International Federation of Library Associations and Institutions
Core Programme on Preservation and Conservation
and
Council on Library and Information Resources

IFLA
Principles for the Care and Handling of Library Material

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International Preservation Issues
Number One

ACKNOWLEDGEMENTS

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CONTENTS

The following list defines words and terms used in the text, not always as they would be encountered in a standard dictionary.

Acid
In chemistry, a substance capable of forming hydrogen (H^+) ions when dissolved in water. Acids can damage cellulose in paper, board, and cloth, by catalyzing *hydrolysis*. Acids may be introduced during manufacture, or may be present in the raw material. Acids may also be introduced by migration from acidic materials or from atmospheric pollution.

Acid-free
Materials that have a *pH* of 7 (neutral) or higher (alkaline).

Acrylics
A plastic material noted for its transparency, weather resistance, and colour-fastness. Acrylics are important in preservation because of their resistance to chemical change. They are available in sheets, films, and resin adhesives. Some common trade names for the sheet form are Perspex, Lucite, and Plexiglas. Ultraviolet-absorbing acrylic sheet is used in preference to glass for glazing framed materials because it is less likely to break and the additional ultraviolet absorbers protect the framed objects from UV damage.

Adhesive tape
Paper, fabric, or other material in sheet form with an adhesive layer. The adhesive is generally activated by pressure, or by the application of heat or water. Pressure-sensitive or 'sticky' tapes should not be used for material intended for long-term preservation, since the adhesive degrades and yellows and the adhesive residues can become impossible to remove.

Alkali
In chemistry, a substance capable of forming hydroxyl (OH^-) ions when dissolved in water. Alkaline compounds may be added to materials to neutralise acids or as an alkaline reserve or buffer for the purpose of counteracting acids which may form in the future.

Archival quality
An imprecise term suggesting that a material, product, or process is durable and/or *chemically stable*, that it has a long life, and can therefore be used for preservation purposes. The phrase is not quantifiable; no standards exist that describe how long an 'archival' material will last. The word *permanent* is sometimes used to mean the same thing.

Brittle
A property or condition that causes failure of a material when it is flexed or folded. Paper is said to be brittle when a corner will not withstand two complete double folds.

Buffer/buffering – see *alkali*

Cellulose
Chemically, a complex carbohydrate. The chief constituent of the cell walls of plants, and consequently the chief constituent of many fibrous plant products such as paper, board, cotton and linen cloth. The traditional Western plants providing cellulose for paper were cotton and linen. Wood has been the major source of papermaking fibres since 1850.

Chemical stability
Not easily decomposed or otherwise modified chemically. This is a desirable characteristic for materials used in preservation, since it suggests an ability to resist chemical degradation, such as paper embrittlement, over time and/or exposure to varying conditions during use or storage. Sometimes described as chemically 'inert'.

Conservation
Specific practices taken to slow deterioration and prolong the life of an object by directly intervening in its physical or chemical make-up. Examples would be repairing damaged bindings or deacidifying paper.

Encapsulation
A form of protective enclosure for paper and other flat objects. It involves placing the item between two sheets (or one folded sheet) of clear plastic film (usually polyester) that are subsequently sealed along four edges. A sheet of buffered paper or board is sometimes included to increase support.

Foxing
Random, rust-coloured spots on paper.

HVAC
Short for heating, ventilating, and air conditioning system.

Hydrolysis
The decomposition of organic compounds by interaction with water. The degradation reaction weakens or breaks molecular bonds, thereby leading to *embrittlement* and discolouration.

Interleaving
The practice of using sheets of paper or other material to separate items. Alkaline-buffered paper is often recommended to be put between acid materials to prevent acid migration.

Lignin
A component of the cell walls of woody plants, along with *cellulose*. Lignin is largely responsible for the strength and

rigidity of plants, but its presence in paper and board is believed to contribute to chemical degradation. There can be large amounts of lignin present in pulp made from wood. It is not removed in the production of mechanical pulp, but it can be optimally removed by using chemical processes.

Lux
The unit of measurement for intensity of illumination (1 lux = 1 lumen per square meter). When considering light levels which are suitable for reading and working, and do not damage library material, then it is more important to quantify the light which falls on an object rather than the power (wattage) generated by a light bulb.

Medium/media
The material on which information is recorded. Sometimes also refers to the actual material used to record the image.

Mould
The spores of fungi that become mould or mildew (another type of fungus) are always present in the air and on objects; they await only proper conditions of moisture and temperature to germinate, grow, and reproduce. Mould causes staining and weakening of most library material.

Oxidation
Any reaction involving the loss of electrons from an atom (oxygen does not have to be present). When *cellulose* is oxidised an *acid* is formed, which catalyses *hydrolysis*. When polymeric materials such as adhesives and plastics are oxidised, they undergo a chemical change which leads to *embrittlement* and discolouration. Oxidation may be caused by impurities present within or adjacent to the material or by atmospheric pollutants.

Paste
An adhesive made from starch or flour such as rice or wheat.

Permanent
See also *archival*. A permanent paper is one which conforms to a recognised standard. It must be acid-free and made to resist chemical and physical changes to a greater degree than is usual in other papers.

pH
In chemistry, pH is a measure of the concentration of hydrogen ions in solution, indicating acidity or alkalinity. Alkaline-buffered storage materials used in libraries and archives typically have a pH above 7 and below 9.

Photochemical degradation
Damage or change caused or increased by exposure to light.

Polyester
The common name for the plastic polyethylene terephthalate. Its characteristics include transparency, lack of colour, high tensile strength, and *chemical stability* (when made with no coatings or additives). Used in sheet or film form to make folders, *encapsulations*, book jackets and adhesive tapes. Trade names include Mylar and Melinex.

Polyethylene
In its pure form, a chemically stable plastic material. Used in film form to make sleeves for photographic material and other uses. A cheaper alternative to *polyester* film.

Polymer
A material built up from a series of smaller units (monomers), which may be relatively simple, such as ethene (the unit of *polyethylene*), or relatively complex, such as *acrylic*.

Polypropylene
In its pure form, a chemically stable plastic material. Used in film form to make sleeves for photographic material and other uses.

Polyvinylchloride
Plastic usually abbreviated as PVC, or sometimes 'vinyl'. Not as chemically stable as some other plastics. It can emit acidic components which damage cellulosic material. Added chemicals called plasticisers are also used to make PVC more flexible. These also damage library material.

Preservation
Includes all the managerial and financial considerations, including storage and accommodation provisions, staffing levels, policies, techniques, and methods involved in preserving library and archival material and the information contained in them.

Pressure-sensitive tape – see *adhesive tape*

Thermohygrograph
A mechanical or electronic instrument which records temperature and relative humidity. Sometimes called a hygrothermograph.

Ultraviolet (UV)
Magnetic radiation having a shorter wavelength and higher energy than visible light, of which it usually is a component. Ultraviolet is damaging to library, archive, and museum objects. Removing UV can reduce the rate of deterioration. Certain acrylic sheets include UV-filtering chemicals.

PREFACE

Background

IFLA has a responsibility to encourage the acceptance and diffusion through its channels of professional principles of preservation and conservation administration .

'Principles for the Preservation and Conservation of Library Materials' was first published in the *IFLA Journal*, 5 (1979), pp. 292–300. This was revised and expanded by J. M. Dureau and D. W. G. Clements, from the IFLA Section on Conservation, and published by IFLA HQ in 1986 as Professional Report no. 8.

Since 1994 the International Federation of Library Associations and Institutions Core Programme on Preservation and Conservation (IFLA-PAC) has undertaken a survey among preservation specialists from a broad range of institutions and organisations (librarians, archivists, ICA, IFLA-PAC, IFLA Section on Conservation) to collect comments with a view to updating the 1986 document.

Over the last twelve years, articles and books have been published on a copious number of diverse themes that the preservation and conservation of library material now entails. Moreover, preservation and conservation have become established themselves, to some degree, in the library profession. However, there are still many libraries throughout the world which need guidance in looking after their collections. Therefore, while planning the revision of the 1986 'Principles for the Preservation and Conservation of Library Materials', IFLA-PAC decided to produce a concise document, which concentrates on certain key elements of preservation that libraries can adopt to look after their collections.

The IFLA-PAC International Centre would like to thank the Council on Library and Information Resources, particularly Deanna Marcum, Hans Rütimann, Maxine Sitts, and Kathlin Smith for their support and advice, and for entrusting us with this publication.

'IFLA Principles for the Care and Handling of Library Materials' is available on the CLIR website: <http://www.clir.org> and the IFLA website: <http://nlc-bnc.ca/ifla>. IFLA intends to publish further revisions when needed.

Aims

This document is a general introduction to the care and handling of library material for individuals and institutions with little or no preservation knowledge. It does not provide a comprehensive list of detailed methods and practices, but gives basic information to assist libraries in establishing a responsible attitude to looking after their collections. The threats to collections are often known, but librarians frequently do not proclaim sufficiently loudly the consequences of ignoring the dangers. 'IFLA Principles for the Care and Handling of Library Materials' is therefore designed to encourage those responsible to face up to these consequences and, together with scientific and technical experts, to formulate a positive policy for the future of the material in their collections.

Primarily, this publication sets out to:

- expose the vulnerability of library material
- advance knowledge about the permanence and durability of library material
- encourage proper care and handling of library material

- aid library staff in their search for solutions to preservation problems
- encourage clear lines of communication among library managers, buildings managers, and preservation and library staff so that all concerned work towards preserving the library's holdings.

Editor's note

It must be emphasised that this publication cannot be used in isolation. It has been compiled from many sources, a few of which are listed in the Bibliography. Such a short document can serve only as an introduction to the many subjects that the care, and handling, of library material entails. Therefore, it is recommended that readers proceed to familiarise themselves with the books listed below, which include comprehensive bibliographies on the topics that this publication briefly covers.

DePew, John N. *A Library, Media, and Archival Preservation Handbook*. Santa Barbara, CA: ABC-CLIO, 1991.

Fox, Lisa L., Don K. Thompson, and Joan ten Hoor (eds. and comp.) *A Core Collection in Preservation*. Chicago: American Library Association, Association for Library Collections & Technical Services, 1993.

Giovannini, Andrea. *De Tutela Librorum*. Geneva: Les Editions Institut d'Etudes Sociales, 1995.

Harvey, D. Ross. *Preservation in Libraries – Principles, Strategies and Practices for Librarians*. London: Bowker-Saur, 1993.

Ogden, Sherelyn (ed.) *Preservation of Library and Archival Materials*. Andover, MA: Northeast Document Conservation Center, revised 1996.

Reed-Scott, Jutta, ed. *Preservation Planning Program*. Washington, DC: Association of Research Libraries, 1993.

Ritzenthaler, Mary Lynn. *Preserving Archives and Manuscripts*. Chicago: Society of American Archivists, 1993.

The word 'preservation' is often defined to include all the managerial, administrative, financial, and staffing considerations necessary to safeguard the welfare of library collections. However, in this document, preservation specifically means the provision of an appropriate level of security, environmental control, storage, care and handling, that will retard further chemical deterioration and protect library material from physical damage.

The 'conservation' of library material has been purposely excluded. While many preservation options can be implemented by non-specialist staff, conservation can be carried out only by trained professionals with access to appropriate equipment and materials. Conservation is also an extremely labour-intensive and costly exercise, which very few institutions world-wide can afford. Therefore, this document concentrates solely on measures that most libraries can take to prevent and slow down the rate of deterioration of their collections.

INTRODUCTION

What are the main threats to library material?

- The nature of the material itself
- Natural and man-made disasters
- The environment in which it is kept
- The way material is handled

Traditional library collections contain a wide range of organic materials, including paper, cloth, animal skins, and adhesives. Such organic substances undergo a continual and inevitable natural ageing process. While measures can be taken to slow this deterioration by careful handling and providing a sympathetic environment, it is impossible to halt it altogether.

The chemical and physical stability of library material also depends on the quality and processing of the raw products used in their manufacture together with the design and construction of the final artefact.

Over the centuries, the pressures of mass production have reduced the material quality of what is received in libraries. Much of the paper stock manufactured after 1850 is highly acidic, is becoming brittle, and will self-destruct in time. Binding techniques have been abbreviated for the sake of automation and many text-blocks are now held together solely by adhesive. In fact, all books and, in particular, leather bindings, are far more susceptible to damage than most people appreciate.

Modern media such as microforms, optical and magnetic disks, digital formats, photographs, and audio and visual media, all have inherent preservation problems and need to be stored and used carefully if they are not to perish prematurely.

It is commonly difficult to accept is that a large amount of library material is reaching the end of its natural life, and the few years that it has left can only be prolonged by careful handling and storage.

Why preserve?

- The type of library and how it is used reflect the preservation needs of its collections. The preservation requirements of a local public lending library are obviously different from those of a national library. However, both are obliged to maintain and keep accessible their collections, whether for a few years or indefinitely.
- Economically, libraries cannot afford to let their holdings wear out prematurely. Replacing library material, even when possible, is expensive. Preservation makes good economic sense.
- It cannot be easily predicted what will be of interest to researchers in the future. Preserving current collections is the best way to serve future users.
- Responsible and professional library staff should be committed to caring for and preserving the material with which they work.

Who is responsible?

Everyone is responsible. While preservation and conservation specialists can advise and carry out specific activities, it is the duty of all library staff, from the head of the library downwards, to safeguard the welfare of their holdings. Preservation measures have to be endorsed, supported, and encouraged from the most senior level to the most junior in the library.

Those who are responsible for managing the library and maintaining the external and internal fabric of the buildings must liaise closely with those who are responsible for the welfare of the collections. For example, if money has been set aside to rewire and replace the lighting of a building, then the opportunity should be used for ensuring not only that energy-saving lighting is used but also that it meets particular preservation lighting requirements. When plumbing is being installed or replaced, all concerned should be working towards ensuring that risks to the collections are reduced, and not increased by having pipes running through areas where library material is present. In such instances clear communication is the key.

The preservation needs of a library have to be considered in line with the social and political climate in which the organisation operates. The organisation's purpose, collecting policies, and available resources also have to be taken into account. Consequently, preservation policies must be made in consultation with various departments for the following reasons:

- The acquisitions and collecting sections of a library should be prepared to purchase additional copies of heavily used material, like reference works, when the cost of repairing such items is greater than replacing them. It is also necessary to calculate whether surrogate copies (i.e., microform or electronic versions, and the machines to read them) are a more economical and effective way of providing access to heavily used material than 'hard' copy.
- A policy should be agreed with the cataloguing and record-creating activities of the library together with readers' services to direct users to surrogates rather than originals and to the most appropriate copy.
- Departments should plan for sufficient, good-quality accommodation for acquisitions.
- Reading room staff should be kept informed of any restrictions concerning the use of original material and briefed on limitations to photocopying.
- Resources should be provided for training staff on security for themselves and for library material, on how to handle library material correctly, and on how best to pass this knowledge on to users.
- An exhibition policy should be drawn up which ensures that items will not come to harm while on exhibition, whether within the library or on loan to other institutions. Librarians and conservation staff should agree on whether items are fit for display. Adequate support and security, and suitable environmental conditions for material to be exhibited, should be enforced.
- Preservation staff and those responsible for the collections, whatever their level of experience, should not only have some technical and scientific knowledge, but should also be familiar with the history of collections, the material they are made of, and the contents of the documents – so as to be able to understand better the preservation problems. Librarians, library staff at all levels, and students of librarianship should be acquainted with the importance of preservation within a library's overall function and policy.

When purchasing material which is damaged, the cost of its repair should be taken into account and appropriate resources provided.

Where to begin?

Part of the process of formulating a preservation policy is to define whether, and to what extent, the library will acquire and retain material. There can be no general guidance for libraries on what material should be selected for acquisition and future preservation; this will depend on each individual library and its policy.

However, national and regional libraries should cooperate in sharing the responsibilities of what to preserve and retain.

In order to be able to care for its holdings, a library must make a comprehensive and honest assessment of the physical state of the institution, the collections, and their preservation requirements. Moreover, to care for collections with a limited budget and limited resources, it is important that decisions are made on a clear and rational basis. Such an assessment can be done internally, by the library itself, or by independent consultants, whose expertise is established – both have advantages and disadvantages. Consultants are expensive and take up a lot of staff time. However, the final assessment should reveal the stark truth of the facts. An internal assessment will probably be cheaper but might be influenced by staff politics. Unfortunately, it is also usually easier to accept recommendations from a body outside than from within.

Such an undertaking must be a cooperative effort of all the departments and be endorsed at the most senior level. An assessment without authority is likely to be ineffectual. The final report is obviously critical to the success of any 'needs' survey. It should clearly identify the risks to the collections and be realistic in its proposals.

How to begin?

