Bill Veillette
Executive Director

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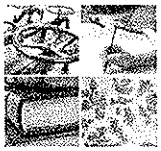

NORTHEAST DOCUMENT CONSERVATION CENTER

100 Brickstone Square, Andover, MA 01810-1494
ph 978-470-1010 • fax 978-475-6021 • www.nedcc.org

Client: Town of Sudbury
322 Concord Road
Sudbury, Ma 01776

Date: 08/25/10
Job Number: 10.290B_I.22

Phone:978/639-3359 **Fax:** **E-Mail:harvellr@sudbury.ma.us**

Attention: Rosemary Harvell
Object(s): record book
Title: Papers from Peter Noyes, 1711-1770
Dimensions: 165 x 107 x 30mm
No. of Pages: 324
Condition: Digital estimate is based on the conservation treatment proposed by the book lab.
Proposal: Imaging services will provide high resolution 300 ppi, 48 bit, RGB TIFF files and deliverable(s).
Joint Client w/: Book

Digital Services Estimate

Digital Capture:

High Resolution Digital Capture:	4.00	**Total image(s)** 324	$1,296.00
Based upon estimate of pages, actuals may vary			

* **File Identification:** volume and page # *please specify*
* necessary in order to complete estimate

Image File Delivery: CD/DVD ☐ ExHD ☑

Shipping: **Billed @ cost**

Total Estimate $1,296.00

It is understood and agreed between the parties of this document that imaging may be modified or halted should it prove difficult to meet original specifications. After consultation with the Owner or Authorized Agent, a new estimate will then be presented to reflect revised specifications.

ESTIMATED COST OF DUPLICATION not including insurance, delivery or other, $ OWNER'S STATEMENT of INSURANCE VALUE: maximum liability limited to $

Unless the owner's insurance policy provides the standard all risk perils and the owner's insurance company sends the Center a waiver of subrogation, all works left here MUST be insured under our policy at a rate of $1.00 per month per $1,000 value. If no valuation is provided by the owner, an assignment of $500 will be placed on the above object(s) for the purpose of insurance coverage

AUTHORIZATION IS HEREBY GIVEN to the NORTHEAST DOCUMENT CONSERVATION CENTER to film the above object(s) as proposed herein. All duplication will be done for the account and at the risk of the Owner without liability to the NORTHEAST DOCUMENT CONSERVATION CENTER for negligence or otherwise.

Bills are payable upon receipt. Objects must be picked up within 30 days after work is completed, unless alternate arrangements are made.
Estimate valid for 6 months.

OWNER OR AUTHORIZED AGENT DATE

NORTHEAST DOCUMENT CONSERVATION CENTER
David Mathews

8/25/2010
DATE

Purchase order required? Yes _____ No _____ #

Please sign white copy and return to NEDCC

Cc: Registrar's Files

Technical Bulletin 2

Establishing a Micrographics Program

Version 1 (1993)

INTRODUCTION
The decision to use microrecords must arise from a municipality's specific circumstances and needs. When considering a microfilm application, the municipality should carefully consider its current situation and information needs and its short- and long-term goals. The various information management strategies available to it will have a broad impact on the manner in which it conducts its business and the services it seeks to provide for its constituents.

As with any technology, microfilm is a tool and not a cure-all; microfilming will not solve systemic faults in an information management system. Poor filing, inadequate indexing, redundant copies, poor information flow or failure to dispose of obsolete materials will not disappear with the establishment of a microfilm program. Rather, the municipality will spend a large amount of money to create a miniaturized version of poorly filed, redundant, inadequately indexed obsolete records.

A technological implementation should not be considered until the existing information system has been examined and optimized. Only at this point will municipal officers be able to clearly identify what problems, if any, exist, and the areas in which a microrecords program can make for better management. In all cases, it should be remembered that an information management system cannot center solely around microfilm. Microfilm is only one component of a successful system that may include paper, magnetic tapes and disks, and optical data storage systems.

PROS AND CONS
When considering a possible microfilm application, it important to be aware of both the advantages and disadvantages of the technology.

Storage space reduction
Storage space reductionis probably the attribute most frequently associated with the use of microfilm. Records reduced to microform occupy as little as 2% of the space required for the original paper documents. Vendors and other enthusiasts have interpreted this figure to mean that space savings of 98% could be realized through microfilming. Such a figure is unrealistic and ignores the fact that many records must be retained in hard copy even after they have been microfilmed, and that space freed by microreduction will need to be devoted to retrieval equipment such as reader/printers. It has been found that in

applications where files are frequently referenced, such as insurance claims, the space savings were in the area of only 15%. Nevertheless, the space reduction afforded by microfilm can be substantial, particularly if the records being filmed are particularly bulky and not subject to frequent retrieval.

File integrity

File integrity is another major benefit to be realized from microfilm. Once a file has been filmed, its constituent records are locked in place in the order and condition in which they were sent to the camera. Alteration of the file is difficult and the retention of a master film copy at an offsite location acts as a backup ensuring that any tampering will be detected. To this extent, the accuracy of filmed files and other records is greater than that of their paper counterparts that are subject to tampering and alteration. Of course, this very integrity precludes the use of microfilm for "live" records, that is, records that must, in the course of business, be regularly annotated or amended. Updating of entire files, however, can be accomplished through the use of jackets or computer assisted retrieval (CAR) indexing programs.

Security of information

Security of information is perhaps the greatest benefit of a microfilm program. The most certain way to ensure the physical security of vital or archival information is to duplicate the source record and store a copy at a secure remote site. Although this is not feasible where large volumes of paper records are concerned, it can be quite efficient in the case of microforms. The security duplicate film provides a back-up should the office copy be damaged or destroyed, and is a control in the unlikely event that the office copy of somehow tampered with or otherwise called into question. Because magnetic media are inherently unstable, transfer to microfilm through a computer output microfilm (COM) application can secure the preservation of long-term information from a short-term medium. Where the original records are themselves of value, the use of microfilm can be substituted in use for the paper records, enhancing their longevity. If the microfilm is designed for long-term retention, the security copy must be on silver-type gel emulsion film and stored under strict security and environmental conditions to ensure preservation and continued usefulness.

Ease and speed of retrieval

Ease and speed of retrieval of microfilmed information are made possible by the reduction in size from the original source documents and by competent indexing systems. Miniaturized information can easily be stored in the working office and can be accessed in seconds rather than in minutes or hours needed for paper stored in file rooms or stored off site. Digital reader-printers allow the retrieved image to be directly faxed or emailed to an off-site recipient or distributed to one or more desktops over the network.

Cost savings

It may be difficult to cost-justify a microfilm conversion based on any one of these factors: cost savings result from a combination of benefits. Rapid retrieval, reduced on- and off-site storage costs, reduced storage equipment requirements, enhanced file and record security, and increased flexibility and productivity in office arrangement and information management can result in significant dollar savings.

User resistance

User resistance is often one of the strongest factors acting against the success of a microfilm program. Some users simply cannot come to terms with not having a piece of paper before them. Other complaints are more substantive and should be dealt with either in the planning phase or during implementation. Indexing may be inadequate and information retrieval difficult or time consuming; the reader may be in a location that makes its use inconvenient; film quality may be poor and the records difficult to read; arrangement of records on film may make the film difficult to use; the display size, format or quality of the reader may cause eye strain or fatigue in the user. Failure to address user problems can lower productivity and endanger the entire program.

Turnaround time
Turnaround time can also limit the acceptability of microrecords. If records are unavailable for excessive periods of time during filming, the organization's operations may be adversely affected.

Startup costs
Startup costs are high, involving not merely filming of records, but creation of indexes, user training and the purchase and lease of equipment.

Legal acceptability
Legal acceptability of microfilm records is often of concern to custodians. However, Massachusetts and Federal laws make ample provision for the use of the medium. Chapter 66, Section 3 of the Massachusetts General Laws establishes microfilm as an acceptable medium for the maintenance of public records. The hearsay and best evidence rules are addressed by C.233 ss.79A, 79D and 79E of the General Laws. Section 79E is an acceptance of the Uniform Photographic Copies of Business and Public Records Act that, along with the Uniform Rules of Evidence, addresses these issues at the Federal level. These laws make microphotographic copies of public records admissible in evidence regardless of whether the original record is still extant. To comply with these laws the microcopy must be:

1. An accurate representation of the original record.
2. Recorded on a durable medium.
3. Identified and certified as an accurate representation of the original record.
4. Created in the regular course of business as part of a program to preserve records on microfilm. This requirement does not preclude one-time microfilm projects designed to eliminate a backlog of records and to initiate a regular program. Of course, there may be other statutory or regulatory requirements that demand the retention of the original hard copy records even after they have been filmed. Prior to filming, always consult any oversight bodies that have an interest in the records and the Office of the Supervisor of Public Records, to determine hard copy retention requirements. None of these considerations apply to computer output microfilm (COM), since COM is an original record and not a copy.

IMPLEMENTING THE PROGRAM
Feasibility Study
Having determined: that the existing system is fundamentally sound; that implementation of other basic records management techniques will not solve existing problems or deliver the desired results; understanding the drawbacks and benefits of microfilm, the organization can conduct a feasibility study to

determine the parameters of a microfilm program that can suit its needs.

