hardware maintenance
- Replacement of media and system components to achieve cost effectiveness
- Migration of data and images to future systems

In many circumstances digital images need to be retained longer than the original hardware and software that were used to create them. As a result, the office must have a plan and a budget for periodically migrating the images and indexes to new technology as the original technology becomes obsolete to ensure that the records remain accessible over time.

Records that may be suited for conversion to digital images are often voluminous, have high retrieval levels, are stored in a decentralized environment that requires multiple user access, and have short retention periods (less than 10 years). Examples include:

- Accounts payable documents
- Journal vouchers
- Canceled checks
- Unemployment applications
- Renewable licenses
- Income tax records

Hybrid Solutions

A hybrid combination of the various media operating in concert may provide the most cost effective and efficient solution for some records.

For example:

- Microfilm can be used to satisfy long-term retention and preservation needs, while digital images are used for quick retrieval and decentralized access.
- Microfilm can be used as a “bridge” to a digital system. First microfilm is produced, and then the film is scanned when retrieval of the records is demanded. This solution combines the relative low cost of the initial capture for microfilm and the ease of retrieving and distributing digital images. This approach is particularly appropriate for cases where the record volume is high and the retrieval rate, as a percentage of the activity for the entire collection, is relatively small.
- Microfilm can be used as an analog back-up to digital imaging systems, to provide certainty of recovery in case of a major system failure.
- Microfilm can be used for reference purposes to avoid damage to fragile paper records with intrinsic or archival value.

Records that may be well-suited for hybrid solutions are often voluminous, have high retrieval for a short period of time, but also have long-term retention periods, and they may be stored in a decentralized environment that requires multiple user access. Examples include:

- Land records
- Student records
- Personnel files
- Retirement files
- Employer tax records
- Law enforcement records
- Meeting records for boards and commissions
- Corporate filings

MICROFILM PRODUCTION

Record keepers can decide to produce their microfilm in-house, to hire a vendor to produce microfilm for them, or they can use a combination of both methods. Regardless of who performs the work, the outcome should be the same. The expectations of the vendor should be equivalent to your expectations for work that is done in-house, and vice-versa. The outcome should be definable and measurable.

If you decide to produce microfilm in-house, you will need to acquire the necessary cameras, chemicals and other equipment and supplies. You will also need to hire qualified personnel, and will need to be able to provide training and supervision for the staff. You will need to have sufficient space for all of the equipment and materials, and will need to be able to maintain these items over time. You will need to address turnaround time for the work, quality controls, and security of the records. If you have multiple record series that need to be microfilmed, and if you have a predictable and consistent volume of records that will need to be microfilmed over time (versus a one-time back-file conversion), then these expenses may be cost-justifiable.

When hiring a vendor, the cost of equipment and supply purchase and maintenance, hiring and supervising specialized personnel, and re-configuring office space are avoided. However, you will still need to address turnaround time, quality controls, security and risk. When selecting a vendor, address the following issues:

- Company background/experience/reputation
- References from other customers
- Production facility inspection
- Quality control processes employed
- Quality assurance processes employed
- Confidentiality and non-disclosure policies and procedures
- Employee bonding and annual background checks
- Age and maintenance of equipment appropriate for the work
- Sub-contracting to other vendors
- Transportation and storage of records
- Security for records
- Handling/disposition of source records after the microfilm is produced
- Volume and variety of records handled
- Special services provided (preparation, indexing, barcoding, for example)
- Pricing and potential add-on fees

MICROFILM QUALITY

Regardless of whether microfilm is produced in-house, or by a vendor, address the following issues to ensure that the microfilm is authentic, reliable and usable.

Pre-production Sample for Quality

Conduct a test prior to converting a collection of records to microfilm. Test records should be representative of the documents found in the collection. Results of the sample will identify the necessary steps in the quality control process.