It is important to have a clear idea of the objectives of the study before investigations into the state of the institution and its collections begin. Details on policies, operations and procedures may be found in written documents, the most likely sources will be through interviews with library staff at all levels, observations on how material is cared for and handled by staff and users, and risk assesments on the buildings and collections.

Identifying major and immediate threats to the library's holdings or particular collections should be of primary concern. Such threats will vary for different institutions, from renewing a fire and smoke detection system, through setting up an integrated pest management programme, to moving an important collection of photographs to an area with a more stable environment.

Surveys are a fundamental tool for developing a library's preservation policy. However, while they should be comprehensive, they do not necessarily have to be too detailed. Surveys can often result in enormous amounts of information being accumulated which later become very difficult to put into order and analyse. Short questions and answers are the key to successful surveys. The purposes of four surveys which will help to form the basis of the assessment are summarised below. The ensuing chapters will provide more ideas on what to look out for when planning the surveys.

Building: to identify any security or environmental threats that are posed by the location of the institution; to describe the history and use of the buildings; and to ascertain the condition of the external and internal fabric of the buildings.

Disaster preparedness and response: to describe potential risks – man-made or natural – to the buildings and collections; to review present precautions against these risks; and to examine disaster preparedness and response plans.

Environment: to report on what environmental measures are in place to preserve the collections; what are the good and bad points of these measures; and who is reponsible for maintaining them.

Collection: to ascertain the current condition of the collection and identify potential problems. Describing the type and quantity of items in collections will

help to create a picture of the library's holdings (for example: 300 photographs, 2,000 books or as 'linear metres' – 10 linear metres of manuscript boxes) and age range (for example: 10,000 books pre-1850; 20,000 books 1850–1900; 500,000 books 1900 to present). Further points that need to be covered include:

- what is the overall condition of the collections?
- which collections are in particularly poor condition?
- which collections are most valuable/important?
- which collections are most at risk?
- how fast are the collections growing?
- what direction is collecting likely to take?
- is space available or allocated for future or expanding collections?

Knowing which material is heavily used will help to determine the preservation needs of particular collections. For example, a run of local history journals which is frequently in demand and in poor condition may become a higher microfilming priority than another run of journals which is also in poor condition but not often used.

Other areas, which are highlighted in subsequent chapters, also need to be documented, such as the security of the collections; how material is stored and handled; the condition of storage areas; reading room practice; and level of staff training and expertise.

What to preserve?

Once a preservation needs assessment has been carried out, the next step is to prioritise the recommendations which have been made. Because of both limited resources and the potential scale of the problem it is necessary to be selective in deciding what is to be done in terms of

- securing the fabric of the buildings
- improving environmental control
- improving the storage and handling of the collections.

Such selectivity needs to be an explicit part of a library's policy if its responsibilities towards future users are to be properly undertaken. It is important to understand that selectivity does not preclude adopting an holistic approach to caring for library collections. All library material may not warrant special attention in the way of boxing or being stored in specific environmental conditions, but all should be safeguarded against man-made and natural disasters, theft and mutilation, pest and mould attack, and poor handling practices.

Generally, selecting material for specific preservation processes such as reformatting or boxing is based on common sense. Boxing a collection which is in good condition and not used before attending to a collection which is in poor condition and heavily used is not common sense; neither is reformatting material which has been reformatted by an institution elsewhere.

What are the financial implications?

Almost always, the amount of information held in libraries is greater than the resources available for carrying out their objectives with total success. It is not, and never has been, possible to save everything. A commitment to indefinite or permanent retention involves considerable financial expenditure on accommodation, special storage conditions, and possibly reformatting. Therefore,

decisions have to be made as to what will be collected and preserved.

Every library has a duty to ensure the welfare of its collections for present and future users. There is no avoiding the fact that the maintenance and retention of collections costs money. For too long, libraries have spent a large proportion of their budget on acquisitions. Most libraries have no, or inadequate, funds set aside for preservation purposes. Spending time and resources on preventing damage to library material is almost always cheaper than repairing or replacing it.

No library can afford not to take precautionary measures against fire, flood, theft, and mould and insect infestation, for salvaging material which has suffered from these disasters is extremely expensive in terms of human and financial resources. The consequences of such disruptions are manifold. Serious disasters are often caused by circumstances which could have been avoided at little cost. Prevention is not only better but, more often than not, cheaper than cure.

Caring for library material does not necessarily mean an excessive expenditure of library funds. There are many common-sense and economical solutions to preservation problems. However, all libraries must realise that preserving and maintaining their collections is as important as acquiring them, and that appropriate funds should be allocated accordingly.

Why cooperate and with whom?

It is not simply sufficient for librarians to be aware of their responsibility for the preservation of their collections, although awareness is the first necessity. It is also important to raise awareness among the general public and those who are in a position to fund preservation programmes. Governments must play an active role in ensuring the welfare of a nation's heritage. National preservation offices, financially supported either by government or private funding, are essential if a country's written heritage, in whatever format, is to survive. These establishments should be in a position to encourage all libraries and institutions to adopt sound preservation policies. Very useful services, such as supplying literature on disaster planning, photocopying, or security matters on request are not enough. Active training and education should also be provided.

Furthermore, national preservation offices can sometimes be appropriate bodies for coordinating retention policies on a national scale. There is also the potential for them to be the political mouthpiece for libraries on issues like the mandatory use of permanent paper in publishing. Enlightening the general public through poster campaigns in schools and public libraries about the respect for and care of library material is another useful responsibility that can be assumed by national preservation offices.

If a nation's heritage is to survive, then the coordination of national, regional, consortial, and institutional preservation programmes is essential. It is unrealistic to expect libraries and archives to address individually and resolve successfully the technical and financial problems associated with preservation on a national level. For instance, in 1996 IFLA and ICA established the Joint IFLA – ICA Committee for Preservation in Africa (JICPA) to raise awareness of preservation issues and coordinate activities in the region.

Libraries should cooperate not only with archives but also with museums and galleries. Considerable savings can be made and duplication of effort avoided by institutions consulting with each other over areas such as environmental control, building and collection evaluation, and disaster preparedness and recovery plans.

SECURITY AND DISASTER PLANNING

SECURITY

It is the responsibility of the library manager to intitiate, coordinate, and implement the development of a security policy within the library. When drafting such a policy other libraries, police, and staff should be consulted.

As part of the building survey, all areas of security should be noted and shortcomings addressed as soon as possible.

Securing perimeters and buildings

- Library perimeters and grounds should be kept tidy.
- Building exteriors should be assessed for ease of access by criminals. An alarm and closed-circuit television system should be seriously considered. All areas should be well-lit.
- Close attention should be paid to doors and windows in respect of locks, security glass, or film.
- The interior of the building should be kept tidy. It will present an image of care and supervision which will deter the potential criminal.
- All entry/exit points and routes should be kept separate if possible and staffed at all times.
- Any staff areas should be locked when not in use.
- Expensive equipment should be chained or bolted down and marked with security markings.
- All contractors should sign in and out of the library and wear passes at all times.
- The need for an alert attitude should be instilled in staff.
- All storage areas should be kept secure and clear policy guidelines provided on who has access to what areas.
- Specific measures, like the use of vaults, should be taken for the security of rare/valuable material.

Preventing criminal and anti-social behaviour

Criminal and anti-social behaviour ranges from the rowdy visitor to the determined thief. Staff, books, equipment, and personal property are all at risk. Starting-points in deterring criminal and anti-social behaviour include:

- having a calm and ordered library
- creating an environment which the genuine reader regards as helpful and efficient, but in which the villain feels anxious and wary
- having prominent notices which clearly define what is unacceptable behaviour
- training staff in how to deal with an awkward or aggressive user or a suspected book thief.

Security in reading areas

Points to consider:

- how are loose items issued and how are they checked on return?
- how well are reading areas invigilated?
- are security devices in place?
- are bags allowed in these areas and are they checked on exit?

Security of library material

All library material should be stamped in a way that clearly identifies it as belonging to a particular institution. Library stamps should be fast-drying, non-fading, stable, and indelible. Security tagging systems, if present, should be regularly inspected.

Emergency information booklet

It is useful for all staff to have easy access to an emergency information booklet which lists only the immediate steps to be taken, key personnel, and how they can be contacted in the event of:

- accidents to staff and visitors
- vandalism, theft, and assault
- incidents like power failures, lift failures, loss of security keys
- emergencies which threaten the welfare of people, the collections, and the fabric of the buildings – e.g. bomb threats
- hurricane, earthquake, and flood warnings.

DISASTER PLANNING

It is vital for any library, no matter what its size, to take every precaution possible to prevent the occurrence of an avoidable disaster. Of equal importance is having measures in place to cope with the consequences of disasters, whether they be natural or man-made.

Natural	*Man-made*
Hurricanes	Acts of war and terrorism
Floods	Fires
Earthquakes	Water (broken pipes, leaking roofs, etc.)
Volcanic eruptions	Explosions
Sandstorms	

Make sure the plan is written clearly and understood by everyone likely to be involved. Update it regularly and store copies on- and off-site.

Numerous resources have been published to aid institutions in implementing disaster avoidance measures and formulating a disaster response and salvage plan. Only the key points are listed here. It should be mandatory for every library to have a written plan in which all these elements are fully developed.

A 'phased' approach can be used in disaster preparedness (as it can in preservation activities in general). That is, it is acceptable, as a first phase, to begin with a few sections (even in outline form), particularly if the institution focuses first on those issues that are of greatest concern. In a subsequent phase, the planners can gradually add more detail and other sections as they become better educated, have time to pursue the plan, and are able to develop consensus on how the institution should organize its preparedness activities.

Disaster planning usually involves five phases:

- Risk assessment — ascertaining the dangers to the building and its collections
- Prevention — implementing measures which will remove or reduce any danger

- Preparedness — developing a written preparedness, response, and recovery plan
- Response — procedures to follow when disaster strikes
- Recovery — restoring the disaster site and damaged material to a stable and usable condition.

Risk assessment

Try to identify any external and internal threats that might cause problems for the collections and assess any shortcomings of disaster prevention measures which are already in place. Consulting with fire departments will help to find any potential hazards which are not immediately obvious.

Identifying external environmental threats

- Describe the district where the collections are housed (residential, industrial, shopping centre, rural, recreational).
- Are there any major industrial or natural hazards very close to where the collections are housed (airport, railroad/motorway, natural waterways such as the ocean, lakes, rivers, natural vegetation or bushland, other buildings)?
- What are the immediate surroundings or perimeters to the building (fences and gates, natural barriers such as rivers, lakes, ocean front, dark corners, overhangs, areas providing cover)?
- Are the surroundings secure (regular patrols, effective lighting, gates secured and access controlled, separate access for staff and visitors/users)?
- Is pollution (dust, gaseous pollutants) from factories, traffic, or the environment a problem?
- How safe is the building from fire and flood – are there hazards in the vicinity, either natural as in woodland and river or man-made, as in petrochemical plants?
- Have any major incidents or disasters occurred in the past five years (bomb threats and bombing, civil disturbances, riots, wars, natural disasters – flood, earthquake, fire, dust storm, vandalism)?

Identifying internal environmental threats

- What materials are used in the structure of the building?
- Is the external and internal fabric of the building fire-resistant?
- Are there fire-resistant walls separating parts of the building and are there fire-resistant doors?
- Are collections stored at a safe distance from plumbing, electrical and mechanical installations – water pipes, radiators, air conditioning, kitchens, laboratories?
- Is the area where collections are stored susceptible to leaks or flooding?
- Is smoking allowed in any areas?
- Are large amounts of flammable material (like chemicals in laboratories) other than books stored on site?

Assessing current preventive measures

- Has the building a smoke, fire or water detection system?
- Is there an automatic fire extinguishing system in the area?
- What sort of manual fire fighting systems are in the area (extinguishers – water, foam, CO_2, fire hoses etc.)?
- Are the fire detection and/or extinguishing systems inspected regularly?
- Does the building have lightning conductors?
- Are special precautions taken when potentially dangerous activities are undertaken, such as rewiring and refurbishing of the internal and external fabric of the building?
- Is the building security system (if there is one) connected to fire/police departments?
- Does a written disaster preparedness and response plan exist for the library?

  Elements it should contain: description of emergency procedures; disaster response outline; emergency supplies list; recovery priorities; conservation experts; supplies stored off-site; list of staff volunteers; other.
- Are staff trained in emergency response procedures (delegated officer-in-charge, regular training, emergency evacuations)?
- Is computer data backed up daily?
- Are manually accessed catalogues, registration and accession records duplicated and stored off-site?
- Are electronic catalogues and records duplicated and stored off-site?

Prevention

Once the risks have been assessed, take all the necessary precautions to make the library buildings and their holdings secure. Consult with the emergency services (fire, police, and hospital).

Fire alarm systems

All parts of the building should be provided with a fire and smoke detection system, which simultaneously alerts occupants and the local fire brigade. Smoke detection equipment can provide early warning of a developing fire, thereby giving an opportunity of manual suppression prior to the activation of a sprinkler system.

Manually operated fire-alarm call points, which can be used by occupants to indicate the presence of fire or smoke, should also be present throughout the building.

Manual extinguishing systems

If an automatic fire extinguishing system is not present, the following should be installed:

- Hose reels or racks so as to ensure that all parts of the building are within 6 m of the nozzle of a fully extended hose.
- Hydrant systems or rising mains on all buildings more than 30 m in height or where a single floor exceeds 1000 m^2.

- The hydrant or rising mains should be located so as to permit the fire brigade to pressurise the pipework from outside the building.
- Portable fire extinguishers should always be available, even if an automatic fire suppression system has been installed. There should be a suitable number of hand-held extinguishers (CO_2, water, or foam according to the likely cause of fire, i.e., electrical or chemical) strategically placed.

Automatic extinguishing systems

Consideration should be given to the benefits offered by an automatic fire extinguishing system.

- A CO_2 gas system is only suitable for smaller compartments, i.e., spaces which can be made airtight and which are not normally occupied by people.
- Halon gas systems are no longer produced as they are environmentally damaging, particularly toward the earth's protective ozone layer.
- Wet-pipe sprinkler systems are a reliable and safe extinguishing method and are relatively easy to maintain. Contrary to popular belief, the activation of one sprinkler does not cause all sprinklers to operate; and so danger of accidental discharge should not be over-estimated. The average sprinkler discharges 15–20 gallons per minute (90 litres per minute) while typical fire hoses release 120–250 gallons per minute (540–1125 litres per minute). It is important to remember that the environmental and human safety aspects of water are known, unlike the possible impact from various chemical agents. Furthermore, the recovery techniques for water-damaged material are also known.
- Dry-pipe sprinkler systems are essentially the same as wet-pipe systems except that the pipes in the protected area contain pressurized air. When the sprinkler is activated a valve opens allowing water to flow into the pipes. This lessens any threat of water leaking into collection areas.
- Micromist systems are being developed which discharge limited quantities of water at very high pressures, resulting in exceptionally efficient cooling and rapid fire control with significantly little water. Tests have proved that water saturation, often associated with standard firefighting procedures, is avoided. Other anticipated benefits include: lower installation costs, minimal aesthetic impact, and known environmental safety.

If water-based fire protection systems, such as sprinklers, are to be installed, provision should be made for rapid drainage.

Routine maintenance

Fire alarms and suppression systems, the building fabric, plumbing, electric, and gas supplies and fittings, etc., should be maintained and routinely tested. All reports should be kept and any maintenance work documented.

Preparedness

The following should be prepared, reviewed, and updated regularly:

- Building floor plans which indicate storage areas, windows, entrances, and exits; fire extinguishers; fire alarms; sprinklers; smoke/fire detectors; water, gas, and heating pipes; elevator controls; electrical and water supply and cut-off points.

- Priority rescue lists made by departments, stating which items are to be salvaged from individual rooms. The fire services may allow entry into a building for salvage purposes for a limited time, and it is essential to know what items are to be saved and where they are located.
- Selecting and training an emergency response team comprising voluntary members of staff who live near the library. The team should be rehearsed in removing material and confident in making decisions about salvage techniques. It is essential for them to have participated in disaster workshops, where a disaster site is simulated and techniques can be practised.
- Detailed, step-by-step instructions on all phases of salvage operation, covering a range of incidents that are possible (e.g., roof/plumbing leaks, flooding, and fire) and the various media included in the collections, such as books and journals, manuscripts/records, coated vs. uncoated stock, sound recordings, photographic media, computer/electronic media, etc.
- Instructions for long-term rehabilitation: procedures for activities including identification and labelling, smoke/soot removal, cleaning, sorting and rehousing, repair and rebinding, etc.
- A list of external contacts and names, addresses, and home and work telephone numbers of personnel with emergency responsibilities.
- Areas which could be used for recording and packing material.
- Locations for temporarily rehousing staff and material.
- Contracts with local freezer services.
- Contracts with vacuum-drying services.
- Arrangements with transportation services.
- Supplies for transporting, cleaning, and sorting material.
- Record-keeping forms: multiple copies of all forms that may be needed in the salvage operation, including inventory forms, packing lists, requisitions, and purchase orders, etc.
- Accounting information: description of institutional funds available in a recovery effort and procedures/authorization for access to them.
- Insurance information: explanations of coverage, claim procedures, record-keeping requirements, restrictions on staff/volunteers entering a disaster area, and information on state/federal disaster relief procedures.