The first step in the study is to examine the records that will be involved in the program. A number of questions should be asked about the records:

* What are the size, condition and color of the documents?
* What are the frequency and nature of changes or amendments made to the documents or files?
* How long are the records scheduled for retention?
* How often are the records accessed? The answers to these questions may decide whether special filming equipment or formats will be needed or whether the records should be microfilmed at all. Oversized, fragile or colored documents require special equipment, handling or photographic techniques. Frequently altered records need special indexing or perhaps ought not to be filmed at all. Except in the face of high security demands, it seldom makes sense to film small volumes of records that are seldom referred to, or, except when space is critical, records with short retention periods.
* Who uses the records?
* How are they used?
* Where are the records?
* Where are the users?
* How many records are unavailable when requested on any given day? The answers to these questions will determine the type of microform to be used, the number of copies and the number and type of retrieval devices needed. The records may be used by office staff, auditors and other oversight personnel, researchers, the public at large or by all these groups. The level of usage will dictate the number of copies of film that must be made available and its potential location(s) (in-office only, in office and library, etc.). If several persons need access to records or files simultaneously, multiple copies of film or digitizing readers may be indicated. Similarly, if users are physically remote from the location of the records, it may be desirable to create duplicates to be sent to the user locations or to use digital reader-printers to transmit individual records on an as-needed basis. The needs of the user groups and the types of information they wish to extract from the records will also drive the type of indexing which will be required.
* How many pages does the average document/file contain? Are the pages double sided?
* Are records stapled or clipped together?
* What is the daily rate of accumulation? The answers to these questions can begin to suggest possible costs for the program. File size and whether the documents are double sided obviously will affect cost. Rate of accumulation will determine how frequently or at what point the files must be filmed. Staples, clips, double-sided documents, all mean more work and expense in the document preparation stage.

Film Formats

The microform to be used will be determined by the characteristics of the records to be filmed and film's intended use. There are a variety of microforms available, some with very limited and specific applications; for the purposes of this discussion, only five will be considered: roll film, microfiche, film jackets, aperture cards and computer output microfilm.

The most common and least expensive microform is roll film. Available in 16,

35 and 105mm widths, it is used for filming source documents or, to a lesser extent, computer output. The film most commonly used for business documents is 16mm. This film is available in a variety of lengths, most commonly 100 or 215 feet, and may be as a loose roll or encased in a cartridge or cassette. While the cassette format is nearly extinct, the cartridge type of enclosure is very popular and can be accommodated by most readers; it has the marked virtue of eliminating the tiresome fumbling associated with threading the film into the reader and protects the film from damage caused by handling. At the standard reduction ration of 1:24, a 100-foot roll of 16mm film can contain 2,500-3,000 letter-sized pages, and a 215-foot roll 5,400 or more pages.

35 and 105mm film are generally in loose rolls and are used for oversized documents such as maps or engineering drawings, or for library or archival applications. A 215-foot roll of 35mm film can contain 1,200 D-size drawings. Because of the size variations of archival records, roll of film may contain fewer documents at a considerably higher cost.

Records are filmed sequentially on roll film and once filmed are locked in the order in which they went to the camera. Thisformat lends itself to chronological or other sequential files and until recently was limited to closed series which were not subject to updating. Computerized indexing schemes now make it possible to film records out of sequence or add to or integrate records in a filmed file. Each out-of-sequence record, however, must be accessed separately and may even be on an entirely different roll of film. This substantially slows information retrieval time.

Microfiche is a flat or unitized film piece produced from a roll of 105mm film that is usually cut into 6-inch lengths. Fiche is generally produced using a "step and repeat" camera or by copying from a microfilm jacket and is a much costlier format to produce than is roll film. Fiche lends itself especially to micropublishing, but is also used for other applications such as checks, payroll and invoices. Cameras that produce fiche generally can accept only individual documents. Although it is possible to create fiche of bound volumes it is not recommended.

An index is often included directly on the fiche with documents located on a horizontal/vertical grid. At the standard 24x reduction, a fiche can contain 98 pages (14 horizontal by 7 vertical).
Fiche are identified by an eye-readable header across the top of the fiche. This header may also be color-coded to facilitate filing. The size and amount of information on a fiche makes it an ideal format for distribution of data.

Microfilm jackets are polyester cards of the same 4x6 inch size as microfiche with sealed channels created along their horizontal axes. Frames of developed film are then "stuffed" into the channels. The channels may accommodate 16 or 35mm film. Jackets are useful for subject-specific applications where reference must be made to a particular individual or other subject. A jacket may be configured to include 35mm film images of plans along with 16mm images of specification sheets. They are easily updateable and very simple to reference but do not provide the file integrity of roll film or microfiche and are understandably more expensive.
A variant of the jacket is the jacket card. These are often preprinted with specific information with channels to allow the addition of microfilm to keep

the file up to date.

Jackets are often copied to fiche for office use and distribution.

Aperture cards are standard-sized tab cards that accommodate developed microfilm, usually a frame of 35mm film. Indexing information is typed along a header or punched into the card itself for automated retrieval. This format has its primary application in filming plans, drawings, maps and blueprints.

Computer output microfilm (COM) is created through a process closely related to electronic publishing. Information from a computer is converted into an eye-readable form and imaged directly onto film. This process is much faster and cheaper than standard technologies for printing to paper. Some COM recorders allow the film to be imaged directly from internal memory without having to create a separate tape. The COM film can then be created on line.

COM may be in roll format but a fiche format is the most common. A standard fiche of COM can contain 270 pages of computer printout at the standard COM reduction ration of 48x.

Two variants of COM deserve note. These are computer input microfilm (CIM) and documents scanned to microfilm. CIM is essentially an input mode for optical character recognition (OCR) systems. Text is recorded on microfilm that can be then optically scanned, converted into ASCII format and input into a computer system. Documents scanned to microfilm are first optically scanned using a laser scanner, converted a format that can drive a COM recorder, and then committed to film; this type of film is usually used as a back-up for optical data storage systems.

Retrieval Hardware

Unless microfilm is to be used only as a security device, it will be necessary to provide a reader or reader-printer to read the filmed documents. Readers and reader-printers range from very simple devices for reading microfiche to massive computer-linked robotic units that can automatically load film, retrieve images and make multiple copies. The simplest and cheapest of these machines is the microfiche reader. Roll film readers are considerably more costly. Readers are available which are capable of accepting both formats.

The choice of retrieval equipment will depend upon the type of film being used in the office, its use and frequency of reference, and the need to generate hard copy of the images. The convenience and comfort of users should be a prime consideration in choosing the type of retrieval hardware (and film format) which will be used. Inconvenience and discomfort associated with microfilm use will decrease productivity, engender hostility among researchers and endanger the program. If users are expected to spend a considerable amount of time in front of the reader, it is important to provide large screens with good illumination and contrast to minimize eye strain. The readers should be provided with comfortable seating and located in a comfortable area convenient to the employees' normal workstations. Readers intended for retrieval of maps and plans should be equipped with interchangeable or zoom lenses to allow the user to inspect details of the images. If the readers are to be used by researchers, or if several employees are expected to be accessing the records simultaneously, a sufficient number of readers and film copies should be provided to minimize

waiting time and consequent reduced productivity and user dissatisfaction.

The public records laws apply to micro-images as well as to paper. If a record is on film, a copy must be provided on request. A reader/printer should be easily available to each office for this purpose.

Indexing

There are a number of ways in which microfilm can be indexed. The choice of indexing scheme is determined by the amount and type of records being filmed, the anticipated frequency of retrieval, the use to which the retrieved images will be put, and whether image retrieval is a time sensitive component of office procedure.

The simplest form of indexing roll film is simply to label the box with the contents and to use a combination of flash targetsand blank frames like folder tabs and dividers in a conventional paper filing system to separate the groups of images on the film. The user can consult a log to identify the proper roll of film and then browse the roll until the proper record group is located.

Roll film can be indexed by odometer reading, that is, by the number of inches of film as indicated by a dial on the reader, or by sequentially numbered frames on the roll. An image is then located by advancing the film to the proper frame number or odometer "mileage." It may also be indexed by blip coding. In this type of indexing, small patches of constant size and density are recorded on the film as each document is photographed. These "blips" can then be read by a photoelectric cell either integral to the reader or available as an add-on. By recording the documents as they are filmed an accurate index can be created with each set of blips corresponding to a single document. The correct blip code can be determined from the index and the reader set to advance the film to the proper location.

Microfiche and jackets are identified by an eye-readable header across the top of the unit. This header contains the important indexing data for the images on the unit. The header may be color-coded and the units arranged as they would be in a conventional filing system. Fiche may also contain an internal index, usually located in the lower right-hand corner indicating the location of a particular document on the vertical/horizontal (numeric/alphabetic) grid.

Aperture cards are indexed in a similar manner. Additionally, indexing information may be keypunched onto the card itself to allow for automated retrieval.