Quality Control

Quality control is defined as the steps in the production processes that are designed to reduce error. Quality control should be implemented for each application to be microfilmed, based upon the results of the pre-production quality sample. Quality criteria may include:

- Overall legibility
- Smallest detail legibility captured
- Completeness of detail
- Dimensional accuracy compared with the original
- Completeness of overall image area
- Density

- Image skew (slant/angle)
- Image orientation
- Index data accuracy
- Image and index format compliance

Once the quality criteria for the various attributes are defined for the production processes, procedures should ensure that these criteria are met.

Quality Assurance

Quality assurance compares the finished product against the quality criteria established in the pre-production test. This will help ensure that the records remain usable throughout their legally mandated retention period.

Quality assurance processes establish sampling plans and procedures to inspect the individual attributes of the created product for quality and consistency. Microfilm attributes that should be measured during this process include: density, resolution, image skew, index accuracy, and image clarity. Upon receipt of a microfilm product, the user should verify that the microfilmed documents match the expectations defined by the sample set.

Quality control steps used in the capture process to detect and correct errors differ from the quality assurance steps which verify the accuracy of the delivered product.

In order to establish a meaningful sampling process; address the following prior to production.

- identify the specific, critical attributes of the work product
- establish the Acceptable Quality Level (AQL) expressed as a percentage
- establish a batch size (number of the items within each batch)

For example, in a production environment, it is not sufficient to simply say, "This is a good image." Objective criteria that define what a good image is must be established so that the production process can routinely and reliably produce the defined "good image." Subjective attributes cannot be measured reliably.

It is crucial that quality assurance processes be performed in a timely manner; prior to destruction of the source documents.

For additional information, refer to (American National Standards Institute) ANSI/AIIM (Association for Information and Image Management) TR34-1996 – *Sampling Procedures for Inspection by Attributes of Images in Electronic Image Management (EIM) and Micrographics Systems*.

Standard Operating Procedures

A standard operating procedure is a document, or a collection of documents, that define the way certain functions or processes are routinely performed in the normal production environment. Microfilm producers and users should have procedures for:

- Equipment testing requirements and frequency
- Document preparation functions common to all record collections
- Index data and film backup
- Access and security
- Administration and maintenance
- Audit trails
- Disaster recovery
- Employee safety

Operational Practices

A benefit of various microfilm formats is that their creation, use and management are supported by well-established standards. Adhering to these standards will ensure that the microfilmed version of the record is authentic/reliable/usable, and will maintain its integrity throughout the established retention period. Recommended practices include:

- For records maintained on roll microfilm, only one record series should be permitted on each roll of film.
- For permanent records, a security roll should be stored in an offsite area.
- Security roll film should only be used to create a new duplicate.
- Original documents may be destroyed only if all requirements for the creation of the original film have been met.

Work Plan

A work plan will help the user develop a consistent microfilm product over time. It should define the necessary tasks, film formats and product deliverables of a given job set. The work plan should include:

- Definitions of the current environment
- desired result
- camera type
- film type and dimensions
- record sequence
- Document preparation requirements and instructions
- Documented results of the quality control sample
- Index attributes
- Quality control processes

REPRODUCING RECORDS

Document Preparation

It cannot be over-emphasized that proper preparation of the original records prior to microfilming is critical. Preparation steps may include:

- Removing all staples, paper clips or other fastening devices
- Repairing all torn or damaged documents
- Removing creases or folds for the pages so that no information is covered or lost
- Identifying any significant categories or subcategories of the collection prior to filming
- Identifying and locating missing or misfiled documents
- Arranging the documents in the order in which they are to be microfilmed
- Ensuring that only pages of a single records series will be contained on any single roll of film.

These stipulations are so important that you may wish to reread them.

Converting Digital Records to Film

Equipment used to create microfilm from digital images places images in the sequence in which they are received. Therefore, offices should determine how records will be accessed in the microfilm format and define a proper sequence for the images. Images on microfilm created from digital images should be organized in a manner that facilitates retrieval.