Response

- Follow established emergency procedures for raising the alarm, evacuating personnel, and making the disaster site safe.
- Contact the leader of the disaster response team to brief and direct the emergency response team.
- When permission is given to re-enter the site, make a preliminary assessment of the extent of the damage, the equipment, supplies, and services required.
- Correct the environment, if necessary, to prevent mould growth.
- Photograph damaged material for insurance claim purposes.

- Set up an area for recording and packing material which requires freezing, and an area for air-drying slightly wet material and other minor treatments.
- Transport water-damaged items to the nearest available freezing facility.

Drying wet material

As part of the preparation for a disaster plan it is essential to be familiar with the various procedures for drying different types of library material. The following drying methods all have advantages and disadvantages:

- Air-drying
- Dehumidification
- Freeze-drying
- Vacuum thermal-drying
- Vacuum freeze-drying

If time must be taken to make critical decisions, books and records should be frozen to reduce physical distortion and biological contamination.

Air-drying

Air-drying is the simplest technique for drying damp – not totally wet – material. A damp book can be stood on its end and its pages fanned out or interleaved with blotting paper. Although this is an effective technique which does not require expensive equipment or materials (fans and interleaving paper), it is labour-intensive, time-consuming, and generally results in some dimensional distortion.

Recovery

- Determine priorites for conservation work. Consult with conservators as to the most appropriate methods for cleaning and repairing material. Obtain cost estimates.
- Develop a phased conservation programme when large quantities of material are involved.
- Select items to be discarded, replaced, or rebound from those justifying special conservation treatment.
- Clean and rehabilitate the disaster site.
- Replace treated material in the refurbished site.
- Analyse the disaster and improve the plan in light of the experience.

It is worth liaising with local and district authorities/councils about the availability of temporary storage facilities and other services they may be able to provide. Cooperating with other libraries, museums, and galleries in the area can save time, money, and resources.

ENVIRONMENT

The environmental factors of temperature, humidity, light, and atmospheric and particulate pollutants can all cause degradation reactions. The chemical, mechanical, and biological nature of these reactions may vary for different materials.

Relative humidity (RH)

Relative humidity (RH) can be expressed as the ratio (in percent) of vapour pressure in a sample of moist air to the saturation vapour pressure at the same temperature.

Relative humidity is a difficult concept to comprehend and therefore warrants explanation.

If the water vapour in one cubic metre of air, at normal atmospheric pressure, was extracted and weighed, the **absolute humidity** of the sample of air would be known and expressed as grams of water per cubic metre of air (g/m^3).

The hygrometric chart below shows the maximum amount of water vapour a cubic metre of air can hold at certain temperatures. As air temperature increases, the amount of water vapour air can hold increases as well.

At 10 °C (50 °F) air can hold no more than 9 grams of water vapour. The air is at its maximum absolute humidity and is said to be **saturated**. At 20 °C (68 °F) the saturation point is 17 g/m^3.

Therefore, if a cubic metre of air in a closed container at 20 °C (68 °F) contains 9 grams of water vapour, the absolute humidity is 9 g/m^3. If 3 grams of water is added to the container, it will evaporate and increase the absolute humidity to 12 g/m^3. If another 8 grams of water is added, 5 grams will evaporate and 3 grams will remain as a puddle on the bottom of the container because air at 20 °C (68 °F) can only hold 17 g/m^3.

The **relative humidity** of the air in the container when only 9 grams of water vapour was present would have been:

$$\frac{\text{absolute humidity of sample air}}{\text{absolute humidity of saturated air}} = \frac{9}{17} = 0.53, \text{ or } 53\%$$

RH is temperature-dependent. If no additional moisture is added to the air, as the temperature increases, the RH decreases.

So, if the air in the container is warmed to 25 °C (77 °F) – the hygrometric chart shows that at this temperature one cubic metre of air can hold 23 grams of water vapour – the RH would decrease.

$$\frac{9}{23} = 0.39, \text{ or } 39\%$$

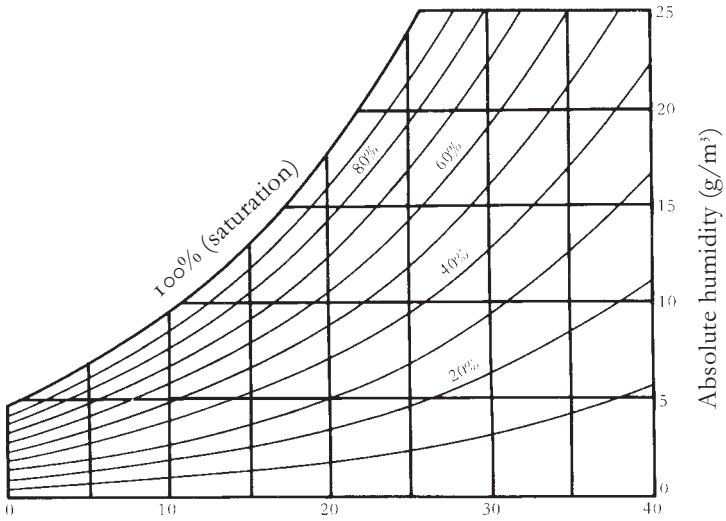
Conversely, if the air in the container is cooled to 15 °C, the RH will rise, even if no more water is added. At 15 °C the air can only hold 12.5 g/m^3 of water vapour:

$$\frac{9}{12.5} = 0.72, \text{ or } 72\%$$

If the air were cooled to 9 °C (48 °F), it would become saturated with water vapour, and the RH would rise to 100%. If the air were cooled any further, droplets would form on the side of the container because the air must give up some of its

moisture as condensation. The temperature at which condensation first occurs (the temperature at which the air reaches saturation) is called the **dew point**.

Indoors, in winter, the room air circulates to window panes, which are often cold enough to cool the air below its dew point. Drops of water then appear on the windows.



Temperature and relative humidity

The following statements need to be kept in mind whenever temperature and relative humidity are an issue.

There is no one ideal level for all types of library material – only values and ranges that minimize specific types of change in materials and objects.

- The first point that needs to be understood about temperature and relative humidity is that there is no one ideal level for all types of library material – only values and ranges that minimize specific types of change in materials and objects. A temperature or humidity that is acceptable for one object may be disastrous for another. For example, photographic film, magnetic recordings, and digital carriers require low storage temperatures and relative humidity levels if their longevity is to be ensured; whereas parchment and vellum items require an RH higher than 50% if they are to retain their flexibility.
- There is extensive scientific evidence to suggest that paper will retain its chemical stability and physical appearance for longer at a **constant**, low storage temperature (below 10 °C / 50 °F)) and relative humidity (30–40%).
- However, while the paper text-block in a leather or vellum binding may benefit from being kept at a low RH, the binding itself will inevitably suffer. Leather and vellum need an RH of at least 50% if they are to continue to operate mechanically. The argument of

  chemical *versus* mechanical damage

  or

  content *versus* artefact

  has to be carefully considered when deciding what temperature and relative humidity ranges will have the most benefit for particular collections.

Chemical reactions increase in organic materials when humidity and temperature rise. While moisture can catalyse chemical reactions, increases in temperature will accelerate the rate of these reactions.

The effects of temperature

- It has been frequently stated that for every 10 °C (18 °F) rise in temperature, the rate of chemical degradation reactions in traditional library and archive material, such as paper and books, is doubled. Conversely for every 10 °C (18 °F) drop the rate is halved.
- Heat coupled with low relative humidity will eventually lead to desiccation and embrittlement of certain materials – leather, parchment/vellum, paper, adhesives, the adhesive binders on audio and video cassettes, etc.
- Heat together with high relative humidity encourages mould growth and creates an environment conducive to pests and insects.
- Cold (less than 10 °C /50 °F) together with high relative humidity and poor air circulation will lead to dampness and eventually mould growth.

The effects of relative humidity

Organic matter is hygroscopic. It gains and loses water with increases and decreases in RH. Consequently, materials expand and contract as moisture levels rise and fall.

- An RH of 55–65% minimizes mechanical damage as materials retain their flexibility.
- A sustained RH above 65% can eventually cause adhesives in both modern and traditional library material to soften and lose their adhesive strength.
- Above 70% RH, biological attack is a serious probability even if temperatures are low. In areas of poor air circulation RH should not exceed 60%; and even when air circulation is good RH should not exceed 65% in order to avoid mould growth.
- A low RH (less than 40%) minimizes chemical change but can cause materials to shrink, stiffen, crack, and become brittle.

The effects of fluctuating temperature and relative humidity

Severe fluctuations or 'cycling' of temperature and relative humidity will cause more damage than constantly high readings and so must be avoided.

- As has been stated, if the water content of a room is fixed, a sudden lowering of temperature will cause a rapid rise in the relative humidity, leading to condensation and possibly resulting in mould and other problems excess moisture causes.
- Moderate changes over a long period of time produce minimal stress in materials that are free to expand and contract.
- Fluctuations of temperature and relative humidity affect the dimensions and mechanical properties of organic materials and can lead to damage if they occur over a short period of time.
- Visible damage can take the form of flaking inks, warped covers on books, and cracked emulsion on photographs.

Measuring and recording temperature and relative humidity

Environmental conditions in all areas should be adequately monitored and recorded with reliable and regularly maintained thermohygrographic or electronic recording equipment. Monitoring is very important because it documents existing environmental conditions; supports requests to install environmental controls;

and indicates whether any climate-control equipment present is operating properly and producing the desired conditions.

When monitoring equipment indicates notable changes in environmental conditions, reports should be given to authorities so that appropriate measures are taken immediately.

Recommended levels of temperature and relative humidity

- In general, library material should be stored and used in stable conditions which are not too hot, not too dry, and not too damp.
- Many attempts have been made to provide 'ideal' figures for temperature and relative humidity levels. However, it is now recognised that it is probably impractical and unrealistic to maintain a building or stack temperature at one setting throughout the year, especially in areas with extreme temperature variations, without incurring huge costs.
- If temperatures do rise above 20 °C (72 °F) it is vital that relative humidity levels do not rise or fall beyond acceptable levels.
- In institutions, temperatures are often dictated by what is deemed suitable for human comfort, around 20–22 °C (68–72 °F) for sedentary activities. Human beings are sensitive to changes in temperature but relatively insensitive to changes in humidity, while the opposite is true for most library material.

Setting relative humidity levels is always a compromise and is largely influenced by several factors:

- the nature of the collections
- local climatic conditions
- resources available to control the environment.

Taking into account these factors the following parameters should be observed:

- a level of moisture high enough to maintain flexibility
- a level low enough to slow deterioration of materials and control insects and mould
- a level that will do no structural harm to library buildings due to condensation in cold weather.

The influence of local climatic conditions on relative humidity

- In humid parts of the world, where relative humidity does not fall below 65% all year round and is much higher for long periods, it is unrealistic to expect a level much below 65%, unless the institution is air-conditioned day and night all the year round at great cost. In these regions good air circulation is imperative if mould is to be discouraged.
- In arid areas, where RH rarely rises above 45%, maintaining a level between 40–45% is all that can really be expected, unless great expense is incurred. Once again the key is to avoid fluctuations, to cool the air, and to keep certain materials like parchment and leather in an area where RH can ideally be maintained at no lower than 45%.
- Temperate regions with warm summers and cold winters often fare far worse

If the temperature in storage areas is considerably lower than rooms where material is used, then it is essential to allow the material to acclimatize in an intermediary space to prevent any possibility of condensation or distortion.

than arid or humid areas. The RH in summer may be acceptable, but in winter, when central heating is used, it is often hot and dry during the day, and at night, if the heating goes off, it becomes cold and damp. Such fluctuations do far more damage than a constant high or low RH all the year round.

- In northern parts of America, Canada, and northeast Europe, maintaining 50% RH in winter without condensation is extremely difficult. Some institutions acclimatize their collections seasonally by gradually reducing levels of RH towards winter and increasing them towards summer.

Atmospheric and particulate pollution

Air pollution is to a large extent associated with towns and industry and is another cause of damage to paper and other organic materials. Air pollutants vary greatly in nature, from gases to particulates such as dirt and dust.

Gaseous pollutants

Gaseous pollution is caused overwhelmingly by the burning of fuels. Pollutants such as sulphur dioxide, hydrogen sulphide, and nitrogen dioxide combine with moisture in the air to form acids that attack and damage library material. Ozone is a powerful oxidant which severely damages all organic materials. It is a product of the combination of sunlight and nitrogen dioxide from automobile exhaust; it may also be produced by electrostatic filtering systems used in some air conditioners, as well as by electrostatic photocopy machines.

Smoking, cooking, and off-gassing from unstable materials (cellulose nitrate film, paint finishes, fire-retardant coatings, and adhesives) may also produce harmful gaseous pollutants. Wood, particularly oak, birch and beech, emit acetic and other acids, and vulcanized rubber releases volatile sulphides that are especially damaging to photographs.

The composition of all equipment, materials, and finishes used for the storage, transport, and display of objects should be tested by recognised methods to ascertain whether they are likely to produce harmful emissions.

Particulate pollutants

Particulate pollutants, such as soot, dirt, and dust abrade, soil, and disfigure materials. Dust and dirt that have absorbed gaseous pollutants from the air become sites for harmful chemical reactions when they settle on library material. Particulate pollutants can also aid mould growth. Modern library material, such as magnetic and optical media, are very sensitive to dust and dirt.

Dust is commonly a mixture of fragments of human skin, minute particles of mineral or plant material, textile fibres, industrial smoke, grease from fingerprints, and other organic and inorganic materials. There are often salts such as sodium chloride (carried in from sea spray or on skin fragments) and sharp gritty silica crystals. In this chemical mixture are the spores of countless moulds, fungi, and micro-organisms which live on the organic material in the dust (fingerprints, for example, serve as good culture media). Much of the dirt is hygroscopic (water-attracting), and this tendency can encourage the growth of moulds, as well as increase the corrosiveness of salts, hydrolysis, and the release of acids.

Light

Light is energy and energy is required for chemical reactions to take place. All wavelengths of light – visible, infrared, and ultraviolet (UV) – promote the chemical decomposition of organic materials through oxidation. Higher-energy ultraviolet is the most harmful. However, light in all its forms, especially in the presence of atmospheric pollutants, leads to a weakening and embrittlement of cellulose, adhesives, cloth, and skin materials. Light can cause some papers to bleach and others to yellow or darken; it can also cause media and dyes to fade or change colour, altering the legibility and appearance of documents, photographs, art works, and bindings. The following factors concerning light should be known by all those responsible for preserving library material:

Light levels must be kept as low as practically possible in storage, reading, and display areas.

- Chemical reactions initiated by exposure to light continue even after the light source is removed and materials are put into dark storage.
- Light damage is irreversible.
- The effect of light is cumulative. The same amount of damage will result from exposure to a strong light for a short time as to a weak light for a long time. 100 lux (the unit of measure of illuminance) on a picture for 5 hours gives it an exposure of 500 lux-hours, equivalent to 50 lux for 10 hours.
- Visible and infrared light sources, such as the sun and incandescent light bulbs, generate heat. An increase in temperature accelerates chemical reactions and affects relative humidity.
- Daylight has the highest proportion of UV radiation and therefore must be filtered.

Types of lighting

- **Incandescent** lamps are the most familiar type of electric light source. Light is produced by passing an electric current through a thin tungsten wire filament. Incandescent lamps usually have less harmful UV radiation output than fluorescent lighting, but they generate more heat through infrared radiation. Tungsten incandescent lights also burn less efficiently and must be replaced more often than fluorescent lights.

Fluorescent light tubes should be fitted with UV filter sleeves; these sleeves are effective only for a few years and so should be checked periodically.

- **Tungsten-halogen** lamps (also known as quartz halogen or just halogen lamps) also produce light by passing an electric current through a thin tungsten wire filament but with the addition of a halogen gas in the bulb, which enables the filament to operate at higher temperatures yielding a 'whiter', more efficient light source. Halogen lamps have three to five times the life and UV output of tungsten incandescent lights.
- **Fluorescent** lamps are low-pressure mercury discharge lamps which produce UV radiation which in turn excites a phosphor coating that emits visible light. The use of different phosphors is responsible for the various colour characteristics these lamps exhibit. Although fluorescent lighting is high in ultraviolet content, it is usually installed in libraries because it generates less heat and is more economical to operate.