These manual or semi-automated retrieval schemes can be successfully applied where the records involved are sequentially or otherwise logically arranged in closed series, and speed of access is not an important consideration. However, where records cannot be filmed in such a logical sequence or where rapid access or access by a complex combination of parameters is needed, these schemes cannot suit the needs of the organization. In these situations, a more sophisticated indexing scheme is needed, and this need is filled by a computer-assisted retrieval (CAR) system. Briefly stated, a CAR system involves on-line entry of index information to a database management system to create, maintain, retrieve and manipulate an electronic index to the locations of records on film. The index information may be linked to filmed record identifiers such as blips or bar codes, or may be text-associated. Sophisticated CAR systems can

conduct Boolean searches and display microform addresses in complex relationships. A CAR system is necessary to any application that calls for integration of microfilm into an active information management system.

THE FILMING PROCESS

All microfilming of public records is governed by 950 CMR 39.00, Regulations on Using Microfilm. These regulations are designed to ensure that all public records are filmed in accordance with the industry standards specified by the American National Standards (ANSI) and the International Standards Organization (ISO), and that the quality and longevity of the film is equal to or greater than that of the original source documents.

Document Preparation

Preparing documents for filming is the most time-consuming, labor intensive part of the microfilm program. All files to be filmed must be carefully inspected to ensure proper arrangement and that all unnecessary or redundant material has been properly removed. Documents within the files must then be inspected for mutilations, tears, stains or obliteration, and placed in the proper orientation for filming. All paper clips and staples must be removed, and folded or curled documents flattened; this is particularly important when automatic feeders are to be used since folded or curled documents can jam in the feeder. All camera operator or other targets should be inserted in the files, and the camera operator should be notified if any adhesives or pressure sensitive tape is present since the adhesive can foul the feed mechanism or document beds of the cameras.

Record series or files are usually filmed in the order in which they were originally created or maintained. However, filming provides an opportunity to reorganize and rationalize file organization into a sequence that may be more valuable to the user. Misplaced items should be placed in proper sequence and extraneous materials purged. Missing items should be identified and missing document targets inserted for filming.

While this process may sound simple and straightforward, it can be grueling and devour unforeseen quantities of staff time if done in-house.

Targets

A number of non-record pages must be inserted among the records to be filmed. These targets may be informational for the persons using the film, or technical, relating the production and quality control of the film. The targets that must be included in filming are specified in 950 CMR 39.05(6) and the captioned ANSI standards, and include:

* Start/end targets, indicate the start and end point of filmed records, series or batches, these targets should be large enough to be read without magnification
* Retake targets indicate the starting point of retakes, i.e., images which had to be reshot because of poor quality in the first attempt, appropriate technical targets, and an end target reading: "END OF RETAKES FOR ROLL NUMBER _____"
* Roll Number targets indicate the number of the film roll in characters large enough to be read without magnification
* Classification/Restriction targets indicate that a record or group of records may be restricted under the provisions of c.4 s.7 cl.26 GLM. An end target should also be included

* Space targets may be used to separate series or batches of records
* Missing Document targets indicate that a record is missing from the series or is located in another place
* Exhibit targets indicate that an item in a file could not be filmed and is located in some other place. These are generally limited to physical evidence or other non-documentary material
* Record Identification targets consist of statements by the record custodians identifying the records delivered for filming, including their status and range. Also called the Declaration by Records Custodian, this document is essential if the records are to be admissible in a court of law
* Declaration by Camera Operator target is the camera operator's statement identifying the records received and the manner of filming
* Technical targets are included for quality control and are used to test for reflectance, resolution, density and reduction ratio

Film Base

In recognition of the fact that all media are impermanent, microfilm is no longer spoken of as archival. Rather, current terminology refers to the length of time the film can be expected to survive under optimal conditions, designated as the LE (life expectancy) rating. Currently, two types of film base are in use for creating master microfilm negatives: cellulose-ester and polyester. Cellulose-ester film has been in use since about 1908. Experience and accelerated aging tests have shown it to degrade with exposure to heat and humidity and in the course of use; based upon this rate of degradation, it has been designated LE 100, or as having an expected usable life of 100 years. Polyester film bases, introduced in about 1956, have many advantages over cellulose-ester including greater strength, stiffness, tear resistance, flexibility, and dimensional stability. Although actual use experience has only been about 35 years, accelerated aging tests and other investigations indicate that polyester base films will have a life expectancy of 500 years and are rated LE 500. Since both types of film are priced about the same, it is likely that cellulose-ester films will tend to disappear from the market. Cellulose-ester films should only be used when it is necessary to splice the microimages into previously created rolls of the same stock. Records with a retention period of 15 years or more must be filmed on polyester LE 500 stock.
Only non-flammable, safety film may be used.

Film Emulsion

Silver gelatin emulsion films must be used for the creation of first generation master microfilms. These films consist of a film base coated with a light-sensitive emulsion of silver halide crystals suspended in gelatin. When the source document is filmed, the silver halide crystals exposed to the light (usually blank) areas of the document are converted into free silver atoms, while those exposed to the dark (text) areas are left unaltered. Thus, the light from the source document passing through the camera lens and striking the film surface forms a latent image. This latent image must then be developed or processed to become stable and readable. During the development or processing stage, discussed at more length below, chemicals are used to convert the exposed halide crystals to metallic silver, thereby creating black areas on the film, and to remove the remaining, unexposed silver crystals, leaving these areas blank. The image thus formed is a negative, or reversed image of the original document with text appearing white on a black background.

Antihalation
During exposure, the light from the source document may penetrate the emulsion layer and reflect back off the film base to form ghost images known as halation. To prevent this, most film contains some type of antihalation compound either integrated into the film as a layer between the emulsion layer and the base or as a dye backing to the film.

The Cameras
There are three basic camera types used in making microfilm copies of original documents. The choice of camera is dictated by the nature of the source document, i.e., dimensions, paper weight, condition, or other physical characteristics; the volume of documents; and the intended use of the film product.

Rotary cameras, having the general size of an office photocopier, lend themselves to the high speed filming of large volumes of documents. These units are usually equipped with automatic feed mechanisms that feed documents to the camera at a very high rate of speed. The high rate of throughput is maintained by the camera mechanism that allows the lens to move in tandem with the document, taking the picture while both are in motion. The source documents filmed in this manner must be uniform in size and weight to allow the automatic feeder to function properly. An ideal application for this type of camera is cancelled checks.

Rotary cameras may also be provided with devices to automatically feed unbursted computer printouts for filming.

Planetary cameras, by contrast, require the source document and the camera to be stationary during the filming process. This provides a marginally higher quality image than that provided by a rotary camera, along with much greater latitude in the type and condition of the records that it can film. Planetary cameras are the cameras of choice for archival microfilming.

The most common configuration for planetary cameras is a flat document bed with dual light sources directed down on the document from above and the camera suspended directly over the document. This arrangement allows a wide variety of documents to be filmed, including full-size engineering plans and bound volumes. Lighting may be adjusted to compensate for the condition of the original document, and the camera can be shifted up and down for a wide range of reduction ratios.

Another version of the planetary camera puts the lens and light source below the document bed. This type camera closely resembles a photocopier and documents are filmed in much the same manner as they would be copied: face down on the document bed, or through an automatic feeder. This type camera is not as versatile as the camera-above style.

The quality and versatility of the planetary camera must be weighed against the fact that it is a slow and labor-intensive method of filming. In all but the auto-feed mode, the source documents must be placed on the document bed by hand and the shutter manually triggered. Even with auto-feed, the documents must come to a full stop before the shutter is activated. The throughput is limited to 800-1,000 documents an hour, equal to the capacity of a rotary camera

operating in manual-feed mode.

Step-and-repeat cameras are essentially planetary cameras specially designed to create microfiche. A document is placed on the copy board, the shutter is tripped and the document is exposed to the first position on the fiche; the camera then steps to the next position on the film and the sequence is repeated; hence, the name. Documents may also be automatically fed in both the camera-over and camera-under configurations. Throughput is slow, as with planetary cameras.

COM (computer output microfilm) recorders are not cameras as we typically understand them but a combination computer peripheral and high-speed microfilmer which converts binary, digital data into human-readable alphanumeric or graphic information with no intermediate paper. The recorders may use one of three technologies. In CRT photography, an image is displayed on a CRT inside the recorder; the image is then photographed by a high-speed microfilm camera. Laser beam recording uses directed lasers to record information directly onto dry silver film in much the same way as in a paper laser printer. Electron beam recorders, used mostly for graphics, are a type of CRT recorder in which the electron beam is directed onto the film rather than the display screen to create an image.

Image Orientations
In roll film applications, images may appear in comic (horizontal) or cine (vertical) mode. In comic mode, the images on the film follow one after the other "like a comic strip" with the short axis of the page and the text on it parallel to the long axis of the film. As the film is scrolled through the reader, the images appear in a normal readable pattern. In cine mode, the long axis of the documents is parallel to the long axis of the film and when viewed in the reader the pages appear to be on their sides. These images may be produced in simplex, duplex, duo or duoduplex mode.

In simplex mode, a single image is created that fills the entire width of the film. In duplex mode the front and back of the document appear side by side across the width of one exposure. Duo records images along one half of the usable width of the film, the exposures are made in one direction then reversed and made in the opposite direction on the other half of the film. Duoduplex uses mirrors to create side by side images of the front and back of a document along one half of the film width, when the roll is completed, the film is reversed and the process repeated.

Configurations of microfiche may be horizontal, vertical or serpentine i.e., back and forth (or up and down).