Micrographic Formats

This document focuses primarily on the production of roll microfilm. However, there are a variety of microfilm formats, including Computer Output Microfilm (COM), microfilm jackets, aperture cards and microfiche. Multiple factors should be considered when selecting a microfilm format, including physical characteristics of the paper, viewing equipment, indexing, and organization of the content. Format evaluation should be incorporated into the feasibility and needs assessment process.

Media

Multiple types of film media can be used when creating microfilm. It is often desirable to create both an original (master) film for preservation purposes, and a duplicate film for daily use. The original (master) film can be used to create new duplicate film if the initial duplicate film is lost or damaged.

Original (Master) Film

Selecting the correct microfilm stock is vital when the record has long-term retention requirements. Other (older) film stocks may be deficient in their chemical composition, and therefore may be unable to meet long-term retention requirements.

Film with a life expectancy of 500 years is known as LE-500 film. Only polyester based silver gelatin film LE-500 should be used to create original (master) film.

Duplicate Film

A significant advantage of the various microforms is the relative ease and low cost of duplication. It is important to note that use of film on a routine daily basis should be performed from duplicate rolls created from the camera original. Evaluation of the

need for duplicates should be incorporated into the feasibility and needs assessment process. Duplicate films may be silver-gelatin film, diazo film or vesicular film. Diazo film is the recommended and preferred type for usage film.

Duplicate copies for daily use should be made, if the film will be handled more than 10 times during its lifetime.

Indexing

When filming original documents, all indexes, registers or other finding aids should be microfilmed in the initial frames of the first roll of a series, the last frames of the final roll of a series, or in the last frames of the final microfiche of a series. Indexing, as a term, may also refer to the placement of flash cards or dividers that are microfilmed in order to facilitate rapidly locating specific information on a roll of film. Indexing may also include a database or spreadsheet to locate a specific image.

Blips

Image marks, also known as blips, are digital dots on the microfilm that are used to identify the frame number of each frame on a roll of film. They are created by the camera at the time of image capture, and are used to facilitate rapid retrieval of items from a roll. Each frame number is uniquely identified by a sequential number on each roll. Retrieval equipment counts the blips to locate the desired image. Computer Assisted Retrieval (CAR) systems may have a unique blip configuration that should be identified in the needs analysis. See ANSI/AIIM MS8-1988 (R1998) – Image Mark (Blip) Used in Image Mark Retrieval Systems.

16 mm rolls should routinely include blips. This enhancement can improve retrieval, and may aid future migration of microfilm images, if necessary.

Targets

Targets are sheets of paper containing information about the records and the filming process that are filmed and placed at the beginning and end of a roll of microfilm. Targets may also be used throughout the roll of film to provide information about subsequent images. Targets may describe the owner of the record, type of record filmed, and when it was filmed. Targets help to certify authenticity of the microfilmed record. Technical targets assure quality by objectively evaluating the density, resolution and reduction ratio of the film. Recommended targets include:

Beginning of Roll

- Density/Resolution Target
- Start Target/Certification of Authenticity - Identifies the record creator/owner, record title, date of filming, reduction ratio, operator's name and roll number.

Throughout Roll

- Flash targets – if necessary, identify file breaks for localized searching.
- Miscellaneous targets identify corrections, omissions, retakes, or additions.

End of Roll

- End Target/Certification of Authenticity
- Density/Resolution Target

Film Leader/Trailer

To avoid image damage, use at least a 3-foot leader of film before the first target of the roll, and after the last target of the roll.

Reduction Ratio

Reduction ratio is the relationship between the dimensions of an original record and those of the corresponding microcopy. Reduction ratios are expressed, for example, as 24:1. The degree of reduction should be chosen after considering all of the system requirements, including:

- Size, line width, quality, and contrast of the characters
- Size and shape of the original documents.
- Number of generations of film to be produced
- Resolution capabilities of the camera
- Size of film being used
- Magnification and image rotation capabilities of available viewing equipment

- Size and shape of screen on viewer
- Resolution and contrast characteristics of film used for duplicates

Lower reduction ratio typically provides a higher image quality. Tradeoffs exist between image quality, storage density and film usage. If image quality alone is considered, larger images are usually better. A larger image is generally more tolerant of poor quality original documents and other microfilm variables, such as density fluctuations, camera vibrations and resolution loss.