Measuring light and UV levels

It is necessary to measure and record light and UV levels at different times of the year, as readings will change with the seasons.

A light meter or lux meter measures the intensity of visible light in lux (lumens per square metre). A camera with a built-in light meter can also be used to measure light levels indirectly.

A UV meter measures the amount of UV radiation (wavelengths less than 400 nanometers) in units of microwatts of UV radiation per lumen.

Recommended light levels

When storage areas are not in use it should be mandatory to switch off lights.

Lighting in museums, galleries, and exhibition rooms is usually left to specialists. This should also be the case for library reading rooms and storage areas. While 200–300 lux are acceptable levels for reading rooms, attaining such levels with a combination of natural and artificial light, which satisfy staff and researchers, is difficult.

In stack and storage areas 50–200 lux is sufficient. However, to achieve these levels it would be necessary to exclude all natural light and rely entirely on artificial lighting.

Light sources with ultraviolet radiation emissions above 75 microwatts per lumen require filtering.

Light levels for material on display

In exhibition situations, the light level falling on the surface of objects on display must be kept low. No more than 50–70 lux during an eight-hour day for a maximum of 60–90 days, is often recommended for light-sensitive materials like coloured paper, newsprint, and certain bindings (e.g. textile bindings), and media like manuscript ink and watercolours.

Mould

The spores of fungi that become mould are always present in the air and on objects and will grow wherever conditions are favourable. In general, moisture (above 65% RH), darkness, and poor air circulation are ideal conditions. Warmth is a factor, but certain moulds and bacteria will thrive in cold temperatures too (think of what can happen in a refrigerator).

Mould can weaken, stain, and disfigure paper and photographic material. It is generaly recognised that 'foxing' may be attributable to mould reacting with trace elements in paper. Cloth, leather, vellum, and certain adhesives are also affected by mould.

Attending to an infestation

- Mould can be checked to see whether it is active or inactive. Generally, active mould is damp, slimy, and smears if touched. Inactive mould is dry and powdery and can be brushed off with a soft brush.
- If mould is discovered in large portions of a collection, isolate the area immediately and do not attempt to clean up without first consulting a mycologist to determine if toxic moulds are present. Certain moulds commonly found in libraries can pose serious health risks, causing headaches, nausea, eye and skin irritation, and respiratory problems.

- A conservator may have to be employed or at least consulted on the treatment of infested items and on the return of the affected area to a suitable condition for housing material.
- If only a few items are affected, place them in a dry paper-based box until treatment. If possible, include a desiccant, such as conditioned silica gel packets. This enclosure will prevent spores from circulating, but will not encourage the growth potentially created by the tightly sealed microclimate of a plastic bag.
- Alternatively, move the affected material to a clean area with relative humidity below 45%, separate from the rest of the collection, and allow them to dry.
- If immediate drying is not possible, or if many objects are wet, freeze them; later they can be thawed, dried, and cleaned in small batches. Material may also be freeze-dried and then cleaned.
- When dry, the items should be cleaned and stored under suitable environmental conditions. The storage environment is critical since even after cleaning, fungal residue will be present.

Cleaning infested material

- If the outbreak is small, and equipment limited, take the items outside – well away from the building – on a calm, mild day and brush them off with a soft white brush, away from you and downwind.
- Remove mould only with a vacuum cleaner that contains an HEPA (high efficiency particulate air) filter capable of retaining 99.97% of all particles down to 0.3 microns. Conventional vacuum cleaners have drawbacks: often the suction is too strong; as the bag fills up the efficiency decreases; the exhaust can be contaminated with fine particles not trapped by the bag, therefore redistributing them around the room. An HEPA vacuum cleaner is an effective way to remove mould because it does not spread the spores around. Vacuum cleaners designed to filter air through water are unsuitable for capturing mould's small particles. Even if a fungicide is present in the water, this will not prevent particles of mould from being discharged back into the air.

Always wear disposable gloves, a respirator, and protective clothing when handling mould-affected items.

While certain treatments can kill mould that is active, they are far less effective with dormant spores, which are protected by relatively impervious cell walls. Proper conditions will insure that dormant fungi remain inactive and will prevent germination of accidentally introduced active spores. If the environment is favorable to fungal activity, mould will grow. Even if complete eradication were possible, it would not be a permanent solution in storage spaces without climate controls. More spores are always being introduced and would sooner or later become a problem.

The most important thing in mould control is controlling the environment.

- If it is not possible to remove mould outdoors, work in front of a fan, with the fan blowing contaminated air out a window, or work in a ventilation hood. Make sure the ventilation hood uses a filter that traps mould. Be sure to remove the mould in an area well away from collection storage and other people. Close off the room. If the building has central/mechanical air circulation, block the uptake vents so that spores are not spread through the building via the air-handling system. Take care when disposing of solid cleaning materials such as vacuum cleaner bags or filters. These should be sealed in plastic bags and

removed from the building.

- To remove inactive mould from paper or books, use a multiple-filter vacuum cleaner (see above). Small brushes and nozzles used for cleaning computers are useful for this purpose. Papers can be vacuum cleaned through a plastic screen held down with weights. A brush attachment should be used for books. Covering the nozzle or brush with cheesecloth or screening will guard against loss of detached pieces. Remember active mould is soft and subject to smearing, and is easily rubbed into porous materials such as paper or cloth.
- Active mould is best removed from valuable artifacts with a small low-pressure vacuum cleaner. This delicate work is best done by a conservator.
- When fungal growth is visible on art objects or valuable items, it should be removed by a conservator. Staining caused by mould can often be removed or at least lightened. This is an expensive procedure and therefore most suitable for objects of significant value.

Treating an infested area

Fumigation is no longer recommended for mould because fumigants are toxic to people, the residue remains on the object, and it does not prevent the mould from returning.

- It is important to find out what caused the mould outbreak in the first place.
- The room where a mould outbreak occurrs must be dried and thoroughly cleaned before the affected material can be returned to it. For moderate to large mould outbreaks contact a professional service that provides dehumidification or cleaning of the premises.
- If the RH is above 55%, it must be lowered before the collection is returned to the area. Adjusting the HVAC system or adding a portable dehumidifier may be all that is necessary. Also check for leaks or water condensation on outside walls. Inspect the heat-exchange coils in the heating/air-conditioning system, a notorious breeding ground for fungi, and clean them with a household disinfectant.
- Vacuum clean the shelves and floor with an HEPA vacuum cleaner, then clean them with a household disinfectant. Before returning the cleaned material to the area, monitor the RH for several weeks to make certain it does not exceed 55%.
- After the items are returned, check daily for new mould outbreaks.

Preventing mould outbreaks

- Check new collections or shipments for the presence of mould.
- Maintain moderate temperature and relative humidity (below 20 °C / 68 °F and 65% RH).
- Circulate air.
- Vacuum clean regularly.
- Do not shelve books directly against an outside wall. Owing to temperature and humidity differences between inside and outside environments, moisture may develop along walls. Allowing air to circulate against the walls will enable the moisture to evaporate.
- Do not allow plants into the building.
- Waterproof basements and walls below ground level.
- Place or adjust outside gutters and drains so that water does not collect near the outside walls. Check gutters and drains regularly to avoid obstructions.

- Place lawn sprinkler systems so that they do not soak outside walls.
- Regularly inspect collections for mould so that any infestation is detected before it becomes serious.

Insects and pests

Insects

Insects which most commonly cause damage in libraries and archives throughout the world are cockroaches, silverfish, book-lice, beetles and termites.

- They feed on organic substances such as paper, pastes, glues, gelatine sizing, leather, and bookcloth; birds nests are also a major source of food for insects, and bird droppings are corrosive.
- They prefer warm, dark, damp, dirty, and poorly ventilated conditions.
- Their damage is usually irreversible – text and images lost by insects eating and boring through paper and photographs cannot be replaced.
- Termites can devastate buildings and collections.

Pests

Rodents such as rats and mice can devastate collections:

- They will destroy books in order to obtain paper for their nests.
- They can cause fires by gnawing through electrical insulation.
- They will pare their teeth on library furniture and fittings.
- Their droppings are corrosive and can leave permanent stains.

Treating infested material

- Always look for the least toxic alternative. For example, when faced with a box of books with silverfish, avoid chemical treatments and simply hand-clean the volumes using a vacuum cleaner and a soft brush. When uncertain if pests are active, clean the item, bag it, and examine it later for signs of fresh activity. Be sure to segregate collections from new accessions or items with possible pest problems.
- The least toxic approach is not only the environmentally friendly approach, but for many collections it is the only responsible approach:

  Most fumigants will likely affect the long-term preservation of at least some materials.

  There is no one fumigant which is known to be safe for all collections.

  Collections may be damaged through contact with the water- or oil-based spray.

  Fumigation offers collections no resistance to future pest attack.
- It is essential that after treatment, steps are taken to prevent any new infestation from being introduced. This will probably mean segregating new (and possibly infested) collections, strictly isolating collections with any signs of pest activity, cleaning, and improving storage conditions.

Some institutions have selected freezing as an alternative to chemical fumigation. By rapidly lowering the temperature to at least –35 °C and holding it at this level

for up to several days, most life stages of most insects can be killed. While some commercial freezers are adequate for pest control, others are not able to lower the temperature quickly enough. A slow reduction in the temperature allows some insects to go into a state resembling 'suspended animation' and survive the treatment. Naturally, it is also important to ensure that the objects are not damaged by the low temperatures and that condensation is controlled.

Preventing insect and pest infestations

It is now accepted that an integrated pest management (IPM) approach should form part of every preservation programme. IPM involves:

- monitoring the building regularly for the presence of insects and pests
- ensuring all staff, from cleaners to librarians, are vigilant and report any signs of fresh damage and activity
- checking all material which is to be accessioned before it enters the library
- using sticky traps. Traps have the advantage of catching insects before they can be found visually; they catch a wide range of species; they can be placed in areas which are difficult to inspect; trapped insects can be identified and counted; traps are good indicators of an increase in insect numbers in one area; they also highlight any failure of control treatment
- understanding the biology and life cycles of insects and pests, which helps to know when and where they are likely to breed, what they are likely to eat, where they are likely to live
- eliminating or containing all sources of likely infestation – ideally food and drink should not be consumed on the premises; flowers and plants should not be allowed in the building
- maintaining an environment not conducive to pests and insects, which is clean, cool, dry, and well-ventilated
- preventing pests and insects from entering the building – making sure doors close properly, installing mesh screens for windows and doors, etc.
- using appropriate exterior lighting, such as sodium vapor, which is less attractive to insects
- implementing a cleaning and hygiene programme – rubbish should be safely and properly disposed of; attics and basements regularly checked and cleaned.

Improving the environment

If the objective is to retain a collection or specific individual items indefinitely, then very close attention needs to be paid to the environment in which the items are stored. The ideal environment includes controlled temperature and relative humidity, clean air with good circulation, controlled light sources, and freedom from biological infestation. Good housekeeping practices, security controls, and measures to protect collections against fire, water, and other hazards complete the range of environmental concerns.

Library buildings should be designed as far as possible to meet preservation

requirements. These requirements affect many aspects of planning: design and orientation of buildings; building materials (which can, under some circumstances, be used to produce satisfactory internal climatic conditions in preference to mechanical air control systems); internal building and furbishing materials; and materials used for furniture, including shelving as well as lighting, both natural and artificial.

Indigenous and traditional building methods and materials in subtropical and tropical areas often provide better storage conditions for library material than those that are imported.

It is always worth considering constructing a sealed area within a building for material which needs tight temperature and relative humidity control.

Practical measures to improve the environment

In many places heating, ventilating, and air conditioning systems (HVAC) may be too costly to install and maintain or may have to be restricted to specific collections. Nevertheless, there are many rudimentary measures and precautions that can improve a library's environment and protect collections.

A first step in all efforts to improve the environment should be sealing the structure. This step alone will improve the physical condition of the building by reducing air infiltration, pest access, heating loss or heat gain, and air and particulate pollution. Making the building watertight will also reduce the sources of moisture within the structure and may significantly reduce relative humidity levels.

- Use draft excluders and weatherstripping to make the building weathertight.
- Ensure windows and doors fit securely.
- Ensure good air circulation by appropriate use of fans and windows.
- Use dehumidifiers and humidifiers to reduce or increase relative humidity.
- Use insulation methods to reduce heat gain or loss.
- Use UV-filters on windows and fluorescent lighting.
- Use screens, blinds, shutters (preferably outside the windows, as this reduces solar heat gain), and heavy curtains to keep out direct sunlight.
- Ensure storage facilities are dark.
- Ensure buildings are properly maintained to keep out dampness during rainy periods.
- Use close-fitting enclosures (boxes and envelopes) wherever possible to protect important and valuable library material. These can create a microclimate around the object, which delays the effects of changes in temperature and relative humidity. They also shield the item from light, and can act as a buffer against atmospheric pollutants and prevent particulate deposits.
- Paint the outside of the building with a pale-coloured light-reflecting paint in hot climates.
- Be aware that while trees and vegetation near buildings can reduce heat gain, they can also encourage insect and pest activity.
- Locate plumbing and heating pipes outside storage areas.
- Locate sanitary premises and sinks outside storage areas.

HVAC sytems

If the institution has a heating, ventilation, and air conditioning (HVAC) plant, then the following questions should be answered as part of any environmental survey:

- Does the air conditioning provide constant climate control throughout the year?
- Is the air conditioning system kept at a constant level 24 hours a day?
- Is the air conditioning turned down or shut off at any time?
- At what temperature and humidity levels is the air conditioning set?
- Are monitoring devices for temperature and RH regularly used in the facility?
- If there is no air conditioning system or, areas not covered by the system, how are rooms heated and/or cooled?
- If there is no air conditioning system or, areas not covered by the system, how is humidity controlled?
- What sort of air filtration system is used?
- To what standard does it operate?
- Who maintains the air conditioning systems and how often?

Housekeeping

To ensure the protection of the collections against particulate pollutants, a regular and sustained programme of cleaning should be maintained, undertaken with care and under supervision. Clean surroundings also discourage fungi, insects, and pests. The cleaning programme should include the examination of collections not only to provide early warning of biological or chemical damage but also to observe conditions throughout the area.

Cleaning the floors of storage accommodation and book stacks may be left to non-specialized staff under instructions to respect the collections and not to touch library material or shelves. Directions should be given to retrieve pieces of bindings, record slips, etc., from the floor (noting where they were found). Library material on the shelves should only be cleaned by properly trained members of staff.

It is important to provide appropriate materials and equipment which remove rather than redistribute dirt and dust. Cleaning cloths to which particulates adhere rather than dusters which merely spread them around in different places should be used to clean library fittings. Floors should be vacuum cleaned (not swept) and damp-mopped once a week. Cleaning agents must be nontoxic and pose no threat to the collections from solvent fumes or abrasives. Products containing oil, chlorine, alum, peroxides, and ammonia should be avoided.

TRADITIONAL LIBRARY MATERIAL

Processing library material

Written notations

Written notations such as cataloguing and foliation inscriptions should be made as neatly and unobtrusively as possible with a soft (B) pencil, applying light pressure to prevent indentations. It is worth considering enclosing notations within brackets [ ] to indicate that the information was added by the institution.

Inked notations (and accidental markings) are often permanent and cannot be removed. Many inks are acidic; others are water-soluble and will bleed and run when exposed to moisture, such as that encountered in a water-related disaster.

Shelfmarks (call numbers)

Shelfmarks should not be painted on books, nor should they be typed onto labels which are attached to books with pressure-sensitive tape or adhesive. Paint is unattractive and disfiguring; tape and adhesive may discolour, stain or otherwise damage the binding. For antiquarian material, shelfmarks should be written on the first fly-leaf with soft pencil.

When using self-adhesive labels, care should be taken to ensure that the adhesive will remain effective over time. It is especially important that the adhesive does not desiccate, causing labels to come loose or fall off, and does not ooze, causing stickiness on the book, which will attract dirt and may damage other materials that come into contact with it. Ideally, labels should be on permanent paper.

Bookplates

If bookplates must be used in books, they should be made of low-lignin, alkaline paper, and should be attached with a stable, reversible adhesive, preferably rice- or wheat-starch paste, or methyl cellulose; or polyester film jackets should be made and the bookplates attached to them. Circulation card pockets should be treated the same way, although books of special value usually should not circulate.

Inserts

All acidic inserts, such as loose bookmarks, scraps of paper, and pressed flowers, should be removed from books, assessed, documented, photocopied, and, if to be saved, then encapsulated in polyester. This is to prevent staining and acidity in the inserts from migrating into book pages and damaging them.

Fasteners

Adhesive tapes, staples, pins, paper clips, and rubber bands should never be used on any type of library material. Items should be boxed, wrapped in acid-free paper, or tied with a flat undyed cotton, linen, or polyester tape. Tape should be tied with knots at the top or fore-edge of the text- block.