Reduction Ratios
One of the primary reasons for using microfilm is to reduce the size of the original volume of records. The extent of this reduction is called the reduction ratio. This is the number of times a given linear dimension of the source document is reduced when photographed. Expressed as 24:1 or 24X, a reduction ratio of 24 means that both the horizontal and vertical aspects of the source document have been reduced to 1/24th their original size, yielding an image that is 1/576th the size of the original. For archival microfilming, records should be reduced as little possible to provide greatest resolution.

A wide variety of reduction ratios are available for use in microfilming, but 24X is generally considered to be the standard when filming normal documents. A reduction ratio of 32X is common for rotary cameras, however, and the standard for COM is now 48X. Some applications, such as old manuscripts or engineering drawings may dictate other reductions. In all cases the primary consideration should be to create records which are of high quality and compatible with the readers in use in the organization. The reduction ratio must be able to ensure a resolution level of 8.0.

Resolution
Resolution refers to the ability of the lens, optical system or emulsion to reproduce fine detail in the photographic reproduction of the original record. Since most microfilm is high-resolution film, the most likely areas for problems involving resolution to arise are in the optical system or camera lens. Lines should appear sharp and well defined. Using the Quality Index method described in Practice for Operational

Procedures/Inspection and Quality Control of First Generation, Silver-Gelatin Microfilm of Documents (ANSI/AIIM MS-23), this means that a letter "e", 2mm high will resolve to the 5.0 test pattern. To ensure that this resolution will be achieved, it is necessary that a series of test shots are taken and read against the appropriate test charts.

Density
Density is simply the amount of light that is stopped or allowed to pass through the developed film. If density values are too low, the film will appear faded or "washed out." On the other hand, too high density will cause fine, light lines to fill and bold black lines to spread. The density must be constantly monitored using a densitometer to ensure that optimal density is maintained.

Processing
Exposing the film in the camera creates a latent image on the film. With a latent image the chemical reactions that create a visible image have been set in motion by exposing the sensitive film to light, but the image is not yet visible and may still be altered or destroyed by additional exposure. To transform the latent image into a visible one, the film must now be processed or developed.

The development process essentially consists of immersing the exposed film in an alkaline reagent that transforms the latent image to a visible one by converting the exposed silver halide crystals to black metallic silver. The process is then stopped in an acid bath after which the film is fixed, that is, immersed in a "fixer" or "hypo" solution to wash away the unexposed silver crystals to leave clear areas on the film. The film is then washed in fresh water and dried. The images created by this process have a negative polarity, that is, they show a reversal of the light and dark areas of the original document. Some processors can accommodate extra steps to reverse this polarization (reversal processing) to create a positive image. Processing should be done within 24 to 48 hours of filming.

Processors are fully automated and self contained and range in size from tabletop to floor-standing. Processing generates large amounts of chemical waste including silver residues, which must be handled and disposed of with extreme care and in accordance with all applicable local, state and federal

environmental and safety regulations.

QUALITY CONTROL

Microfilming is a costly process and extreme care must be exercised throughout the entire program to ensure that records are properly prepared, filmed and processed. Following processing, post film inspection must be made to ensure that the film is of the highest possible quality. The following inspections must be made and reports filed:

* Completeness. The film must be inspected to ensure that all records have been filmed as intended.
* Sequence. The records must be in the proper sequence in which they were submitted to the camera operator.
* Format. The images must be in the intended format consistently throughout the film.
* Film image defects. The images must be free of defects such as over or under exposure, fogging, water spots, curling, double exposures, etc.
* Density. The density must be checked with a densitometer to ensure it is within the proper parameters and provides images of high quality.
* Resolution. The resolution must be checked using the appropriate test charts and targets. Residual thiosulfate ion or hypo residue. Excessive hypo or thiosulfate residue left over from processing will react with the metallic silver and cause the image to fade and become discolored. The film must be subjected to one of the tests specified in 950 CMR 39.00 and the captioned ANSI standards to ensure that the processed film is within acceptable tolerances.

Reports of the deficiencies found should be made and filed with the records of the program.

If deficiencies are severe, it may be necessary to refilm the entire roll. If only individual records are affected, these should be reshot and spliced at the end of the roll along with the prescribed retake targets and certificates. Only one retake section should be spliced to each roll.

Redox Blemishes

Redox blemishes, or measles, are red spots that form on film due to the reaction of the silver with atmospheric pollutants. Left unchecked, the spots, which may start out as mere pinpoints, can grow in size and spread, eventually obliterating images or rendering them unreadable. Treatment of the film with gold, sulfides or selenide has been proven to provide a certain level of protection for film and to increase its longevity. Gold treatment is effective but quite expensive; selenium has been shown to be only partially effective. The best treatment for film to date is with sulfides. Kodak Brown Toner and IPI SilverLock are two products which involve bathing film in a polysulfide solution to convert the most of the silver in the processed microfilm to silver sulfide. Silver sulfide does not react with atmospheric pollutants and therefore has a greater longevity than untreated film. The treatment is inexpensive and relatively safe by both health and environmental standards. Use of this type of treatment is highly recommended. For further information, contact the Image Permanence Institute, Rochester Institute of Technology, 70 Lomb Memorial Drive, Rochester, New York, 14623-5604, 716-475-5199 or Eastman Kodak for more information.

DUPLICATE FILM

The silver halide master film should never be used as a reference or working film. It should be safely stored under the conditions described below to serve as a security copy for the filmed records. Duplicate copies of the master should be made for actual office and reference use. Duplicates may be made from silver, diazo or vesicular films.

Silver gelatin duplicating film also called print film is also composed of silver halide crystals suspended in an emulsion on a film base. The master is duplicated to the print film by exposing it to light and the latent image is developed in the same manner as the original master film. The polarity of the duplicate will be reversed from that of the master. The process is slow and costly, and usually limited to making a duplication master from which other, tertiary copies can be made.

Diazo duplicating films are so named because they consist of an emulsion of diazonium salts on the film base. When ultraviolet light is transmitted through the master negative, the salts are dispersed in the areas of the diazo film that correspond to the light areas of the master. The latent image is then developed by exposure to ammonia fumes. Because of their physical construction, diazo films are sturdier and can take more handling and abuse than their silver emulsion counterparts, but they degrade much faster and their image quality will become severely degraded after only 50 years. Diazo duplicates retain the polarity of the master negative.

Vesicular duplicating film consists of a light sensitive emulsion suspended in a thermoplastic resin on a polyester base. When ultraviolet light is transmitted through the master onto the vesicular film pressure pockets are formed creating the latent image. Rapid application of heat then develops the image by deforming the emulsion that hardens when the heat is removed. Image polarity is the reverse of the master negative.

STORAGE

Like all record media, microfilm is subject to degradation due to age, handling and environmental conditions, and needs careful protection to ensure its long-term survival. Diazo and vesicular duplicate films are easily reproduced from the master negative or silver duplication master. These films are also tough, scratch resistant and relatively tolerant of suboptimal environmental conditions. These films are intended for office use and can be stored under normal office conditions, avoiding extremes of heat and cold and humidity. Care should be taken in handling, of course, and the films, reader plates and drives should be kept clean and in good operating condition.

The master negative should be safely stored in a secure, environmentally controlled, fire and heat resistant area and should be used onlyin extreme circumstances. Silver emulsion film is more fragile than the duplicate films and, since the emulsion is an organic substance, is also susceptible to greater environmental damage. Heat and humidity can weaken the emulsion and also promote mold growth. Long-term retention of the master negative film can only be ensured by storage under strictly controlled conditions. The film must be stored in a vault constructed to the standards prescribed in the National Fire Protection Association Publication NFPA 232, except that the vault must be modified to allow for a heating/ventilation/air conditioning installation to maintain the necessary environmental parameters. The vaults must maintain a

constant temperature of 70oF. or lower, and relative humidity of 20-30% with daily fluctuations of not more than 5%. The HVAC system must be fitted with air filters to prevent air-entrained impurities from entering the vault. Because of the environmental requirements, it is not feasible to store film in vaults primarily intended for the storage of paper records. It may be necessary to seek a vendor who can provide offsite vault facilities. The State Records Center, operated by the Office of the Secretary of State, can provide such storage space, free of charge. Small quantities of film may be stored in safes, UL class 150 rated for 4 hours (or equivalent).

All enclosures and storage containers for the master film must be chemically nonreactive and non-corroding. Materials used must also be chemically stable and resistant to giving off reactive fumes after heating to 150oF. for 4 hours. Great care must be taken that only photographically stable adhesives are used in containers and enclosures as provided in ANSI IT 9.2. If there is any question that proper humidity, ventilation or air purity will not be maintained, all film must be stored in sealed containers.

INSPECTION
Periodic inspection of stored master negatives is essential. The procedures for inspection of the film are set out in 950 CMR 39.07. Every 2 years, a statistical sample of the total volume of microfilm must be inspected for evidence of damage or deterioration. The inspection shall include: rereading of resolution test target and remeasurement of films density; inspection for residual processing chemicals, microbial growths, film curl or discoloration, excessive brittleness, evidence of separation of the emulsion from the base ("blocking or fused film"), adhesion of the emulsion, base shrinkage and the presence of redox blemishes. Cans, boxes, and reels of film should also be inspected for evidence of rust, corrosion and other deterioration.