Due to the variety of filmed-document size/type, this guide will not specify which reduction ratio should be used. The reduction ratio selected should meet legibility/quality requirements identified in the sample test for quality. Record characteristics, system tasks, and user requirements should determine the reduction ratio. If reduction ratio changes within a roll, the camera operator should so indicate on a film target.

Density

Density is defined as the ability of a photographic object to transmit light. The higher the density, the darker the image (or area of an image); and the lower the density, the lighter the image. This is true for all original silver microfilms, and can be true for some types of duplicate copy films. Density, as a concept, is critical in microfilm creation, because images should not be excessively dark, nor excessively light. An objective reference by which density can be measured ensures that the microfilm images are legible.

Three density measurements ensure that processed micrographic images are properly exposed.

- D-MAX: The highest density achieved in an exposed and processed image. D-MAX range should be from .80 to 1.20.
- D-MIN: The lowest density achieved in an exposed and processed image. D-MIN should not be greater than .06.
- Base-plus-fog: The base-plus-fog measures the density of a film that has been processed but not exposed. Base-plus-fog should not exceed 0.06.

Density measurements require a properly calibrated densitometer. For high volume production, the densitometer should be calibrated daily. Systematic monitoring and recording these densities should be performed in accordance with ANSI/AIIM MS23-1998 – Practice for Operational Procedures / Inspection and Quality Control of First-Generation Silver-Gelatin Microfilm of Documents.

Resolution

Resolution is the ability of a photographic system (film, lens and processing) to record fine detail. This critical concept ensures that microfilm images are sharp/clear enough to be reliable usable. Poor resolution yields images that appear fuzzy or unclear. Resolution is determined by reading the line count and direction method using the ISO test chart No.2 (or similar) for planetary cameras and ANSI/AIIM MS17-1992 test chart (or similar) for rotary cameras. Using a microscope with a 100 X lens, the inspection of microfilm produced from documents with common font types must yield a minimum resolution of 90 line pairs for rotary cameras and a minimum of 120 line pairs for planetary cameras. Resolution is determined by sighting the line pair pattern where all five lines and spaces in both the horizontal and vertical direction can be discerned. Multiply the numbered pattern that can be viewed as described by the known reduction ratio of the image. The numeric result is the effective resolution. Resolution should meet the minimum line pairs in all four corners, as well as the center, of the each resolution chart contained on the roll of film.

Generally, for common type fonts of 8 point or greater, the acceptable level of resolution for a rotary camera is a minimum of 90 line pairs per millimeter. Acceptable level of resolution for a planetary camera is a minimum of 120 line pairs per millimeter.

For smaller type fonts, embellished type fonts, and hand written documents, acceptability levels are directly related to the document collection, and therefore the quality index (QI) method for determining resolution should be employed. See ANSI/AIIM MS23-1998 – Practice for Operational Procedures / Inspection and Quality Control of First-Generation Silver-Gelatin Microfilm of Documents.

Silver Film Processing

Process exposed microfilm within two weeks of image capture. Control the processing for consistency per ISO 18901:2002 – Imaging materials – Processed silver-gelatin type black-and-white films – Specifications for stability and ANSI/AIIM MS23-1998 – Practice for Operational Procedures /Inspection and Quality Control of First-Generation Silver-Gelatin Microfilm of Documents.