No attempt should be made to separate documents that are attached with lines or dots of paste or glue. If such items must be separated to allow for the safe handling, use, or filming of the records, a conservator should be contacted.

Great care must be exercised when removing old fasteners such as staples, paperclips, etc. Fasteners that have rusted or become strongly adhered to paper surfaces must be gently lifted; before removal, the line of contact between the paper and any encrusted rust must be broken. When removing fasteners, the document should be fully supported on a table, and one hand should be placed on the document to hold it in position and support the paper while the fastener is being removed. If the procedure is conducted in mid-air, documents are likely to be torn and damaged.

Staple removers should not be used on fragile or brittle documents, as they can easily remove an entire weak or brittle corner along with the intended staple.

Reading room practice

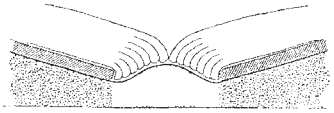
Reading rooms should have sufficient numbers of staff to ensure security against theft, mutilation, and vandalism.

Supporting books when in use

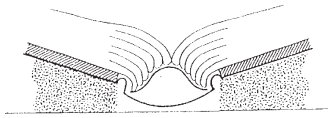
Books are complex composite objects which open in a variety of ways and require different methods of support when opened. Very few books can be opened at 180° without being damaged. It is strongly recommended that no book is opened more than 120°, and tightly bound volumes no more than 90°. Bindings are far more vulnerable and fragile than is presumed and need to be handled with great care. Board attachments are often precarious, with extremely thin leather over the joints. Such books should always be supported when in use and boards should never be flipped back 180° from the text-block.

The traditional wooden lectern or reading stand has caused many volumes to be damaged by presenting the book at a steep angle which strains the sewing and does not support the joints, which will soon weaken and eventually split. Moreover, such steep lecterns are not comfortable for readers to use.

For fragile and rare material, the foam book supports designed by Christopher Clarkson provide the most suitable way of supporting both tight- and hollow-back volumes. A book can be set up at a comfortable reading angle of 20°, with an opening not greater than 120°, the joints fully supported, and the leaves restrained with strips of weighted fabric. As the reader progresses through the volume, the blocks can be adjusted to retain optimum support for the book's vulnerable joints. With a thicker book, the reader should add or remove one or more of the flat pads to fit the volume's changing profile as it is opened in different places. A larger wedge may be placed beneath the two side-supports, to form the base of the book-rest and provide a more comfortable reading angle.

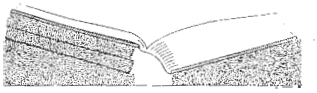


In *tight-backs* the cover adheres firmly to the spine.



In *hollow-backs* the cover is not attached to the spine.

Never open a hollow-back volume flat on a table surface, as the hollow will eventually split along the joints or in the middle of the spine.



Book opened at the front

Book opened near the middle

Book opened at the back

Notices to readers

Reading rooms should have notices clearly directing readers **NOT** to :

- drink, eat, or smoke in the library except in designated areas
- handle library material with unwashed hands
- use ink of any kind
- use correction fluid or highlighters
- annotate texts, or write on paper placed on top of the pages of an open book
- lean on library material
- touch illuminations, painted images, manuscript or printed text areas
- insert slips or notes in the gutter of a book
- leave items in direct sunlight
- leave out items not in use
- have more than a limited number of items out at a time for consultation
- pile items on top of each other
- shuffle loose items to fit them in an enclosure, but to handle them individually (in order to prevent hidden edge tears from interlocking and causing further damage).

Assistance for readers

Reading rooms should provide readers with:

- information to encourage a regard for the welfare of library material
- guidelines on how to handle library material
- book supports and guidelines on how to use them
- guidelines on how to remove and replace books on shelves
- adequate space for the viewing of large items
- cotton gloves for handling valuable material and photographs
- clean work surfaces
- polyester sheets for tracing maps
- assistance with handling large items
- clean, smooth weights to restrain unrolled plans.

Photocopying

Adequate ventilation should be provided which reduces exposure of staff and library material to ozone.

Photocopying raises serious preservation issues. Flat-bed photocopiers and poor handling can cause severe damage to the structure of books and documents. Photocopy machines specifically designed for bound material and not office photocopiers should be provided. Overhead photocopiers, which allow a book to be copied face-up, are ideal but expensive. Ideally, photocopying should be carried out by the library's own fully trained staff, with each item being examined for its suitability. The criteria for restricting certain material and copyright regulations must be thoroughly understood by all staff members. Training sessions in good handling practice and good copying practice should be mandatory for all new staff, with refresher sessions for existing staff at frequent periods. If it is not possible to allocate staff to carry out copying, there are some factors which can help to reduce wear and tear:

Never leave material on photocopy machines.

- Position the machines where they are within clear sight of staff.
- Post clear and concise guidelines on careful handling prominently by the machines. It is worth considering posters illustrating that the spine of a book should never be pressed down with the hand or the cover of the copier to ensure a good quality image.
- Make criteria for restricting material clear to users and discourage practices such as photocopying an item for the sake of a few sentences.
- Keep a record of what has been photocopied so that items which are frequently requested can be microfilmed.

If a book is too brittle to photocopy safely, it should be microfilmed instead and a photocopy made from the film copy.

The following material should not be photocopied:

- fragile or damaged items
- tightly-bound volumes
- rare books and photographs
- books stapled or stitched through the sides
- fine bindings
- vellum and parchment
- items with seals attached
- perfect bindings (books which rely on adhesive to keep the pages together and are not sewn)
- oversize items that would have to be excessively manipulated to obtain a complete image.

Storage methods and handling

Storage methods have a direct effect on the useful life of material. While proper storage can extend life, slovenly, haphazard, overcrowded conditions soon result in damage to collections. Moreover, poor-quality storage enclosures can accelerate the deterioration of the material they are intended to protect.

Storage areas should always be clean and regularly checked for signs of insect or biological infestation.

Handling by staff and users also directly affects the useful life of library collections. Damage to books is cumulative. Repeated poor handling can quickly transform a new book into a worn one, and a worn book into an unusable book that requires costly repair, rebinding, or replacement. By following the guidelines presented here, the library can make significant strides toward improving the welfare of the collection.

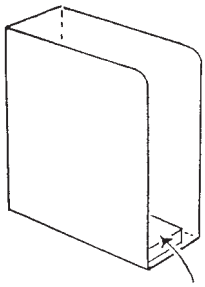
Shelving and the shelving of books

- Shelving should be designed to provide smooth, secure, clean, and convenient support. Any protrusions and sharp edges should be attended to. Ideally, book cases should be constructed of steel with a baked enamel finish.
- Volumes should be shelved a minimum of 10 cm off the floor to reduce the risk of damage from flooding or passers-by. When possible, use shelving units that have a 'canopy' on top, as this will deflect water, dust, and some damaging light.
- Good air circulation should be maintained in storage areas and around shelving.
- Book cases should be at least 5 cm away from walls and the books another 5 cm away from the back of the book case. This is especially important when book cases are positioned against the outside walls of a building.
- When books are stored in steel cabinets, ensure the cabinets are adequately ventilated. Holes should be in the sides and not on the top of the cabinets to avoid dust and debris falling on the books.
- Books kept on mobile shelving must be shelved carefully to avoid any possibility of them falling off or being crushed when the shelves are moved.

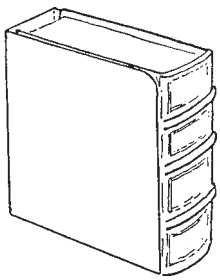
For the maximum protection of books, the following rules should be enforced:

- Shelve books so that they are not difficult to remove or replace. Books which are tightly shelved will soon be damaged when they are removed or replaced.
- Use bookends to support books when shelves are not full. Allowing books to lean will distort and strain the structures and eventually cause their breakdown. Bookends should have smooth surfaces and broad edges to prevent covers from being abraded and leaves torn or creased.
- Do not let books extend beyond the edges of shelves into aisles because they can be damaged by passers-by and trollies.
- Shelve books by size whenever possible. Avoid keeping large books next to small ones because the large book will be inadequately supported.
- Box, or at least separate with a piece of card or board, bindings with metal furniture (clasps, bosses, studs, etc.), which are shelved next to unprotected books.

- Separate paper and cloth bindings from leather bindings. Acidity and oils in the leather migrate into paper and cloth and hasten their deterioration. Furthermore, degraded powdery leather will soil paper and cloth.
- Shelve small, structurally sound books upright.
- Move the books or rearrange the shelves if books are too tall to stand upright. Do not store books on their fore-edges as this will damage the structure of a book and loosen the binding.
- Store oversize, heavy, structurally weak, or damaged books horizontally to give them the overall support they require. Additional shelves may need to be inserted at narrow intervals to avoid having to stack these books.



text-block support in book-shoe



- When oversize books that are stored flat are removed, the upper volumes should be transferred to an empty shelf or book trolley. The desired volume should be removed by lifting it with both hands, and the removed volumes should then be transferred back to the shelf. Replacing the book on the shelf is done in the same way.
- Avoid stacking books in piles on shelves or tables as the books can easily topple over. Ensure the stacks contain no more than two to three books.
- Take special care to ensure that shelfmark flags or titles of books that are stored flat are visible so the books can be identified without moving them.
- Do not place a large book on a small book.
- When the binding must remain on view, such as in a period room in a historic house, the use of book-shoes (supports that cover the sides but leave the spines of books visible) or placement of a piece of polyester film between the books.

Poor handling procedures can cause irreparable damage to books.

- They should not be pulled off the shelves by the headcap, a practice that causes the headcap to fail, tearing the spine of the binding.
- If there is room above the book, reach over the top of the book to the fore-edge and then pull it out.
- If there is no room, push back the books on either side of the one to be retrieved, to expose enough of the spine to allow for a firm grip on either side of the spine with the thumb and fingers.
- The book should be removed, and the remaining books on the shelf and the bookends readjusted.

Carrying and transporting books

All staff involved in the constant handling and moving of books should receive authorised instruction in the correct ways in which to lift and handle heavy loads for health and safety reasons.

- Do not carry more books than can be comfortably held firmly in both hands.
- Pack books flat in tough boxes when moving them out of a room.
- If necessary, pad the box with polystyrene or foam so that the books do not slide around.
- Transport individual books in card boxes. Carry the box in a polythene bag when going outside.

- Use water-resistant polypropylene containers with securely fitting lids when moving books out of a building.
- Whenever possible use two people to move containers.
- Avoid leaving library material in vehicles.

Book trollies and books on trollies

Use book trollies that:

- have large rubber wheels, for this helps stability, and manoeuvrability, and reduces vibration
- have wide shelves or protective rails to secure the items in transit
- have bumpers on corners to minimize damage from inadvertent bumps.

When putting books on trollies ensure that:

- they are shelved upright on the trolley and are properly supported as in the stacks
- volumes do not protrude beyond the edges of the trolley
- the trolley is loaded so that it has a low centre of gravity.

Enclosures for books and paper material

Enclosures should be lignin-free, sulphur-free, alkaline buffered, and have a high cellulosic content (above 87%). Enclosures include boxes, envelopes, and folders and are available commercially in a range of shapes and sizes.

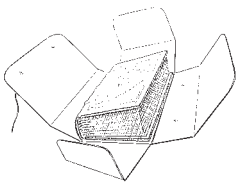
Enclosures for photographic media require different specifications.

Enclosures are crucial to library preservation, for they:

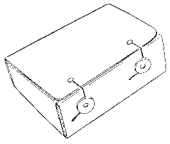
- provide protection from over-handling
- provide protection in transit
- provide protection on the shelves
- provide protection against fire, smoke, and flood damage
- keep out light
- keep out dust
- act as a buffer against fluctuations in the ambient environment
- act as a buffer against atmospheric pollution.

Types of enclosures for books

- Tailor-made boxes of bookboard and cloth are ideal but are expensive and require time and skill to make. They can be justified only for extremely rare, unique, and valuable material. They have the advantage of being able to provide all round support and are more robust than other types of enclosures.
- Phase-boxes are a cheaper alternative, which provide adequate short-term (15–20 years) protection, and are much quicker and simpler to construct. They can be made in-house or commercially.
- Commercially made, archival-quality boxes and four-flap folders come in a wide range of sizes and can be purchased in small and large quantities.



phase-box



- Book-shoes are appropriate for books that require structural support while being displayed on shelves.
- Slipcases should be avoided because they often abrade the surface of the binding and damage the text-block when the book is slid in and out.
- Envelopes are sometimes used for the storage of books. These generally do not provide the support books need and should be replaced with boxes.
- Wrappers of a permanent durable paper or card can be used to protect books that are infrequently used, if enclosures are too expensive or take up too much space on shelves.

Selecting material to be boxed

When prioritising books for boxing the following should be considered:

- Books with fragile and important bindings.
- Vulnerable and damaged books – books with loose or torn leaves, and books with loose covers.
- Books bound in vellum or with vellum text-blocks. Vellum responds readily to changes in relative humidity by expanding and contracting. This can result in warped covers and cracked joints. Boxing helps restrain vellum bindings and thereby minimizes warping.

Shrink-wrapping and vacuum-packing

Shrink-wrapping and vacuum-packing, adapted from the food and packaging industry, are economical ways of protecting material. Both processes involve placing an item between sheets, or into pouches, of polyester/polyethylene film. The film is either shrunk using heat, as in shrink-wrapping, or a vacuum is created around the item and all air expelled, as in vacuum-packing. While they seem to be stable in the short term, further tests have yet to be carried out on the effects of long-term storage. Material which is to be moved and fragile items, in particular those with brittle paper, can be placed between boards and protected in one of the above ways; the result is a rigid and strong enclosure. Shrink-wrapping and vacuum-packing are also being used as means of combatting insect and fungal attack and creating a stable micro-environment. Space can be saved as the process expels most of the air, thereby reducing the thickness of the item.

Newsprint

Commercially made, archival-quality boxes and vacuum-packing are both ways of preserving newspapers. However, because much of the newsprint produced after 1840 is made of short-fibred paper that contains lignin and other impurities, its long-term preservation is difficult at best and, consequently, microfilming has become the most common method of dealing with newspapers.

While it is possible to alkalize (deacidify) newsprint to retard its deterioration, this is often not practical because it will still continue to deteriorate at a relatively rapid rate. Also, alkalization after newsprint has become yellow and brittle will not make it white and flexible again.

Collections of newsclippings are usually important because of the information they contain and not because of the value of the clippings themselves. For this reason, again, photocopying and microfilming are the most practical preservation options. All photocopying should be done on low-lignin, buffered paper using an electrostatic copier with heat-fused images. Newsclippings that must be retained should be treated and then physically separated from better-quality papers in a folder or in an enclosure made of polyester film.

Periodicals and pamphlets

Periodicals and pamphlets can be stored in boxes, folders, or card envelopes (meeting the specifications mentioned for enclosures). Several items of the same cover size can be stored together in commercially made boxes. Items that differ in size can be placed in card envelopes and then boxed. If a single periodical or pamphlet must be shelved between books, it should be placed in a card envelope.

Scrapbooks and ephemera

Many historical collections include scrapbooks and ephemera (e.g., trade cards, valentines, patterns, paper dolls, etc.). These items pose challenging preservation problems because they often contain a variety of components and media. They may have raised surfaces, three-dimensional decoration, or moving parts. They are frequently unique, fragile, damaged, and of significant associational value. They should never be interfiled with other categories of library and archival material because damage may result from the different sizes, shapes, weights, and materials represented.

Scrapbooks that are of special historic value in their original form should be individually boxed. Unbound ephemera should be grouped by size and type (e.g., photographs, printed material, manuscripts, etc.), individually enclosed to protect items from acid migration and mechanical damage, if needed, and stored in a way that will support them structurally.

Single-sheet material

- For paper collections, only objects of the same size and category should be stored together.
- Differences in bulk and weight are potentially damaging, so it is not advisable to store single sheets in the same box with books or pamphlets.
- Generally speaking, heavy objects should be stored separately from lighter ones, as should bulky objects (which cause uneven pressure inside boxes).
- As acid migrates from paper of inferior quality to any other paper with which it comes into direct contact, it is important to separate poor-quality papers from those that are better. Newsclippings and other obviously inferior-quality papers must be removed from direct contact with historical documents and manuscripts on better-quality paper.
- Documents and manuscripts should be unfolded for storage, if this can be done without splitting, breaking, or otherwise damaging them. If unfolding may result in damage, a conservator should be consulted before proceeding.
- Documents should be stored in file folders. Ideally, no more than ten to fifteen sheets should be placed in each folder.
- Folders should be placed in document-storage boxes.
- All folders inside a box should be the same size and should conform to the size of the box.
- Boxes should not be overfilled because this can cause damage when items are removed, replaced, or reviewed.
- Boxes can be stored flat or upright. Flat storage will give the documents overall support and will prevent crumbling edges, slumping, and other mechanical

damage to which upright storage might subject them. Flat storage, however, causes documents on the bottom of the box to suffer from the weight of those above. If boxes are stored flat, they should be stacked only two high in order to facilitate their removal from, and replacement onto the shelves.