Problems that are noted in film or storage containers and housings are often not isolated incidents, and if they are the result of conditions subsequent to processing they can become contagious and spread throughout the film collection. If samples of any lot of film rated as in fair condition, additional samples must be inspected. All film of any lot rated as poor must be inspected. All film rated as poor or bad shall be replaced.
Reports of the inspections shall be made to the Supervisor of Public Records.

IN-HOUSE OR VENDOR SERVICE
In determining whether the program should be carried out in-house, there are a number of issues to be considered. An in-house operation has a number of advantages:

* Control of records is not compromised, records stay on-site and under the control of their custodians within the offices.
* Turnaround time is reduced since there is no transit time between the office and the location of the filming, and the filming is done according to a rigid schedule.
* Access to the records is not impeded; since they never leave the office, they can be accessed at any time. An in-house system allows effective centralized control of the entire program, including the ability to build the program into an overall information management environment.

Conducting an in-house microfilm program is most effective in economies of scale where there is sufficient work to fully employ both cameras and operators. Where there is sufficient volume of material to be filmed, an in-house program can result in significant cost savings and management benefits.

An in-house program, however, involves a significant investment in equipment and personnel. A simple desktop planetary camera will cost around $5,000, and a low- to medium-volume rotary camera will run at least $10,000. If the filming program is to be used for more than creation of security copies, it must be flexible enough to accommodate a variety of film sizes, formats and retrieval techniques and will require multiple cameras. Trained, skilled personnel must operate the cameras; sloppiness or incompetence by the camera operators can ruin an entire program, not only by spoiling a batch of film, but also by destroying the faith of users in the quality and usability of their output. A program depending on poorly trained, sporadically employed personnel is doomed to failure.

A film program also requires that a considerable amount of space be dedicated to the cameras and the document preparation area. Records must be processed and filmed in secure, clean areas where their physical security and file integrity can be assured.

Even in large-scale micrographics programs, the advisability of in-house film processing must be carefully assessed. Processing involves chemicals that may be governed by federal, state and local health, safety and environmental regulations. Compliance with these regulations may require plumbing and ventilation modifications to be made to the building, and involve a level of compliance activity that would make in-house processing economically unfeasible.

Careful cost analyses must be performed to determine whether an in-house program is realistic. There are three alternatives to such a program:

* Cooperative programs can be established between two or more entities to create an economically feasible program.
* A vendor can be contracted to perform the entire program.
* Hybrid programs can be implemented with certain applications (e.g. high-volume filming of uniform records such as checks) being conducted in-house on automated equipment, and more critical or specialized operations contracted to a vendor. Contracting out the entire program is the most common alternative.

DEALING WITH A VENDOR

When selecting a microfilm vendor, it is important to consult with other agencies which have gone through the process themselves and which have experience in dealing with vendors. By tapping the experience of others, you can anticipate the process and be aware of the virtues or failings of the vendors who are likely to respond to your request.

At the request for proposal stage and throughout the entire project, it is essential to be able to communicate freely and clearly with the vendors. The vendors must be provided with sufficient information to submit an adequate response and they must be able to show that they are aware of all the factors that will influence their work on the program.

Bonding
Since the vendor may require that valuable records be moved offsite, it is highly recommended that he be required to post a bond to guarantee their security. A bond should also be secured to ensure that the performance of the vendor in terms of quality and delivery of the finished product will be as promised.

Information for the Vendor
To successfully formulate a response to an RFP and carry out a program, the vendor must be provided with a variety of information:

* Description of records to be filmed. The vendor must know the physical characteristics of the records: bound or loose; size; one- or two-sided; paper weight; color; and damage; whether they contain any documents that will require special handling e.g., brittle paper or documents in which inks have leached through and are visible on the opposite side of the page. All these factors will affect the equipment used, throughput time and cost of the job.

The description of the records should also indicate if they are active or inactive, and the estimated retrieval frequency. The manner of retrieval and any particular reference patterns should also be noted to allow the proposal to be tailored to meet the needs of the records' users.

* Rationale for Filming. The vendor will need to know the reason the records are being filmed in order to develop the most suitable program. Are the records being filmed for security, to save space or as part of an overall information management program? The reasons for filming, and the anticipated use of the film will dictate the format and retrieval systems needed.
* Arrangement and Editing. How will the records be delivered to the vendor? What will the vendor's responsibilities be for arranging files and document preparation? In general, weeding and arranging files should be done by the contracting agency. Document preparation, however, is a laborious task that consumes large amounts of staff time and requires a relatively large amount of space. Vendors customarily charge between $9 and $13 per hour for this service, but unless the contracting agency has plenty of staff it is generally considered a good investment.
* Access Restrictions. The vendor needs to know whether any records are confidential or restricted. This information assists in determining format and targeting or indexing requirements, and allows the vendor to make necessary security arrangements.
* Work Space. The vendor will need to know where the work is to be performed. The volume of records and the types of equipment needed will affect the vendor's willingness to work off site.
* Time Frame. The vendor will need to know what turn around time is expected for particular batches of records and for completion of the entire job.
* Public Records Requirements. All public records are governed by the provisions of c.66 MGL. The vendor must be made aware of the provisions of this chapter with regard to security and access to records. The actual filming of the records is governed by 950 CMR 39.00, Regulations on Using Microfilm; these regulations incorporate current industry standards and should be provided to the vendor. Information to be Provided by the

Vendor
For their part, the vendors making proposals must provide certain information

and proofs:
* Knowledge of Governmental Operations. The vendors must be able to demonstrate familiarity with the operations of the governmental office letting the contract, and that they will be able to tailor a program best suited to the office's needs.
* Track Record. The vendors should be able to demonstrate that they have successfully undertaken similar projects before. References and recommendations of clients are helpful.
* Knowledge of Public Records Requirements and Compliance Capabilities. The vendors must be able to demonstrate their awareness of the requirements of c.66 MGL. They must be able to demonstrate how they intend to provide for issues such as records segregation, security, confidentiality and access within the terms of the chapter. The fact that the records may be on the vendor's premises in no way relieves the custodian of the requirements of the chapter.
* Flexibility. The filming program which best suits the client's needs may involve several different film formats and indexing and retrieval strategies. A vendor who has only overhead planetary cameras cannot provide the best service where large volumes of standardized records must be filmed. A CAR system is essential for filming active case files. It is wise to reviewa vendor's equipment inventory and staffing levels to determine whether the proposal has been predicated upon the vendor's capabilities rather than the office's needs or if it is even realistic.

If the microfilm is to be integrated into an information management program, the vendors must be able to show that they are thoroughly familiar with other facets of such a program including paper document management, electronic information management and optical data storage systems.

The vendor must also be able to show an operational flexibility that will ensure that the job will be completed on time in the event of unforeseen circumstances, even if this requires going to additional shifts.

* Knowledge of Industry and Regulatory Standards. The vendors must be able to demonstrate their familiarity and ability to comply with the provisions of 950 CMR 39.00 and the national and international standards governing the production of microfilm.
* Support and Training. The vendor must be able to support all equipment sold to the client. More importantly, the vendor must be able to provide training for all of the client's users. The best conceived and executed micrographics program will come to naught if the end users are not comfortable with it. Training must include instructions on how to use the hardware, make and transmit prints, use indexes (including CAR databases) and how to update indexes.

SUMMARY
Properly implemented, a well-thought-out micrographics program can provide a variety of benefits to government offices and be part of a powerful information management program. Improperly implemented, it can be a major waste of money. Preliminary study of the technology and the functions and dynamics of the office, and consultation with experts including vendors, professional associations such as AIIM and ARMA, and the Office of the Supervisor of Public Records are essential if the program is to succeed.

ADDITIONAL INFORMATION

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Elkington, Nancy, editor. RLG Archives Microfilming Manual. Mountain View, CA: Research Library Group, 1994.
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"Resources for Facsimile Replacement of Out of Print and Brittle Books." Preservation of Library and Archival Materials: A Manual. Andover, MA: Northeast Document Conservation Center, 1999. Also available at www.nedcc.org/tleaf52.htm.
Saffady, William. Micrographic Systems. 3rd Edition. Silver Spring, MD: Association of Information and Image Management, 1990.
Saffady, William. Optical Disk vs Micrographics. Westport, CT: Mecklermedia, 1993.
Smith, Charles. Micrographics Handbook. Dedham, MA: Artech House, 1978.
Thomas, Bill. The Thomas Handbook of Quality Control in the Microfilm Industry. Burnsville, MN: MicroD Interntional, 1990.

Standards for the production of microfilm are established by the American National Standards Institute (ANSI) and associated organizations and are available from:

American National Standards Institute
1430 Broadway
New York, NY 10018
Phone 212-642-4916
Fax 212-398-0023
Web www.ansi.org ANSI also distributes standards of the International Standards Organization (ISO).

ANSI and ISO standards relating to microfilm and document imaging are also available from the Association of Information and ImageManagement (AIIM). AIIM is a professional organization dedicated to information and image management and publishes its own journal, Inform. For more information or a listing of ANSI or ISO standards and AIIM technical reports:

Association of Information and Image Management
1100 Wayne Avenue
Suite 1100
Silver Spring, MD 20910-5699
Phone 301-587-8202
Fax 301-587-2711
Web www.aiim.org
See www.aiim.org/industry/standards/97stdcat.htm for the AIIM catalog of

standards.