Residual Thiosulfate

In normal silver film processing, fixer or "hypo" is used to remove unused silver particles from the emulsion of the film. If left in the emulsion, these silver particles will continue to react and over time begin to alter the appearance of the film. Fixer is a fairly strong basic compound. If left on the film, this basic (salty) compound will damage the film image. Fixer must be sufficiently washed from film in order to reduce the possibility of film damage. Residual thiosulfate should be measured using ANSI/NAPM IT9.17-1993 – Photography-Determination of Residual Thiosulfate and Other Related Chemicals in Processing Photographic Materials-Methods Using Iodine-Amylose, Methylene Blue and Silver Sulfide. Testing film for residual thiosulfates (commonly known as methylene-blue testing) should be performed weekly. In the event of a failure, all film processed after the last successful test should be recalled, rewashed and retested to ensure that sufficiently low levels of residual thiosulfates reside on the film. This re-washing process must be performed within two weeks of the original film processing. LE-500 films should contain no more than 0.014 g of thiosulfate ion per m2.

Inspection of Newly Processed Film

Inspect newly processed film for both major and minor defects. Minor defects may require retakes of individual images, and major defects may require re-filming the entire roll. Examples of minor defects: images that are skewed, incorrectly orientated, folded at an edge or corner, or that overlap. Minor defects are repaired by recreating and replacing the defective image.

Major defects may include a failure to meet minimum resolution or density requirements, or incorrect targets. Major errors cannot be repaired and require the re-filming of the roll. For additional information, refer to ANSI/AIIM MS23-1998 – Practice for Operational Procedures/Inspection and Quality Control of First-Generation Silver-Gelatin Microfilm of Documents.

Splicing and Retakes

Routine film inspection may reveal errors in the filming process. Corrected images can be put on a separate roll of film, then added (using splicing) to the end of the original roll. Such corrections must be clearly identified, both on the roll and its label. Corrective film should contain a list of the retaken images, in front of the added images. No splice should occur less than 6 inches from the End of Roll Target. A single re-take may contain single or multiple consecutive images (as displayed on the original film). However, the splice should contain no more than two feet of images, total. No film splice should appear between the Start and End target. Splicing is corrective; normal filming operations avoid splices.

During the filming process, the operator may detect an error. The operator may correct that error by filming a "Start retake" target followed by the corrected images, and an "End retake" target. This type of correction requires no splicing.

A single roll of film should contain no more than one splice and no more than three retakes. Splices can be made using heat, ultrasonic or splice tape manufactured specifically for that purpose. Splices should be butt splices, not overlap splices. Tape splices should contain no rubber-based adhesives.

MICROFILM MAINTENANCE

Reader Printers

As microfilm use diminishes, manufacturers who produce microfilm reading and printing devices decrease in number. Most reader-printers produced today are not analog devices, but instead are digital. These devices scan the film image and convert it to a digital format; the digital image can be printed from virtually any laser type printer. Yet how long will microfilm readers/reader-printers be available for retail purchase? Fortunately, the number and variety of digital film scanners available today is significant, and competition for the sale of these devices is still brisk.

Film Storage

The conditions required to meet the life expectancy of LE-500 microfilm are: (1) residual thiosulfate levels that are sufficiently low (1.4mg/cm3), and (2) film is stored in an environmentally controlled storage facility. The state archives may provide such a facility.

An environmentally controlled facility should meet the following minimum requirements:

- Original (or security) film should be kept in a separate building from the duplicate or working copy.
- The storage room must be separate from other types of storage, offices or work areas.
- The storage room must be equipped with a fire alarm system.
- Film should be maintained in a constant cool environment, with temperatures not exceeding 70 degrees.
- Humidity of the storage facility must be maintained at 35% +/- 5%.
- Dissimilar films (silver, diazo, vesicular) should not be housed in the same storage container or cabinet.
- Film should be contained in acid free cardboard boxes or inert plastic containers.

For additional information, refer to ISO 18911:2000 – Photography -- Processed safety photographic films -- Storage practices.

Inspection of Stored Film

Stored LE-500 microfilm may interact with other types of film in the storage area (such as diazo and silver-gelatin). As a result, routine inspection of microfilm is recommended.