- Upright storage is acceptable when documents and folders are well-supported to prevent slumping and edge damage. 'Spacer' boards made out of stable materials can be used to fill out boxes that are not quite full.
- Vellum documents and maps, etc., are highly susceptible to fluctuations in temperature and relative humidity and should be placed in an enclosure. Suitable enclosures include encapsulation, folders, mats, and boxes, or a combination of these.

Fascicules

Rare and unique single-sheet items, such as letters, have been traditionally bound into guard books. These are satisfactory if they are kept fairly thin and allow a support sheet for each manuscript page to ensure that the support and not the manuscript is handled. A simpler method is to make up fascicules.

A fascicule is a single-section, pamphlet-sewn binding comprising support sheets of bifolia and hooked leaves (acting as compensation guards) with an acid-free stiff paper cover. Sizes are made to fit commercial boxes. All items are foliated and placed loosely in the fascicules by librarians. The leaves on which the items are to be attached are also foliated. A Japanese paper hinge is pasted onto the edge of the item. The hinges are then pasted and the items attached to the recto of the support sheets. The fascicules are then boxed. Fascicules have several advantages:

- Each item is kept flat and supported.
- Items can be easily removed and replaced if necessary (e.g., for exhibition).
- Flexing of the object is reduced.
- Abrasion between items is reduced.
- Handling is reduced.
- A variety of materials within a standard format can be accommodated.
- The contents are protected from light and airborne pollutants.

Oversize single-sheet material

Blueprints should not be stored in alkaline folders because they may fade or turn brown when they are in contact with high alkalinity for an extended period of time. Lignin-free, neutral folders should be used for these.

Oversize material includes architectural drawings, blueprints, maps, large prints, posters, and wallpaper samples. These items are best stored flat in plan chests. They should be placed individually in folders cut to fit the size of the drawer. If several items are placed in one folder, interleaving with acid-free tissue paper is desirable, especially if the items have colours or are of special value.

There should be sufficient space between chests to facilitate the safe removal and replacement of oversize material. There should also be an adequate surface on which to place items once they are removed or prior to replacement.

If they are not brittle or fragile, oversize material can be rolled when flat storage is not possible.

Some items need to be rolled individually; others can be rolled in groups of four to six similar-sized items, the exact number depending on the size and weight of the paper. A tube several inches longer than the largest item being rolled and at least four inches in diameter (larger diameters are preferable) should be used. If

the tube is not made of low-lignin, pH-neutral materials, it should be wrapped in neutral or buffered paper or polyester film.

Alternatively, place the items between two sheets of polyester film or acid-free tissue cut several inches larger in both dimensions than the largest item being rolled. Roll the item or items onto the tube. Wrap the assembly with neutral or buffered paper or polyester film to protect it from abrasions. Using flat linen, cotton, or polyester tape, loosely tie up the wrapped roll. This assembly can be stored inside a larger rectangular box for added protection if desired. Tubes should be stored horizontally.

Handling and transporting oversize single-sheet material

- Use both hands when handling large items.
- Take care that large pendant seals are supported and turned with the document.
- Consider the route and destination before setting out, even if simply moving items from one room to another.
- Place maps, plans, and large single-sheet material in a portfolio or purpose-made folder.
- Use two people for carrying large portfolios.
- Carry portfolios vertically.
- Use waterproof portfolios when moving items outside.

Exhibitions

When exhibiting library material, special attention should be paid to the following:

Library material which is to be displayed is most at risk when an exhibition is being mounted and dismantled.

- Selecting items which are fit for display.
- The security of the exhibit – cases should have locks, shatter-proof glass, be alarmed, and the room should be invigilated at all times.
- Materials used for case construction should be chemically stable and checked for offgassing.
- The climatic factors of temperature, relative humidity, light, UV radiation, and atmospheric pollutants should be tightly controlled and monitored by appropriate equipment.
- Materials used for mounting exhibits should be chemically stable and pose no detrimental threat to the artefact.
- Books should be strapped with polythene to tailor-made card or acrylic cradles which acurately follow the profile of the opened or closed book. Books generally should not be displayed at an angle greater than 20° from horizontal, nor opened wider than 120°, and should be provided with a text-block support when appropriate.
- Acid-free card with an alkaline reserve should be used for window mats and mounts.
- Exhibits like paintings, not in cases, should be secured to walls or floors and cordoned off for security reasons so that visitors cannot touch them.
- A record of all items exhibited should be kept.

Loans to other institutions for consultation or for exhibition may involve risk or damage. The librarian has a duty to see that such requests, if granted, involve the borrower's making adequate provisions for safekeeping. All items should be protected against wear and damage in transit, and for security reasons the lending library may require such items to be carried both ways by personal courier, preferably a conservator or librarian. The mounting of the exhibit should also be carried out or supervised by the courier. Loan items must be adequately insured, on an all-risks basis, again at the borrower's cost. The librarian needs to be satisfied that the conditions for exhibiting the item are appropriate on conservation grounds, and also that the security arrangements for the exhibitions are dependable.

Travelling exhibitions pose particular problems for conservation, because the likelihood of damage is multiplied. Lending institutions should make condition reports, including photographic records, of items being sent away for exhibition; they also should consider making a complete microfilm of each loan, for the sake of security.

PHOTOGRAPHIC AND FILM-BASED MEDIA

Photographic media

Since the birth of photography in 1839, photographs have been made employing many different methods. Some of the materials used were extremely self-destructive, others were very sensitive to physical contact, and almost all photographic material is sensitive to the environment – not only temperature, relative humidity, and air pollution but also oxidising substances found from emissions in building materials, wall paints, wooden furnishing, cardboard, wall paints, and even the enclosures used to protect them. While the conservation of photographic material should be left to specialists, library staff can take certain precautions to safeguard the welfare of photographs within their collections.

Composition of photographs

A typical photograph consists of three different parts:

Support – the support layer may be of glass, plastic film, paper, or resin-coated paper.

Binder – The emulsion or binder layer, most commonly gelatine, but also albumen or collodion, holds the final image material or image-forming substance to the support.

Final image material – The final image material, made of silver, colour dyes, or pigment particles, is usually suspended in the emulsion or binder layer.

Many different final image materials and binders have been used over the years. Today, however, almost all black-and-white photographs are composed of silver suspended in gelatine.

Handling

Photographic media are extremely susceptible to damage from careless handling; staff and users should therefore:

- provide copies rather than originals whenever possible
- wear clean, lint-free cotton gloves when handling photographic media and never touch the emulsion side of any photographic image (e.g., print, negative, transparency, lantern slide, etc.)
- prepare a clean work surface
- use two hands to hold a photograph, or support it with a piece of stiff card
- not use adhesive tapes, staples, pins, paper clips, or rubber bands on photographic material
- consult a photographic conservator on issues of storage and handling.

Enclosures

PVC sleeves must not be used.

All enclosures should pass the Photo Activity Test (PAT) as described in ANSI standard IT. 2 1988. This stringent test evaluates the effect of housing materials on photographic media. Many manufacturers and suppliers of housing materials now conduct this test on their products. If at all possible, purchase products that have passed the PAT, or specify that any housing purchased must pass the PAT.

Enclosure materials for photographs fall essentially into two groups: paper/

board and plastic. Paper and board should conform to the following criteria:

- high cellulose content (above 87%)
- neutral pH (around 6.5–7.5)
- undetectable reducible sulphur content
- free of lignin, pH buffers, metal particles, acid, peroxides, formaldehydes, and harmful sizing agents.

Plastic enclosure materials should conform to the following criteria:

- free of plasticiser
- surface not glazed, coated, or frosted
- polyester is recommended for most enclosures so long as the environment is stable. The exceptions are prints and negatives with delicate surfaces (such as flaking emulsion and hand-colouring), glass-based material, Tintypes, cased photographs, and early film-based material.

Environmental recommendations for storage

Photographic media are exceptionally sensitive to environmental factors.

- Generally, storage temperatures should be kept as low as possible and measures should be taken to reduce exposure to light, UV radiation, atmospheric, and particulate pollution.
- Black and white prints and negatives should be kept below 18 °C (65 °F) and 30–40% RH.
- Colour material should be placed in cold storage (below 2 °C or 35 °F) and 30–40% RH if its longevity is to be ensured. Place material in cold storage only after consulting a specialist.
- For mixed photographic collections, 35–40% RH is recommended.
- Fluctuations of temperature and RH should be avoided.

Storage

Photographs – it is best for each item to have its own enclosure. This reduces damage to the photograph by giving it protection and physical support. Because paper enclosures are opaque, the photograph must be removed from the enclosure when it is viewed; clear plastic 'L' sleeves (two sheets of polyester placed on top of one another and joined along two adjacent edges), with a piece of board behind the print for added support, have the advantage of allowing researchers to view the image without handling it, thus reducing the possibility of scratching or abrasion.

Different types of photographic material, such as glass and film negatives, paper contact prints, and colour transparencies, should be stored separately.

Special care must be given to the storage of oversize photographic prints mounted on cardboard. This board is often acidic and extremely brittle. Embrittlement of the support can endanger the image itself because the cardboard may break in storage or during handling, damaging the photograph. Such prints must be carefully stored, sometimes in specially made enclosures. They should be handled with great care.

Once photographs have been properly housed in folders, sleeves, or envelopes, they may be stored upright or flat in drop-front boxes of archival quality. Horizontal

storage of photographs is usually preferable to vertical storage, since it provides overall support and avoids mechanical damage such as bending. Vertical storage, however, may make access to the collection easier and decrease handling. With vertical storage, photographs should be placed in acid-free file folders or envelopes that are themselves housed in hanging file folders or document storage boxes. Overcrowding should be avoided. The use of hanging file folders will prevent photographs from sliding down under each other and will facilitate their handling. In either case, care should be taken not to pack the photographs too tightly.

Prints in albums – may be interleaved with a photographic conservation paper if they appear to be suffering damage from adjacent prints or album pages. This should not be done if the binding will be stressed by the extra volume of paper. Modern albums of the type that have adhesive coated pages and plastic cover sheets should not be used.

Photographic albums – should be stored flat, preferably in boxes lined with acid-free tissue paper padding.

Glass-plate negatives – should be kept in individual paper enclosures and stored vertically in suitably padded cabinets or strong boxes with a board separator after every fifth plate.

Film negatives – can be stored in paper or polyester sleeves. They can then be placed in boxes or in a hanging file system in a cabinet.

Cased photographs – such as Daguerreotypes and Ambrotypes should be kept horizontally in their cases and these stored in cabinet drawers and/or boxes.

Boxes containing photographic material should be housed on metal shelves. Where possible, items of similar size should be stored together; the mixing of different sizes can cause abrasion and breakage, and can increase the risk of misplacing smaller items. Regardless of the size of the photograph, all enclosures within a box should be the same size and should be the size of the box. Boxes should not be overfilled.

Film-based media

There are three main types of film-based photographic materials: cellulose nitrate, cellulose acetate, and polyester. These materials have been used as a support for negatives, positive transparencies, motion pictures, microfilms, and other photographic products.

Cellulose nitrate and cellulose acetate are unstable. The by-products of their degradation can severely harm and even destroy photographic collections. In particular, institutions should isolate and properly store cellulose nitrate material because of its extreme flammability, especially when in a deteriorated condition.

Cellulose nitrate-based film

- It was manufactured 1889–1951 and in use 1900–1939.
- It is unstable and highly flammable.
- At room temperature and lower, it slowly and continuously deteriorates, emitting

gases in the process.

- If these gases cannot escape from the container in which the film is kept, then decomposition accelerates – the base turns yellow, then brown, becomes sticky and then brittle, until it disintegrates into ashy-brown powder, resulting in the complete destruction of the picture/sound records.
- The reaction can lead to spontaneous combustion of the film with disastrous consequences for other adjacent material, people, and buildings.

Owing to the fire hazards associated with cellulose nitrate negatives, it is especially important to isolate any cellulose nitrate material; in fact, this is required by many insurance policies. Cellulose nitrate film should be stored in specially designed storage areas approved by the Fire Brigade.

It is recommended that cellulose nitrate film be duplicated onto safety film.

Cellulose acetate-based film

- It was introduced in 1935, and from 1939 onwards almost totally replaced cellulose nitrate.
- It slowly decomposes at room temperature, giving off gases that resemble the smell of vinegar – hence the process is known as 'vinegar syndrome'.
- It eventually breaks down altogether.
- Until recently, cellulose triacetate films had been considered suitable for archival records; however, stability problems have become evident with this film as well.

Polyester-based film

Commonly known as 'safety film'. For the most permanent photographic records, films incorporating a polyester (polyethylene terephthalate) base are currently recommended.

Handling

Film-based media can be damaged easily, even when in good condition. All three film types, and the gelatine binder on them, can be scratched, abraded, and creased. Oils and dirt from hands can also damage the support and binder, as well as the final image material.

Once deterioration has begun, film-based media are even more prone to handling damage. Deteriorated media can become quite brittle; in this state, repeated removal from a housing can cause considerable harm. Furthermore, deteriorated materials may become sticky and adhere to other items.

Ideally, film should not be handled at all by non-specialists and should be projected or copied only by a film conservator. Handlers should wear lint-free cotton gloves, handle the edges only, and work in a clean, well-lit, and well-ventilated area with enough room for processing. Eating, drinking, or smoking should not be allowed in the processing/examination area. Prolonged exposure to deteriorated negatives can be a dangerous health hazard, especially when in large collections.

The degradation products of cellulose nitrate and acetate pose serious health and safety hazards, so due care and caution must be exercised when handling these types of film.

- **Wear neoprene gloves.**
- **Maintain good air circulation.**
- **Use a respirator.**
- **Do not wear contact lenses.**
- **Limit exposure time.**

Environmental recommendations for storage

Recent work at Rochester's Image Permanence Institute makes explicit the relationship between storage temperature/relative humidity and long-term stability. The results, published in the *IPI Storage Guide for Acetate Film*, predict the life span of fresh and already degraded films under different combinations of relative humidity and temperature. The following chart illustrates the predicted life expectancies for the previously cited storage conditions. The first number of years in each storage condition is for new film and the second is for film that has begun to deteriorate.

Pollutants which can harm film include peroxides (from paper and wood), chlorine compounds, oxides of nitrogen, sulphur dioxide, hydrogen sulphide (ordinary rubber bands could contain sulphur), impurities in adhesives, gases from paint, ozone produced by photocopiers and certain lamps and electrical equipment, ammonia, smoke, insecticides, dust, abrasive particles, and fungus. Activated charcoal air filters and looped, rather than cut, pile carpeting are recommended in reading areas because bits of fibre can be released from a cut pile for a very long time, and these are abrasive.

Estimated life expectancy (in years) for new and for deteriorating acetate film in selected storage environments

Office, Air Conditioned	21 °C / 70 °F at 50% RH	40–5
Cool Storage	18 °C / 65 °F at 35% RH	90–15
Cool Storage	13 °C / 55 °F at 30% RH	200–40
Cool Storage	04 °C / 40 °F at 30% RH	800–130
Cold Storage	–04 °C / 25 °F at 30% RH	1500–400
Cold Storage	–18 °C / 0 °F at 30% RH	1500–400

The Guide is a very practical tool for a collections manager, since the cost of an improved storage environment can be directly compared to quantitative benefits measured in years of additional preservation. As indicated by the Guide, cold storage is the only viable option to increase stability of material that already shows signs of deterioration and for keeping new material in good condition.

If cold storage is not an option over the short term, the storage facility should be well ventilated to prevent the build up of acidic gases that drive the autocatalytic degradation reactions of cellulosic films. As much as possible, the environment should be stable, cool, and dry. Significant fluctuations of temperature and relative humidity should be avoided.

Segregated storage

Ideally, each type of film-based material should be stored separately, isolated from other types of film supports. Organising storage in this way protects other photographic media from the harmful degradation products of cellulose nitrate and the cellulose acetates. In particular, the nitric acid formed by the degradation of cellulose nitrate can fade silver images, cause gelatine binders to become soft or even tacky, and corrode metal containers and cabinets. This type of material-based organisation also makes monitoring the condition of the collection more efficient and effective.

While it is important to separate different types of material if possible, it is also important to segregate deteriorating media from those in good condition. As mentioned earlier, deteriorating materials produce degradation products that can induce deterioration in other photographic media.

Enclosures

The same standards apply as for photographic material (p. 48).

General storage

Sheet film, like negatives and transparencies should be placed in sleeves, the sleeves in a box or drawer, and these boxes or drawers on metal shelves or in a cabinet.