The Association of Records Managers and Administrators (ARMA) is another professional organization dedicated to efficient management of records. ARMA publishes a journal, Records Management Quarterly, and a number of publications for the guidance of persons in the records management field. Contact:

Association of Records Managers and Administrators
4200 Somerset
Suite 215
Prairie Village, KS 66208
Phone 800-422-2762 or 913-341-3808
Fax 913-341-3742
Web www.arma.org The Society of American Archivists (SAA) is a professional organization that provides leadership, training and information for the identification, preservation and use of the nationís historical records. SAA is an excellent source of educational material, including many of the resources listed in the bibliography. SAA also publishes the American Archivist and Archival Outlook. Contact:

Society of American Archivists
527 S. Wells, 5th Floor
Chicago, IL 60607
Phone 312-922-0140
Fax 312-347-1452
Web www.archivists.org

The Supervisor of Public Records is charged by Chapter 66 of the General Laws of Massachusetts with oversight of the public records of the Commonwealth, counties, cities and towns. Pursuant to this mandate, the Supervisor publishes the Records Management Manuals for state, municipal and county records. A series of policy statements, Supervisor's Bulletins, explicate policy on various issues and provide further guidance for record custodians. 950 CMR 39.00, Regulations on Using Microfilm, are a part of the Code of Massachusetts Regulations and govern the use of microfilm for retention of public records.

To obtain copies of these publications, visit the Records Management Unit Web site or contact:
Supervisor of Public Records
Massachusetts State Archives
Records Management Unit
220 Morrissey Blvd.
Boston, MA 02125
617-727-2816 Phone
617-288-8429 Fax
www.sec.state.ma.us/arc/arcrmu
recman@sec.state.ma.us

For information on storing microfilm at the State Records Center, please contact:
State Records Center
220 Morrissey Blvd.
Boston, MA 02125

Related pages:

Records Conservation Board

State Records Center

Public Records Division

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Technical Bulletin 3

Records Security

Version 2 (1999)

Purpose
Two of the prime responsibilities of records custodians are ensuring the physical security of the operational records and preserving the corporate memory of the agency/department.
Loss of records can result in:
* Disruption of government business and services.
* Legal risks and excessive legal bills.
* Severe operational and financial setbacks.
* Damage to the interests of the constituency.
* Loss of political and historical context and legitimacy.
There are also legal repercussions if the custodian's responsibilities have been clearly enunciated. Failure to provide for the security of records in the face of clear requirements to do so may well be interpreted as negligence.

Threats to Records
Records custodians have a responsibility to protect their records against a variety of threats including fire, flood, theft, vandalism, pests and environmental damage. In the past, this was relatively straightforward: today, advancements in storage technologies and a proliferation of record media have complicated the task.

Environment
Now records custodians must provide protection for a variety of media, including paper, photographic film and magnetic media. Each recording media has its own environmental requirements and limits at which irreversible degradation will occur. These requirements must be taken into consideration when planning for the security of public records.

Paper
Paper is the most durable of recording mediums. While paper can survive temperatures up to 350EF., humidity levels up to100%, or total immersion in water, only a stable environment will assure long-term security and preservation. Temperatures below 70EF. and relative humidity of 40-45% are optimal. Due to the difficulty and expense of meeting these criteria, it is permissible to maintain average vault temperatures of 70EF. or below and an average relative humidity of 30-50%, with daily fluctuations of ±2EF. and ±3% RH. The Supervisor of Public Records publication Performance Standards for Safes and Vaults mandates that in the event of a fire, storage spaces with public

records may not exceed the upper limit of 350o for the duration of a fire.

Photographic Film
Silver halide microfilm masters require a constant temperature of 70EF. or below and a relative humidity of 20-30% for long-term preservation. It is preferable that temperatures do not exceed 65EF, and cooler temperatures are preferable. Storage space designed for the protection of paper records is not sufficient for the low humidity storage requirements of film. Storage requirements for film are specified in 950 CMR 39.06 of Regulations on Using Microfilm.

Magnetic media
Magnetic media has a much lower tolerance for high heat and humidity levels than paper. Magnetic media begins to suffer severe degradation at 150EF. and relative humidity of 85% and above. Storage space designed for the protection of paper records cannot protect magnetic media from the heat of a fire or the moisture generated by fire-suppression efforts. Periodic copying and dispersal of media, and specialized Class 150 records storage devices or vaults are necessary for the protection of magnetic media; please see the "Records Storage Equipment" section for more details. Storage devices and vaults must meet the guidelines specified in the Supervisor of Public Records publication Performance Standards for Safes and Vaults.

Please see the Records Management Unitís Web page at www.sec.state.ma.us/arc/arcrmu for a copy of the publications mentioned, or contact the RMU (617-727-2816 or recman@sec.state.ma.us) for a paper copy. For more information, please see the "Environment" section of Northeast Document Conservation Centerís Preservation of Library and Archival Materials at www.nedcc.org/index2.htm

Dirt and Pollutants
Cleanliness of the vault is essential to the protection of the records. Dust and pollutants can damage records and are sources of ignition. Unsanitary conditions are a hazard and are a breeding ground for insects and vermin. Prohibit food, drink and plants from the vault. Remove trash daily, and do not allow collected trash to accumulate in areas directly outside the building.

Protect archival records from dust and pollutants by housing them in archival-quality folders and boxes. The folders and boxes should meet the American National Standards Institute (ANSI) standard for permanence, Z39.48-1992. The alkaline reserve serves as a buffer between the contents and a potentially harsh environment. Boxes and folders meeting the ANSI standard will create a stable micro-environment for permanent records. For more information, please see the "Storage" section of this publication.

Maintain an overall environment that is as dust-free as possible:
* Change furnace and air conditioner filters on a regular schedule, e.g., quarterly.
* Use vacuum cleaners equipped with high-efficiency, particulate air (HEPA) filters if possible, so as not to redistribute dust. Sweeping is discouraged, since it stirs up and scatters dirt.
* Avoid introducing materials that create internal pollutants, such as wooden cabinets and shelves, cleaning compounds, andcarpeting.

* Do not store records near copying machines, which produce ozone and toner dust. Records should be properly boxed and shelved. Boxes should not hang over shelf edges. Records should be promptly returned to their boxes; boxes should be promptly reshelved. Lit tobacco products, matches or lighters should be prohibited from the vault.

Cleaning compounds with ammonia, chlorine, solvents or volatile oils should not be used in the vault. Typically dust cloths and water are sufficient. Use caution with water because of the risk of spills and raising the relative humidity in a confined area. Make sure shelves are completely dry prior to reshelving. For more information, please see Northeast Document Conservation Centeris technical leaflet "Cleaning Books and Shelves" at www.nedcc.org/tleaf43.htm.

Insects and Vermin

Pests indicate an environmental problem such as high humidity or gaps in the building structure, or poor housekeeping. Unless there is a specific problem, avoid regularly scheduled chemical treatments. Chemicals emit strong odors that may create long-term problems for staff, records, and record users.

There is no all-purpose solution for eliminating every pest problem. Practice a preventive approach to pest management. Maintain good housekeeping, prohibit food, beverages and plants, monitor the environment, use the least toxic eradication methods first, and work with your pest control professional. A pest infestation inside records boxes indicates a serious condition. Call the Records Management Unit at 617-727-2816 immediately.

Light

Artificial and natural light causes irreparable and irreversible damage. Vault areas should not have windows: if records are in an environment where they are exposed to light, cover windows with shades or drapes that completely block the light. This will also help maintain a stable temperature. Turn off interior lights when they are not in use and install ultraviolet (UV) filters on florescent lights. Store archival records in archival-quality folders and boxes.

Photocopiers are a powerful source of light. Avoid repeatedly copying the same record. Create "surrogates" or use copies for heavily requested records. Provide users with surrogate copies to reduce wear and tear on originals.

Mold

Excessive heat, poor air circulation, and relative humidity above 65% can provide a suitable climate for mold growth. If relative humidity goes over 65% for more than two days, or the airflow is stagnant, there is a risk of mold growth. High humidity is especially problematic in basements, where ground water and cooler temperatures encourage water vapor to collect. The appearance of mold indicates a serious condition and requires immediate action.

If mold occurs, reduce the temperature and relative humidity. Do not move records or try to remove mold from records without first consulting preservation personnel.

Determining the mold species is an important first step in addressing the mold outbreak. Some molds can present very serious health concerns. Even dormant (dry or powdery) mold spores can be readily redistributed within a storage

space, becoming active (velvety) when environmental conditions are favorable for growth.
If you discover records with mold, immediately contact the Records Management Unit at 617-727-2816.

Records Storage Equipment
Records storage equipment and facilities should be designed and constructed to protect paper, photographic film and magnetic media against catastrophic events such as fire or flood, malicious attack or theft, and against long-term threats caused by environmental factors.