Routine film inspection should reveal harmful reactions. At a minimum, each year a random sample of not less than 2% of the total number of rolls should be examined to determine if deterioration is taking place. Each successive year the sampling population should include new rolls and the balance of the rolls not examined during the previous year. Older films should be inspected more frequently. For additional information, refer to ANSI/AIIM MS45-1990 – Recommended Practice for Inspection of Stored Silver Gelatin Microforms for Evidence of Deterioration.

Contamination

Testing for residual thiosulfates that are a common component of the fixer should be a part of the standard operating procedures for processing microfilm. If residual thiosulfate levels are sufficiently low and film is stored in an atmospherically correct environment, film can be expected to meet the long term storage definition. However, improper storage conditions or inadequate rinsing of film will certainly accelerate the REDOX process

Film life expectancy can be negatively influenced by two chemical processes, REDOX and the “vinegar syndrome.”

REDOX is rust on the film surface that impacts the stability of the silver used to create the image. Silver degeneration on the film surface can be caused by failure to wash fixer from the film during original processing. Overtime, the microfilm may become unreadable.

For many years, acetate compounds were the base material of microfilm. Acetate was a substantial improvement over earlier bases. Yet microfilm with an acetate base may degenerate by chemically separating the emulsion from the base. Unfortunately, this is a normal reaction of the acetate reducing to acetic acid (which has the smell of vinegar), causing the separation of base from the emulsion. This is called

the vinegar syndrome. Fortunately, most film manufacturers stopped using acetate as a base material in the late 1980's. Acetate film created prior to 1990 should be examined to detect this syndrome.

Contaminated microfilm should be replaced with either duplicate microfilm or with scanned digital images. Scanning will cost more than duplication, and should only be considered if retrieval is high.

Expungement

Expungement is the removal or destruction of an image from microfilm. This procedure requires that no record, or identification of the documentation ordered expunged, remain on the film.

Images should be expunged by the abrasion method, and only in accordance with an approved retention schedule or court order. Punching a hole in the image, blotting out the image with any type of ink or marker, or chemically removing the image should not be done, because surrounding images may be damaged. Duplicates should be recalled and destroyed, or re-duplicated from the corrected original and re-issued. An expungement certificate should detail the reason for expungement, authority to expunge, date of original filming, and date of the expungement. Expungement certification should also document destruction of the original and all copies.

Summary

Proper creation and use of microfilm can be a practical solution for the maintenance and distribution of many official records. Microfilm is a stable storage media that has been used for many years, and it enjoys the benefit of established standards. There is no "one size fits all" solution for efficient and effective recordkeeping. Users must evaluate the pros, cons and cost benefits, of the various options (including microfilm).

Bibliography

Many states have issued standards, laws, policies or guidelines for the creation and storage of microfilm. Local governments should ensure that they comply with these legal documents, as applicable. In addition, the following standards and recommended practices issued by the American National Standards Institute (ANSI), the Association for Information and Image Management (AIIM), the National Association of Photographic Manufacturers (NAPM) and the International Organization for Standardization (ISO) may contain information that will assist in the production of authentic, reliable and usable microfilm. These publications are available from AIIM at http://www.aiim.org/ and ANSI at http://www.ansi.org/. Note: the publications cited in this document may be updated or replaced periodically. Please refer to the most recent version, regardless of the date listed in this document.

ANSI/AIIM MS1-1996 – Recommended Practice for Alphanumeric Computer-Output Microform – Operational Practices for Inspection and Quality Control

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ANSI/AIIM MS6-1981 (R1993) (R1999) – Microfilm Packaging Labeling

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ANSI/AIIM MS37-1988 (A1996) – Recommended Practice for Microphotography of Cartographic Materials

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ANSI/AIIM MS41-1996 – Dimensions of Unitized Microfilm Carriers and Apertures (Aperture, Camera, Copy and Image Cards)

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