Roll film, such as motion picture film and microfilm, should be kept wound on cores, emulsion-side-in and placed in canisters which are free from plasticizers, chlorine, and peroxides. Acceptable materials include polyethylene or polypropylene. Any paper or card inside the can should be removed, as should any outside paper wrappings, and stored separately with appropriate documentation.

Both flat and roll material should be stored horizontally on metal racking in cool, dry, dark conditions, with good air circulation.

AUDIOVISUAL CARRIERS

Audio disk recordings

The most likely form of sound recordings to be found in libraries will be long-playing microgroove disks (12-inch, 33⅓ rpm and 7-inch, 45 rpm), usually pressed on polyvinyl chloride, or the 78 rpm shellac disks.

Shellac disks

The first shellac disks date from the 1890s, and this format was used until the 1950s, when it was gradually replaced by vinyl disks.

Determining the causes of shellac degradation is difficult because a very wide range of qualities of shellac and 'fillers' have been used by manufacturers.

In a proper storage environment, these disks suffer a slow, progressive embrittlement of the shellac. High humidity levels accelerate the embrittlement of shellac disks. This embrittlement causes a fine powder to be shed from the disk after each playback, effectively scraping away groove information. Organic materials in the aggregates are susceptible to fungus attack, while shellac itself is said to be fungus-resistant.

Vinyl disks

Although vinyl is stable, its life is not indefinite. Vinyl discs are made of polyvinyl chloride (PVC), which degrades chemically when exposed to ultraviolet or to heat. Stabilization is therefore achieved by adding a chemical to the resin during manufacture. This does not prevent the degradation but controls it.

Vinyl disks are resistant to fungal growth and are unaffected by high humidity levels.

Handling

- Remove grooved disks from the jacket (with the inner sleeve) by holding it against the body and applying a slight pressure with a hand and bowing the jacket open. Pull the disk out by holding a corner of the inner sleeve. Avoid pressing down onto the disk with the fingers, as any dust caught between the sleeve and the disk will be pressed into the grooves.
- Remove grooved disks from the inner sleeve by bowing the inner sleeve and letting it slip gradually into an open hand so that the edge falls on the inside of the thumb knuckle. The middle finger should reach for the centre label. Never reach into the sleeve.
- To hold a disk, place the thumb on the edge of the disk, and the rest of the fingers of the same hand on the centre label for balance. Use both hands on the edge to place disk on turntable.

Storage

- Store records in soft polyethylene inner sleeves. Avoid using inner sleeves made of paper, cardboard, or PVC.
- Do not leave recordings near sources of heat or light (especially ultraviolet), as plastics are adversely affected by both.
- Do not place heavy objects on top of recordings. Recordings should never be placed on top of each other.

- Shelve recordings vertically, on edge.
- Do not use shelving units where supports put more pressure on one area of the recording or where supports are more than 10–15 cm (4–6 inches) apart.
- Do not interfile recordings of different sizes, as smaller items may get lost or damaged, while larger items may be subjected to uneven pressure.
- Remove shrink-wrap on long-playing gramophone records (LPs) completely. Shrink-wrap can continue to shrink, thus warping the disk.

Environmental recommendations for storage

A proper environment for the storage of sound recordings is essential to retard degradation. Elevated and rapid fluctuations of temperature and humidity can affect certain chemical properties of the plastics that make up recording media, causing distortion of sound quality and warping of the disk itself. 18 °C (64 °F) and 40% RH is recommended.

Fungi on disk surfaces can cause pitting, which affects playback quality.

Dust, combined with the pressure exerted on the grooves by the stylus, can permanently abrade the walls of the grooves, which affects playback quality; dust can also be embedded permanently into thermoplastic substances.

Magnetic media

Magnetic tapes (audio and video recordings on cassettes, audio and computer reel-to-reel tape, computer diskettes, etc.) are most commonly made of a magnetic layer of chromium or iron oxide bound with an adhesive onto a polyester film base. It is the adhesive binder which is susceptible to deterioration, through hydrolysis and oxidation. As the information is stored on magnetic tape in patterns formed by the magnetized particles, any loss or disarrangement of the magnetic oxide causes loss of information.

Since the early 1950s, there have been more than forty video formats that have varied in size, speed, and the manner in which the tape is held.

Cassette tapes are much thinner and weaker than reel-to-reel tapes, and their useable life expectancy is very short. Use reel-to-reel tape for long-term retention.

Magnetic tape has a much shorter lifespan than is presumed. Magnetic tape that is over 15 years old almost certainly needs careful attention, and most tapes over 20 years old need professional help.

Handling

- Minimize handling.
- Avoid touching the surface of any tape or computer diskette. Oil from skin leaves a residue that can coat the equipment's playing head and attract dust.
- Do not touch the tape surface or the edge of the tape pack unless absolutely necessary, and then wear lint-free gloves.
- Do not use commercial products advertised to clean tapes and diskettes. Contact an experienced professional to clean or repair dirty or damaged tapes.
- Return tapes and diskettes to their individual boxes immediately after use to

avoid possible damage and dust.

- Never use paper clips or adhesive tape to attach notes directly to cassettes, reels, or diskettes.
- Handle tape only in clean areas.
- Do not let tape or leader ends trail on the floor.
- Return tapes to their containers when they are not in use.
- Do not drop tapes or subject them to sudden shock.
- Cut off damaged tape or leader/trailer ends from open-reel tapes.
- Do not use general-purpose adhesive tapes to secure the tape end or for splicing. If necessary, use adhesive products designed for the purpose.

Use

- Label all tapes.
- Maintain machines according to manufacturer's specifications to ensure that equipment will not damage tapes.
- Clean the recorder tape path thoroughly at the recommended intervals.
- Discard tapes with scratches or any other surface damage, which causes significant debris to be left in the recorder tape path.
- Use a cleaning cassette after playing a damaged tape.
- Ensure tapes to be reused are thoroughly erased before they are put back into service.
- Fast forward and rewind tapes periodically.
- Do not leave a tape stopped in the middle – always rewind the tape fully.
- Protect the operating equipment and tapes from dust.

Backup and refreshing

Backup copies are the best insurance for protecting valuable tapes and important diskettes. In the event of media ageing or a natural disaster, a copy may be the only means available to retrieve information from a master that is no longer playable.

The loss of a single computer diskette can mean the loss of a large quantity of information. For this reason, backup copies are critical to ensuring the preservation of computer-based records. If maintaining an active computer database of records is part of an institutional operation, copy the information recorded on the system's hard drive onto backup diskettes or tapes on a daily basis. As a part of disaster prevention, store backup copies in another secure location.

Audio, video, and computer tapes which are to be retained for long periods of time will require periodic copying/refreshing to ensure access to information. Every three to five years, re-copy all master tapes onto high quality, polyester-based tape in the currently established format for the media. Use this copy master only when making another 'use' copy. Make the copies of masters at different times so they do not age together.

Use reel-to-reel audio tape for master audio copies. A written transcript of an audio or video tape can also be used as a 'use copy' or 'backup copy'. A transcript may contain every word on the original tape, or only a general rendering of the discussion.

Migration

Information formats disappear as new technology emerges. Within the last twenty years, 8-track tapes, beta format video, ½-inch videotape, 3-inch, 5¼-inch and 8-

inch computer diskettes and countless other formats have become obsolete.

Access to information is limited when machines necessary to read these records fail and cannot be replaced. To ensure access to information, copy older formats onto a stable technology while playback machines remain available.

Be knowledgeable about the formats of all machine-readable records in your care.

Storage

- Keep tapes and diskettes away from magnetic fields – do not stack tapes on top of electrical equipment.
- Keep storage areas clean and free from dust. Dust attracts and traps moisture and will precipitate hydrolysis, a common and serious cause of long-term magnetic tape degradation. Also, dust may cause permanent damage to the tape: the abrasiveness of the dust, along with the pressure exerted between the tape surface and the tape recorder heads, will scratch the oxide layer and the tape recorder heads.
- Do not leave open reel or cassette tapes exposed to the sun.
- Store open-reel and cassette tapes with the reels or tape packs vertical. Reels should be supported by the hub.
- Use high quality reels or cassettes, boxes/containers, and accessories.
- Use protective collars for open-reel tapes.
- Do not store the tapes in poor quality cardboard sleeves/boxes, which may be acidic, or vinyl boxes containing chlorine.

Diskettes should be stored on edge.

Environmental recommendations for storage

- Tape storage areas should be cool and dry: 15 ±3 °C (59 ±5 °F) and 30–40% RH are safe practical storage conditions. Extreme heat and frost will damage magnetic media.
- RH above 40% accelerates the deterioration of the tape binder.
- Avoid subjecting tapes to rapid temperature changes. If storage and operating area temperatures differ by more than 8 °C (15 °F), allow an acclimatization time within the operating area of four hours for every 10 °C (18 °F) difference.

Optical media

Laser disks

Laser disks were launched in 1978 and are usually 12-inch (30 cm) disks of glass or plastic. Millions of pits are etched into the surface which are read by a laser beam directed at the surface. A light beam is reflected, which is then converted into a conventional analogue signal.

CD-ROM

CD-ROM (compact disk – read only memory) originated from the audio compact disk which was available in the mid-1980s, and thus its physical dimensions and characteristics are the same. The main difference between CD-ROM and CD-Audio is that CD-Audio contains only audio data, while CD-ROM may contain audio, computer, and video/picture data.

The moulded plastic compact disk incorporates a continuous spiral of pits,

which contain the data. An aluminium reflective layer allows a laser in the compact disk drive to read the encoded information. Data integrity is protected by a lacquer coating on one side and a plastic substrate on the other side.

Handling

The worst handling stresses for an optical disk are caused by severe flexing or application of a sharp point to the top surface. These actions deform the substrate, wiping out pits and causing areas of the disk to become unreadable. A sharp stylus – a ballpoint pen, for example – can cause compression of the polycarbonate substrate and the metallic reflecting layer in the area under the pen point. Do not leave disks in disk drives. Wear lint-free gloves when handling optical media.

Labelling

Applying labels of any kind may unbalance an optical disk and make it difficult for the player to read. Also, labels may peel in humid conditions. Once a label is on the disk, however, it is especially important not to try and remove it. The act of peeling off a label creates a lever action that concentrates stress in a small area. Such stress can cause delamination, especially in a writable CD. If it is necessary to write on the top side of a disk, a soft felt-tip marker is preferable to other writing instruments, but with some solvent-based markers there may be a danger of the solvents migrating into the protective lacquer.

Cleaning

Avoid using cleaning solvents. Light dust or dirt may be safely brushed off with a non-abrasive lens tissue, but the use of an air gun is preferable. Always be gentle and wipe from the centre hub toward the outside edge of the disk. The motion should be in a radial direction (like the spokes of a wheel), not circumferential.

Storage

The acrylic 'jewel cases' provided by many manufacturers and distributors are good protection against scratches, dust, light, and rapid humidity changes. Protect the individually cased CDs further by placing them in a closed box, drawer, or cabinet. This gives additional protection from light, dust, and climate fluctuations. If the manufacturer provides a spacer card or other material as part of the jewel case package, it should be retained.

Environmental recommendations for storage

Optical disks should be stored in a dust-free, cool (below 20 °C or 68 °F), and moderately dry environment (40% RH). Warmer and humid conditions will lead to the oxidation of metallic reflecting layers, dark fading of dyes, and deterioration in polymer substrates and coatings. Do not leave disks in sunlight.

REFORMATTING

When reformatting is performed an emphasis must be placed on the welfare of the original material in terms of training staff to handle items correctly, the temporary storage of material which is awaiting reformatting, and the environmental conditions of reprographic studios.

When bound material is to be microfilmed or digitized cradles should be used that support items in such a way that no damage is inflicted during reformatting.

Why reformat?

Although libraries can take steps to prevent damage to their collections and the rate at which they deteriorate, few institutions can afford the labour-intensive and costly process of conserving their collections. Preserving the intellectual content, by putting it into another, more durable format (reformatting), is all that is feasible and may be all that is required. Many publications are available which cover in detail the issues that reformatting raises and the methods and techniques involved. This section summarises some of the most common points and is concerned mainly with looking after the reformatting media. It is also a reminder that material which is to be reformatted needs to be handled with all due care.

Library and archive material is reformatted for numerous reasons:

- To preserve its intellectual content.
- To reduce wear and tear to originals.
- To save space – brittle and badly damaged material may be disposed of if it has no artefactual worth and if intellectual content is the only concern.
- To improve access – copies of microfilm and digitised media can be distributed to off-site locations, providing access to more than one user at a time.
- To duplicate certain records for security reasons, in case the originals are damaged, stolen, or destroyed.

Reformatting, if it is to be a truly successful preservation process, depends upon the cooperation of institutions on a national and international scale. Projects like that of the European Register of Microfilm Masters (EROMM), a database of existing microforms in the most important libraries of Europe, must be set up. EROMM records what reformatted texts exist and where, so that institutions avoid duplicating their efforts (two institutions microfilming the same newspaper is a waste of valuable resources, as is one institution's reformatting a run of journals when a 'healthy' set exists in another town nearby). Furthermore, cooperation is necessary between libraries in planning what is to be reformatted and by which institution. Many guides have been published to aid librarians in selecting material for reformatting and in setting up reformatting programmes. Generally, the following questions have to be asked:

- Is the item or collection unique or rare?
- Are there other copies of the item in the library or elsewhere?
- Does the item need to be treated (is the paper already, or is it likely to become, highly acidic and brittle)?
- Is it possible to replace the item?
- Is it, or is it likely to be, heavily used?
- Does it need to be retained in its original form?
- Has it been reformatted somewhere else already?

Reducing wear and tear to originals

When the objective is to reduce wear and tear to originals, great caution has to be exercised in preventing damage occurring during the reprographic process. Reformatting increases the risk to an item because of the number of times it has to be handled in the process.

Selecting a format

There are three main reformatting processes:

- Photocopying
- Microfilming
- Digitizing

Each has advantages and disadvantages over the others, but they can all serve different purposes, and all are worth having present in a library to some degree.

Photocopying

Photocopying as a reformatting process is not a complete preservation tool since usually no master is made from which other copies can be taken. However, it is particularly useful for replacing missing pages or text:

- Damaged or missing items in hard-copy periodical runs can be copied and bound for storage on open shelves.
- Photocopies may also be used when an embrittled item can no longer be used without risking damage, and a paper copy replacement (rather than film) is desired but is not available from a commercial publisher.

Fragile and rare books/ bindings should never be photocopied on flat-bed photocopying machines.

In each case, it is essential that photocopies be of the highest quality and on permanent paper.

Advantages

- There is no reading machine interface required other than the photocopier itself.
- The medium and format of the original can be retained.
- It usually costs less than other processes, particularly if the original is a monochrome document.
- Library patrons prefer paper facsimiles to the use of, say, microfilms, except where bulky documents, such as newspapers, are involved.

Disadvantages

- Photocopies made directly from a master photocopy are usually of poorer quality than paper prints of microfilms.
- The costs of making subsequent photocopies is higher than the cost of printing microfilms.
- There is some loss of information, especially for graphic objects other than line art.
- If the original is kept, more space has to be created.

Photocopy paper, toner, and machines

- Paper: photocopies should be made on paper that meets the American National Standards Institute (ANSI) standard for permanent paper, Z39.48-1992 or ISO 9706, using a black-and-white copy machine, since colour photocopies are not stable over the long-term.

- Toner: other considerations are toner quality (carbon black is recommended), and the fusion of the toner to the paper. Photocopy machines should be well maintained to ensure that the temperature is right for fusing the toner to the paper. If a freshly-made copy smudges when an attempt is made to erase the image, the machine is not fusing the image to the paper properly and must be adjusted.
- Machines: photocopying bound items on common library photocopiers exerts enormous strain on bindings and inevitably damages them. Photocopiers which allow an item to be photocopied face-up are preferable. Overhead photocopiers which also digitise text and images are now available. They have great potential for being able to capture good-quality images of volumes which do not open well.

Microfilming

Microfilming process

A wide range of standards covering all aspects of microfilm production and storage have been published. Preservation microfilming comprises a number of steps:

Selection – making informed decisions on what is to be filmed.

Preparation – checking the item is complete; cleaning and repairing pages; preparing 'targets' that denote details such as title and magnification.

Filming – similar to basic photographic procedures.

Processing the film – after exposure, the film is processed to archival standards and tested to ensure residual processing chemicals are removed.

Inspection – after processing, the film is inspected for blemishes, legibility, and completeness.

Record creation – the creation and mounting of machine readable records (MARC) to promote use of film and prevent duplication of effort.

Commercial microform bureaux

Using a commercial microform bureau can be more economical than setting up an in-house operation. It is vitally important to evaluate the qualifications of any microfilm service company.