Storage units should be fire resistant in the sense of being noncombustible, and must be heat resistant, in order to prevent degradation or auto-ignition of the records. Storage units must protect records against water intrusion and high humidity levels. It is crucial that records storage units (vaults, records safes, or insulated files) prevent the transfer of heat and that the storage units maintain their structural integrity.

Unrated devicesóincluding the so-called Old Line steel and cast iron safes found in many officesócannot be relied upon to provide the required level of protection. Although Old Line safes have been known to survive serious fires, they cannot be counted on to provide the heat-resistance or impact-resistance necessary to safeguard public records. Old-fashioned steel plate vault doors, with or without inner doors, provide only 10 or 15 minutes of fire protection, respectively. Unrated steel or wood filing cabinets, desks, etc., only provide 5 minutes of fire protection.

Storage equipment is tested by various testing laboratories e.g., Underwriters' Laboratories and is classified in terms of interior temperature limits and time in hours. For non-paper records, protective storage devices are classified 150 and rated 1, 2 or 4 hour e.g., the storage unit can maintain an internal temperature of 150EF. or below for 1, 2 or 4 hours. Units that are classified 150 require the maintenance of 80% or below internal relative humidity for the period tested.

For paper records, devices are classified to 350o and rated 1, 2 or 4 hour, with an allowance for 100% internal relative humidity. Devices may be equipped with inserts for greater fire resistance or for the storage of mixed media; for example, a storage device for paper records may be fitted with small, internal units for magnetic media. These devices may carry more than one classification and rating. The first classification applies to the whole unit and the second classification applies to the insert, e.g. 350 4 hour/150 4 hour.
Ratings assigned to various records storage devices are as follows:

Insulated Records Containers Class 150 rated for 4, 2 and 1 hour
Class 350 rated for 4, 2 and 1 hour
Fire-resistant Safes Class 350 rated for 4 and 2 hour
Insulated Filing Devices Class 350 rated for 1 hour
Insulated File Drawers Class 350 rated for 1 hour
Vault Doors Class 350 rated for 6, 4 and 2 hour
Insulated File Room Doors Class 350 rated for 1 and 1/2 hour Since fires often result in the collapse of structures, the fire-rated storage device must be able to withstand high impact e.g., the force of dropping through the building floor. This is tested as part of the classification rating.

Vaults must be constructed to withstand the impact of falling building members, equipment and the stresses and strains of collapsing structural members. Vaults must be constructed so that a fire will not: destroy the vault structural supports; produce stresses that will cause the walls, floors or ceilings to crack; cause the vault to erode due to sudden cooling from fire hose streams; and so that the vault will in no way lose its structural integrity.
It is undesirable to locate vaults and other record storage units in the basement of buildings, since burning debris may accumulate in the basement and create a "cooking effect." This leads to high temperatures for longer periods of time than would otherwise be the case. Basement units are also more susceptible to the impact of falling equipment and structural members. It is also more difficult to evacuate personnel from basement units.
In addition to fire-imposed hazards, basement areas are more prone to flooding and high humidity than areas at or above grade. This increases the risk of environmental and preservation hazards.

VAULT OPERATIONS
Because of the expense and inherent size limitations of vault construction, it is crucial that the vault is utilized effectively. The vault is specifically designed to ensure the safe preservation of the government records. Using the vault for the storage of supplies, office machines, seasonal decorations, equipment or other non-record materials is a waste of valuable and secure space, and is an egregious misuse of scarce government resources.
Secure space is a limited resource: care must be taken to determine which records are stored in the vault. In order to make the most efficient use of vault space, public records should be prioritized as outlined in the following section, "Vital Records Management." Records that should be given priority for vault storage are records that are 1) vital to the operation of the organization, or are 2) archival due to their historical value and importance for preserving institutional and community memory. Secondary space allocations should be made for records appraised as important. If the vault cannot accommodate all important or useful records, provisions should be made for their storage in fire-resistant file rooms as specified in NFPA-232, Protection of Records.
When planning the size and location of a new or reconstructed vault, records custodians should consider the current volume of records needing protection and attempt to estimate future space needs; this estimate should take into account projected growth estimates for the community and the annual accumulation of each record series. In the planning stage, it is appropriate to explore various avenues for reducing the growth of records e.g., miniaturization, electronic archiving of electronic records, and implementation of a comprehensive information management program and review.

Since vital records are usually active records, consider the needs of all involved and ensure convenient access to the vault. It may be desirable to construct two or more small vaults that are readily accessible to the operational offices, rather than a single large vault that is distant and inconvenient to access.

Supervision and Control
The vault should be under responsible supervision at all times. If the vault is not under constant surveillance, it should be closed and locked at all times it is not in use. Only authorized personnel should be allowed access to the vault: the authorization procedure should be documented in the record management policies and procedures manual, and it should designate which individuals are

authorized to deposit or remove records. The vault should be inspected several times a day and at closing time to ensure that all records are properly shelved, all waste papers are removed, and that the door is closed and locked.

Removal of records should be controlled through the use of a sign-out or charge-out system. An example is the use of an outguide, a stiff cardboard divider with a protruding tab, which is placed in the box in place of the folder. The outguide should be ruled and labeled so that the worker may write in the file name, his name and the date the file was removed. There are many variations of sign-out systems ranging from basic lists to the use of bar codes. Whatever system is decided on, it should be documented in the records management policies and procedures manual.

It is highly recommended that a single officer or employee be placed in charge of the vault. This individual should have the authority to: control access to and change the combination; allocate space; establish requirements for boxing and labeling records; accept or reject records to be stored, based on the vital records program; and require the removal or rescheduling of records that have exceeded the required retention period.

Equipment

All filing equipment should be noncombustive throughout. If mobile shelving is installed, it must be of the mechanical type. Only equipment needed to service the files should be allowed in the vault. Desks, chairs and other furniture should be forbidden. If possible, ladders needed to reach upper shelves should be stored outside the vault; ladders should only be brought into the vault as needed. In the event of a fire or other emergency, the vault lights will probably fail, and it is essential that the vault aisles are kept clear. Aisles cluttered with boxes or equipment present a safety hazard.

Filing cabinets provide extremely inefficient storage and should not be used. Optimize space with shelving: shelving allows five times as much storage per square foot as equivalent office space. High-density shelving allows ten to twelve times as much storage per square as equivalent office space. Shelving should be designed for standard-size record boxes (typically 10" x 12" x 15"), as this will maximize the use of space.

Shelves that are closed on the ends and that have a front closure system, and mobile shelving in the compressed position, provide additional protection against fire and water damage from sprinkler heads or fire suppression. These systems also reduce air circulation, which may lead to mold growth. If closed systems are chosen, the environment should be carefully monitored.

Storage

All files should be properly arranged prior to boxing: only important records should be sent to the vault. Remove duplicate records and other non-essential materials. Record boxes should be of uniform size and clearly labeled with the office of origin, contents and span and disposal dates. For a sample inventory database (including box labels), please see the "Tools and Models" section of the Records Management Unit Web page at www.magnet.state.ma.us/sec/arc/arcrmu/arctoo.htm. In order to prevent mixing records with different offices of origin, each office should be assigned its own storage area in the vault.

Record containers should be at least 6 inches from piping and conduit that penetrates the wall. Record containers should be at least 4 inches from the wall to allow for maximum air circulation. Record containers should be kept a minimum of 18 inches below sprinkler deflectors. All records should be stored on shelves that are a minimum of 3 inches above the floor of the vault.

Storage Boxes and Enclosures for Permanent Paper Records
Paper records should be stored in archival-quality folders and boxes (low lignin or lignin-free, buffered, pH 8.5 or above). The folders should be stored in archival-quality boxes with lids. The calcium carbonate "buffer" of archival-quality materials prevents the formation of acid in paper records.

Select the appropriate-sized boxes and folders for paper records. Do not overstuff folders, and do not bend the materials to fit the folder or box. Folders should stand upright in the box. If necessary, use archival-quality fillers to support the folders and to prevent them from falling over.

Mark folders in pencil: pen and labels are chemically unstable and labels will fall off. Purchase supplies from companies that specialize in archival products. Contact the Northeast Document Conservation Center at 978-470-1010 or see their technical leaflet "Preservation Suppliers and Services" at www.nedcc.org/listsup.htm for a list of suppliers. Also see the Massachusetts Historical Records Advisory Boardís (MHRAB) technical leaflet "Preservation Basics" at www.magnet.state.ma.us/sec/arc/arcaac/aacipre.htm.

See the Records Management Unitís publications page www.magnet.state.ma.us/sec/arc/arcrmu/arcpub.htm for more information on archival storage of non-paper records or contact the Records Management Unit at 617-727-2816. Also see the Northeast Document Conservation Centerís "Storage and Handling" section of Preservation of Library and Archival Materials: A Manual at www.nedcc.org/index4.htm.

VITAL RECORDS MANAGEMENT
There is a small percentage of information within any organization that is crucial to the successful operation of the organization. Without this information, the organization cannot function. These records are the vital records of the organization.

Although vital records typically constitute 3-5% of the organization's total information stock and may have only short-term value, vital records are essential for the:

* Operation of the organization
* Resumption or continuation of operations following a disaster
* Re-establishment of the legal, financial and functional status of the organization
* Determination and protection of the rights and obligations of the employees and citizens. Loss of this information can result in: vulnerability to litigation; exposure to unplanned financial losses due to financial settlements or revenue loss; disruption of the continuity of operations; loss of efficiency; and damage to the interests of the citizens and employees of the organization.

The objective of vital records management is to minimize risks and hazards to

vital information, and to do so in the most efficient and economical manner possible. In the public sector, vital records programs protect the public interest, ensure the maintenance of individual rights, and preserve the public trust.

Establishing a Vital Records Program
Before implementing a comprehensive plan to safeguard vital records, the organization must complete a thorough study of its records. This study should include: determination of records classification; physical volume by class; storage space requirements; costs of the loss of each class; protection needed; and handling procedures.

Records Classification
Records are generally classified in one of four groups in a scheme suggested by the National Fire Prevention Association:

CLASS DEFINITION EXAMPLE
RECOMMENDED
PROTECTION

Class I
Vital Records essential to the continued life of the organization. These records are irreplaceable because they give evidence of legal and financial status, and of the rights and obligations of the organization. Vital records are generally housed in active storage. Accounts receivable, contracts, charters, minutes, payroll, ordinances and resolutions, master personnel listings, all documentation needed to run and read electronic records systems. Fire resistant vaults and safes, dispersal.

Class II
Important Records necessary to the continued life of the organization. While the records can be replaced or reproduced, this can only be done at considerable cost in time and money. These records may be housed in either active or inactive storage. Accounts payable, tax lists, directives. Fire resistant safes, vaults or file rooms.

Class III
Useful

Records useful to the continued life of the organization.

These records may be replace although their loss would cause temporary inconvenience. Bank statements, correspondence. Fire resistant safes, file rooms, filing devices.

Class IV
Non-essential Records that have no present value and should be destroyed. Requests answered, advertisements, announcements. Use, then destroy.

Although there is a tendency to equate vital records with records that have historic or archival value, they are not always one and the same. The life span of vital records may be very brief, and may inversely proportional to its importance to the organization. While archival records have enduring interest and historical value, they may not be relevant to the continued functioning of

the governmental unit.

Documentation of computer systems, accounts receivable and insurance policy information are essential to restoring operations after a disaster, even though this information may have a brief usable life or retention period. On the other hand, records such as militia lists, Civil War records, and pre-1870 correspondence have historical interest and should be retained permanently, but they are not essential to the resumption or maintenance of government operations. The vital and archival categories are not mutually exclusive: records frequently fall into both categories. Since the protection of vital records should take precedence over other records, vital records classifications should be carefully assigned.

Protection Methods

To determine the most appropriate level of vital records protection, estimate the severity of potential disasters. The severity of the disaster, costs of protection, and budgetary levels will dictate the level of protection. There are two means of protection available to local governments in Massachusetts: on-site storage, and duplication and dispersal.

1. On-site storage

Considerations for on-site storage of vital records include the analysis and improvement of buildings or facilities, equipment and supplies, and establishing procedural controls.

1. Building considerations. Establish the adequacy of the floor-load capacity, lighting, ventilation, environmental controls, wall and door fire ratings, smoke and fire alarms and fire suppression systems. Eliminate hazards such as leaks and pest infestation.

2. Equipment considerations. Determine whether the vaults, safes and storage devices meet or exceed Underwriters' Laboratories specifications. Underwriters' Laboratories tests and rates storage and filing equipment on the basis of impact resistance and internal fire and humidity levels during various lengths of exposure to fire. As a general rule, paper begins to deteriorate at 350EF., and magnetic media and photographs begin to deteriorate at 150EF. Storage devices for magnetic media must also be able to maintain an internal relative humidity of below 85%. See the "Vault Operations: Equipment" section for more details.

3. Procedural considerations. Routinely update vital records; prohibit food, beverages and smoking in records areas; do not store combustible materials with records; conduct periodic electrical, building and fire inspections; and periodically test the vital records program through simulation of post-disaster scenarios. See the "Vault Operations" section for routine procedural considerations.

The vital records program should not rely exclusively on on-site storage: there is always the risk that a single area can be destroyed or suffer near total destruction in a disaster. Duplication and dispersal of vital records must be part of the vital records program.

2. Duplication and Dispersal
Off-site storage of original, record copies of public records is forbidden under Massachusetts statutes. Duplication of vital records and storing the copies away from the central or primary office if one method of protecting vital records. This strategy is most effective for records that have been microfilmed and for records that are maintained in electronic format.

The environmental requirements for storing master microfilm negatives are very stringent; see the "Threats to Records" section for more detail. To ensure the safety of master microfilm and to ensure proper environmental controls, consider storing the master negatives with the Massachusetts State Records Center or with a private vendor. The State Records Center provides this service free of charge; please see the Additional Information section for contact information. In the event of a disaster, the off-site repository should be able to rapidly retrieve and copy the master negative. The master negative should never be used as a use copy. The master copy should only be used to produce duplicate film.

Electronic records should be backed up at frequent intervals; see the Records Management Unit publications for more detail. Backup copies should be stored off-site; reciprocal arrangements should be made between offices to store their backup copies. Programs and documentation needed to retrieve and read the backup copies should be secured at an off-site location. Agencies and departments should be aware of others who are using the same hardware and software: in the event of a disaster, it may be possible to utilize their hardware and/or software. Electronic archiving may also be investigated as a security measure.

In all cases, the dispersed records should be retained for their full retention periods and should be made available to the appropriate officers.

Program Staff
The Vital Records Coordinator
If the office already has a comprehensive records management program, the records manager is the most appropriate person to coordinate the vital records protection program. If a comprehensive records management program does not exist, appoint a coordinator who has experience with records management e.g., a staff member of the Clerk's office. It is essential that all members of the organization recognize the authority of the coordinator: the coordinator should act with the administrationís authority and should have authority over vital records for all departments.

Most local governments have emergency response procedures for dealing with disasters. Public safety, public works and other personnel are all assigned a role in safeguarding lives and property. These procedures typically do not involve a long-term plan for preserving information and restoring severely disrupted operations, except for physical services such as water, electricity and public safety. A vital records program should be designed to preserve information that is essential to governmental functions. The vital records program should be part of the emergency response program and/or local disaster plans. The vital records coordinator should be part of the overall emergency planning process.

The Vital Records Team

The vital records team assists the program coordinator and is an important part of a successful vital records program. The major function of the team is to help the coordinator determine which functions and supporting records are vital to the organization, and to ensure that they are properly safeguarded. Administration, finance, law, information systems, and records management experience are important background for team members.

Communications
All officials should be aware of the importance of their vital records, and how critical they are to the survival of the organization. In larger organizations, it may be desirable to have a vital records manual; smaller organizations may find a simple master list to be sufficient. Vital records should be designated on the master records inventory. It is essential that the vital records program is part of management policy.

Summary
A vital records management program:
* Prevents the loss of information that is critical to the daily operations of government organizations.
* Begins with a records inventory that describes the function of the record within the organization.
* Classifies records into one of four categories: vital, important, useful or nonessential.
* Selects appropriate protection methods to safeguard vital records.
* Permits the organization to continue functioning during a disaster and to reestablish services after the disaster.
* Should be part of management policy, and should be part of community emergency response and local disaster plans.

ADDITIONAL INFORMATION
For more information, please see Northeast Document Conservation Centerís Preservation of Library and Archival Materials: A Manual at www.nedcc.org/newman.htm and see the Massachusetts Historical Records Advisory Board (MHRAB) technical leaflet "Preservation Basics" at www.magnet.state.ma.us/sec/arc/arcaac/aacipre.htm. Also watch the Records Management Unitís Web page at www.sec.state.ma.us/arc/arcrmu for new technical bulletins.

For more information, please contact the Records Management Unit.

The Records Management Unit is available to help government officials and their staffs with records management. Analysts can assist you with:

Technical Assistance including:
* Development of records management programs
* Records inventory
* Analysis of record-keeping systems
* Appraisal and scheduling of records
* Implementation of schedules

Training Sessions and Presentations. Analysts will plan an agenda tailored to the records management needs of the agency/department. Analysts frequently speak at meetings of professional associations. Sample topics include:

* Records Retention and Disposition
* Safety and Security of Records
* Records Lifecycle
* Care and Handling of Records
* Public Records Issues

Workshops. Let the Records Management Unit teach a workshop at your next professional association meeting.

For more information, please contact:
Massachusetts State Archives
Records Management Unit
220 Morrissey Blvd.
Boston, MA 02125
617-727-2816 Phone
617-288-8429 Fax
www.sec.state.ma.us/arc/arcrmu
recman@sec.state.ma.us

For information on storing microfilm at the State Records Center, please contact:
State Records Center
220 Morrissey Blvd.
Boston, MA 02125
617-727-2816 Phone
617-288-4505 Fax

APPENDIX 1: RELATED BULLETINS FROM THE SUPERVISOR OF PUBLIC RECORDS
Please see our web site or contact the Records Management Unit for the following publications:

Requirement to Use Permanent Paper (02-93)

Recording Material for Permanent Public Record (05-94)

Security and Custody of Records Created Outside the Town Hall (04-94)

Designation of Records Custodian (02-96)

Facsimile Transmissions (01-92)

Backing Up and Archiving Electronic Records (01-96)