- Talk to other institutions, particularly archives, and inquire about their experiences with microfilming companies.
- Ask potential firms about their experience in filming records that are bound, fragile, or oversized.
- Ask for at least three references from other institutions.
- Contact the referees to see how the microfilm vendor handled records, met deadlines, and responded to refilming corrections.
- Inspect the microfilmer's operation. Ask questions about standards, procedures, and security.
- Draw up a contract between the institution and the bureau.
- Commission sample film.

Advantages

- A well-proven history – library material has been reproduced in microformats since the 1930s .
- Problems with the technology have largely been ironed out.
- Numerous standards exist for filming, processing, and storage.
- Microfilms can be economically created, duplicated, and distributed.
- Microfilms can be digitized if good-quality film has been used.
- Film is very compact.

Disadvantages

- User resistance – usually microfilm reading machines in libraries are of poor quality, and not designed for human comfort.
- Users must access the film manually by
  - locating the film
  - loading it onto a machine
  - spooling through dozens of images to find the required one.
- If the film is not in the library, it may take weeks to be delivered.
- Film can become scratched when handled.
- Each generation or succeeding copy loses resolution (about ten percent).
- Printouts may be of poor quality.
- Film creation variables are difficult to control.
- Image quality can be determined only after filming is complete.
- Bad pages must be re-filmed and spliced in.

Types of microfilm

Silver-gelatine – the only type for archival master negatives, which are to be retained indefinitely off-site in tightly controlled conditions. Master negatives are used solely for generating further copies and never for viewing.

Diazo – an interim printing copy can be made from the master on diazo film, from which other copies are taken.

Vesicular – positive copies can be made on vesicular film for use and circulation.

Polyester-based diazo and vesicular film are not regarded as being of proven archival quality but if stored in appropriate conditions may last for 25–100 years.

Storage and environmental recommendations

Most of the recommendations for film-based media (pp. 51–52) apply to microfilm material.

Many films in existing collections are on acetate-based stock. Such film chemically decomposes, giving off a vinegar smell and ultimately leading to shrinkage and emulsion damage. Indeed, all cellulosic films are susceptible to deterioration. The rate of deterioration of the film base proceeds gradually until it reaches the autocatalytic point, at which time the rate rapidly increases. Temperature and humidity have a significant impact on how long it takes the film base to reach the autocatalytic point (see table on p. 52).

Microfilms should always be preserved in conditions which conform to ISO 5466.

It is frequently claimed that properly processed and stored, black-and-white, silver gelatine film has a usable life of about 500 years, far longer than the useful

life of many poor-quality originals. However, improper processing and storage conditions will reduce film longevity.

- Master negatives should be stored in fire-proof vaults (not safes, as these can not be kept at the required RH), free of dust and atmospheric pollutants and maintained at a temperature of 18 °C ± 2 °C (64 °F ± 5 °F), with a constant level of RH between 20% and 40% for silver gelatine on a cellulose ester base, and 30% to 40% for silver gelatine on a polyester base.
- Intermediate printing copies on diazo film and viewing copies on vesicular film can be stored in less stringent conditions. However, cool and dry conditions will help to prolong the life of these types of film.
- In all cases, rapid fluctuations of RH and temperature should be avoided.
- Diazo film images will fade, and exposure to light accelerates fading, so diazo film should be stored in darkness and always in its container when not in use.
- Vesicular film is particularly vulnerable to dust and the high temperatures produced by microfilm reading machines, so it is important to keep the machine clean and cool.
- Containers should be free from acidic, oxidising and reducing agents and meet the Photographic Activity Test (PAT), specified by ANSI Standard IT9.2-1991.

Machines for viewing and copying microforms must be kept clean to avoid scratches and deposits on the film. Patrons must be educated in careful handling to avoid damage.

Digitizing

What is digitizing?

Digitizing is a way of capturing and storing images using computer technology. A digital camera or a scanning device takes an electronic photograph, which is converted into binary digital code (essentially a string of zeros and ones), and can be viewed on a computer screen or printed out on paper. The data are stored within magnetic and optical media. The information content of digital images is not converted to alphanumeric form at the time of scanning and thus is not text-searchable.

Optical Character Recognition (OCR)

OCR software enables a scanned printed document to be converted into text which can be edited using word processing programmes. Unfortunately, the process is not completely accurate and time has to be spent rectifying misread letters. Moreover, OCR programmes are not capable of saving the original document's typography or page layout.

Advantages

- Digitizing offers quick access to multiple users world-wide.
- Images can be electronically restored and enhanced.
- High-quality user copies can be provided.
- Automated retrieval aids facilitate the finding of information.
- Digitizing provides an image which can be reproduced many times with no loss of quality.
- Digital images do not decay with use.

Disadvantages

- It requires an expensive commitment to supporting technologies used to convert and retrieve records.
- A digital image, displayed or printed, may not yet be acceptable as a legal substitute for the original.
- Standards are lacking in many areas.
- Digital storage is not yet accepted as truly archival – it requires continuous monitoring and eventual or periodic refreshing and transfer.
- The drive systems will become obsolete.
- There are relatively high but rapidly declining storage and production costs.
- The time needed to capture and store high-resolution archival images, and the costs of doing so increase as the quality increases.
- It is expensive to reproduce colour images.

Obsolescence issues

The technological life span of any optical or electronic medium and its associated hardware and software is a major issue that does not exist when considering microfilming as a reformatting process. Computer hardware and software both change rapidly, with new versions of each coming out on a regular basis. In addition, technologies come and go. Libraries will probably not be able to use many of the technologies of today in the future. Certainly, parts for the hardware will no longer be manufactured, and old software will eventually not work on new machines. What this means is that libraries may not be able to retrieve information stored on optical media in 25 years, and this will almost certainly be a problem in 100 years. To deal with hardware obsolescence, archival copies of magnetic and optical computer media will have to be 'migrated' when newer technologies become the standard.

Magnetic and optical media, such as hard disks, floppy disks, magnetic tapes, CD-ROMs and CD-Rs are inherently unstable, easily damaged and, like all media, are deteriorating as soon as they are made.

Digitizing and microfilming combined

The production of both microfilm masters for preservation, and digital masters for access, seems likely to become the preferred preservation strategy for the next decade. On the whole, a film-first policy is currently favoured. However, the rapid advancement of computer technology, the emergence of sophisticated equipment, which can produce microfilms and high-resolution digital images simultaneously and at low-cost, and the ever-increasing pressures of providing greater access will eventually see digital technology in the ascendancy. Nevertheless, until standards are in place, the use of digitizing for preservation will remain questionable.

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Where to turn for advice

Abbey Publications Inc
7105 Geneva Drive, Austin TX 78723, USA
Tel: + 1 (512) 929 3992 Fax: + 1 (512) 929 3995
e-mail: Abbeypub@flashnet
<http://palimpsest.stanford.edu/byorg/abbey/>
Publications: *Abbey Newsletter* and *Alkaline Paper Advocate*.

American Institute for Conservation of Historic and Artistic Works (AIC)
1717 K Street NW, Suite 301, Washington DC 20006, USA
Tel: + 1 (202) 452 9545 Fax: + 1 (202) 452 9328
e-mail: InfoAic@aol.com
<http://palimpsest.stanford.edu/aic/>
Publications: *AIC News* and *AIC Journal*.

Bibliothèque nationale de France (BnF)
Services de Conservation
Quai François Mauriac, 75706 Paris cedex 13, FRANCE
Tel: + 33 (0) 1 53 79 41 65 Fax: + 33 (0) 1 53 79 41 61
<http://www.bnf.fr>

The British Library
National Preservation Office (NPO)
Great Russell Street, London WC1B 3DG, UK
Tel: + 44 (0) 171 412 7612 Fax: + 44 (0) 171 412 7796
e-mail: npo@bl.uk
<http://www.bl.uk/index.html>

Canadian Conservation Institute (CCI)
1030 Innes Road, Ottawa, Ontario K1A OM5, CANADA
Tel: + 1 (613) 998 3721 Fax: + 1 (613) 998 4721
e-mail: cci-iccpublications@pch.gc.ca
<http://www.pch.gc.ca/cci-icc>
Publication: *Bulletin de l'ICC* bilingual (French and English), biannual and free of charge.

Canadian Council of Archives (CCA)
1009–344 Wellington Street, Ottawa, Ontario K1A ON3, CANADA
Tel: + 1 (613) 995 0210 Fax: + 1 (613) 947 6662
e-mail: dubeau@fis.utoronto.ca
<http://www.fis.utoronto.ca/groups/aao/index.htm>

Conservation on Line (CoOL)
<http://palimpsest.stanford.edu>
Full-text searchable database of articles and reports, as well as numerous links to a wide range of resources including conservation-related organizations, vendors and library preservation department home pages.

Council on Library and Information Resources (CLIR)
1755 Massachusetts Avenue, NW, Suite 500
Washington, DC 20036, USA
Tel: + 1 (202) 939 4750 Fax: + 1 (202) 939 4765
e-mail: info@clir.org
<http://www.clir.org/cpa/>

European Commission on Preservation and Access (ECPA)
PO Box 19121, NL-1000 GC, Amsterdam,
THE NETHERLANDS
Tel: + 31 (20) 551 0807 Fax: + 31 (20) 620 4941
e-mail: yola.de.lusenet@bureau.knawl.nl
<http://www.knawl.nl/ecpa/ecpatex/welcome.htm>

European Register of Microform Masters (EROMM)
Tel: + 49 (551) 39 34 68 Fax: + 49 (551) 39 95 25
e-mail: eromm@mail.sub.uni.goettingen.de
Is an international database to help libraries coordinate microfilming and other reformatting activities aimed at the preservation of the printed information which is threatenend by brittle paper. It also serves as an instrument for ordering service copies of reformatted books.

Fédération Internationale des Archives du Film (FIAF)
1 rue Defacqz, B-1000 Bruxelles, BELGIUM
Tel: + 32 (2) 538 3065 Fax: + 32 (2) 534 4774
email: fiaf@mail.interpac.be
<http://www.cinema.ucla.edu/fiaf/enfiaf.html>
Brings together institutions from all countries dedicated to the collection and preservation of films of both cultural and historic interest.

Fédération Internationale des Archives de Télévision (FIAT)
Elmfield Mansions, Elmfield Road, Balham, London SW17 8AA, UK
Tel: and Fax: + 44 (0) 181 675 5941
e-mail: gosta@msn.com
<http://www.nbr.no/fiat/fiat.html>

Fundaçáo Nacional de Arte (FUNARTE)
Rua São José 12° andar - Centro, CEP 20010-020,
Rio de Janeiro, BRAZIL
Tel: + 55 (21) 533 8090 Fax: + 55 (21) 262 4516
e-mail: zuniga@omega.eincc.bc
Among other things FUNARTE has set up a national programme for photographic preservation and research in Brazil. It is conceived as a network of working centres throughout the country.

Getty Conservation Institute
1200 Getty Center Drive, Suite 700, Los Angeles,
CA 90049-1684, USA
Tel: + 1 (310) 440 7325 Fax: + 1 (310) 440 7702
<http://www.getty.edu/gci>
Publications: Newsletter three times a year in English and Spanish, free of charge.

Image Permanence Institute (IPI)
Rochester Institute of Technology,
Frank E. Gannett Memorial Building, PO Box 9887,
Rochester, NY 14623-0887, USA
Tel: + 1 (716) 475 2736 Fax: + 1 (716) 475 7230

Institute of Paper Conservation (IPC)
Leigh Lodge, Leigh, Worcester WR6 5LB, UK
Tel: + 44 (1886) 832323 Fax: + 44 (1886) 833688
e-mail: clare@ipc.org.uk
<http://palimpsest.stanford.edu/ipc>
Publications: *Paper Conservation News* is issued quarterly. *The Paper Conservator* is published annually.

International Association of Sound Archives (IASA)
Tel: + 46 (8) 783 3700 Fax: + 46 (8) 663 1811

International Centre for the Conservation and Restoration of Cultural Property (ICCROM)
13, via di San Michele, I-00153 Roma, ITALY
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International Council on Archives (ICA)
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e-mail: 100640.54@compuserve.com
<http://www.archives.ca./ica>

International Federation of Library Associations & Institutions (IFLA)
PO Box 95312, 2509 CH The Hague,
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Tel: + 31 (70) 31 40 884 Fax: + 31 (70) 38 34 827
e-mail: IFLA. HQ@IFLA.NL
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IFLA Section on Preservation and Conservation
National Library of Canada, 395 Wellington Street, Ottawa
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6 Buckingham Street, London WC2N 6BA, UK
Tel: + 44 (171) 839 5975 Fax: 44 (171) 976 1564
e-mail: 100731.1565@compuserve.com
Publications: *IIC Bulletin*, bimonthly, free to IIC members.

Joint IFLA-ICA Committee for Preservation in Africa (JICPA)
Kenya National Archives and Documentation Service
Moi Avenue, PO Box 49210, Nairobi, KENYA
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Library of Congress
Preservation Directorate
LM-G21, Washington, DC 20540, USA
Tel: + 1 (202) 707 5213 Fax: + 1 (202) 707 3434
<http://www.lcweb.loc.gov/preserv/>

National Library of Australia
National Preservation Office
NIAC, Canberra Act 2600, AUSTRALIA
Tel: + 61 (6) 262 1571 Fax: + 61 (6) 273 4535
e-mail: claw@nla.gov.au
<http://www.nla.gov.au/archive/npo/html>

Northeast Document Conservation Center (NEDCC)
100 Brickstone Square, Andover, MA 01810, USA
Tel: + 1 (978) 470 1010 Fax: + 1 (978) 475 6021
e-mail: nedcc@nedcc.org
<http://www.nedcc.org>

Research Libraries Group (RLG)
1200 Villa Street, Mountain View, CA 94041-1100, USA
Tel: + 1 (800) 537 7546 (North America)
Tel: + 1 (650) 691 2333 (outside North America)
Fax: +1 (650) 964 0943
e-mail: bl.ric@rlg.org
<http://www.rlg.org/toc.html>

Solinet Preservation Service
1438 West Peachtree Street, NW, Suite 200, Atlanta, GA 30309-2955, USA
Tel: + 1 (404) 892 0943 or + 1 (800) 999 8558
e-mail: helpdesk@solinet.net
<http://www.solinet.net>

UNESCO – Memory of the World
1, rue Miollis, 75015 Paris, FRANCE
Tel: + 33 (0) 1 45 68 44 96 Fax: + 33 (0) 1 44 49 00 58
<http://www.unesco.org/webworld>

Standards

International and national standards are documented agreements containing technical specifications or the precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose. Although it is recommended that they are followed, they may have to be adapted for local requirements.

If we are to be fully confident about our preservation efforts, then we need to know that our practices, procedures, and purchases conform to established standards. While adherence to some standards is mandatory, electrical standards for example, in other cases compliance is voluntary. This puts the responsibility on the practitioner or consumer to be aware of, and to insist on, conformance with all standards governing an activity or product.

Some relevant ISO standards:

ISO JCT 1: Information Technology

ISO TC 6: Paper, Board and Pulps

ISO TC 21: Equipment for Fire Protection and Fire Fighting

ISO TC 35: Paints and Varnishes

ISO TC 37: Terminology (Principles and Coordination)

ISO TC 42: Photography

ISO TC 46: Information and Documentation

ISO TC 47: Chemistry

ISO TC 61: Plastics

ISO TC 92: Fire Safety

ISO TC 94: Personal Safety – Protective Clothing and Equipment

ISO TC 120: Leather

ISO TC 122: Packaging

ISO TC 146: Air Quality

ISO TC 171: Document Imaging Applications

International Organization for Standardization (ISO)
1, rue de Varembe
CP 56, CH – 1211 Genève 20
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Fax: + 41 (22) 733 3430
<http://www.iso.ch/welcome.html>

ISO conducts its work through technical committees that work on specific materials, methods, systems, terminologies or technologies.

American National Standards Institute (ANSI)
11 West 42nd Street, 13th Floor
New York, NY 10036
USA

Tel: + 1 (212) 642 4900
Fax: + 1 (212) 398 0023
<http://www.ansi.org/>

ANSI is the USA representative to ISO and principal national standards organization in the USA. It is a private organization that coordinates work of committees and organizations that it has accredited as standards developers.

Standard for permanent paper

Permanent paper is free of any substance leading to self-deterioration. It has a life-expectancy of several hundred years according to accelerated ageing tests. Permanent paper characteristics are described in the ISO standard: ISO 9706:1994 – Information and Documentation – Paper for Documents – Requirements for Permanence.

- pH between 7.5 and 10
- Alkaline reserve (calcium carbonate equivalent): 2%
- Kappa number (resistance to oxidation): under 5
- Tear resistance: 350 mN for all papers over 70g/m^2

This symbol should appear on any publications printed on permanent paper: