Environment and Storage

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Environmental conditions and methods of storage have a great influence on the preservation of documents. Control of the environment and the provision of good storage conditions constitute the first of all preventive measures.

External Causes of deterioration

Libraries and archives are situated in a given geographic region characterised by a climate (temperate, tropical, equatorial) and a microclimate (town or country). The collections housed inside a building, whether it is new or old, are exposed to various causes of deterioration.

Causes of deterioration may be external or internal. External causes are : poor environmental conditions, unsuitable storage procedures, risky handling, unauthorised exposure, as well as theft, vandalism and natural or accidental disasters. Internal causes are essentially : the poor quality of materials making up documents or the poor quality of assembly of these materials. In the present text, only external causes of deterioration are considered. External causes fall into several categories :

- mechanical forces
- theft and vandalism
- fire
- water
- biological agents
- air pollution and dust
- light, infrared and ultraviolet radiation
- magnetic stray fields
- temperature and humidity

Mechanical Forces

The origin of these forces may be natural (earthquake), accidental (collapse of a roof or a shelf), or human (handling, but also vibrations from a busy road nearby). The forces may act for a very brief period of time or a prolonged period. In the first case, the damage they cause generally results from shocks received by the document. In the second case, they cause deformation of the document.

Thus the use of inadequate supports during an exhibition or the piling up of documents during storage may cause this type of damage. The damage caused by vibrations may come into one or the other of these categories according to whether the vibrations last for a short or long time.

For audiovisual carriers of all kind mechanic deterioration is one of the greatest risk. Especially mechanical and magnetic carriers are deteriorated by the normal playback process. Therefore, handling and replay of originals have to be reduced to the absolute minimum. Moreover, with all machine readable carriers, the condition of replay equipment is of high importance to the integrity of the carriers. Badly maintained or inadequately used equipment may immediately destroy the documents. Therefore, maintenance and proper handling of equipment must be given utmost priority.

Nevertheless, mechanical deterioration is most frequently caused by poor handling of documents while they are being moved, made available to readers, photocopied or photographed.

Theft and Vandalism

These risks are normally dealt with by the security service. Theft, like vandalism, may lead to the total loss of the object or document. Acts of war can be included in this category.

Fire

Fire is a danger for all collections, but organic materials are particularly vulnerable. Fires cause widespread damage and massive losses.

Water

Water is a serious threat to collections. The damage may be due to : leaking pipes, leaking roofs, flooded rivers, hurricanes, fire-fighting. When the water damage is not discovered in time, or when rescue measures are insufficient for the scale of the disaster, then further damage is generally caused by mould.

Biological Agents

Biological agents of deterioration (mould, insects and rodents), are the major cause of damage to collections. These agents feed on the organic layers they find in materials. Absence of ventilation, darkness, and high temperature and relative humidity levels encourage their spread. The damage caused (destruction of paper and bindings, stains…) is irreversible.

Air Pollution and Dust

Another important factor is air pollution. This takes the form of gas : sulphur dioxide or nitrous oxides and ozone from motor vehicles and industry, formaldehyde escaping from certain materials (wood, textiles, papers) used in exhibitions or for storage. It also takes the form of solids (soot, particles).

Gaseous pollutants catalyse chemical deterioration of materials by oxidation and hydrolysis. Solid pollutants cause mechanical deterioration by abrasion and encourage the spread of mould and insects.

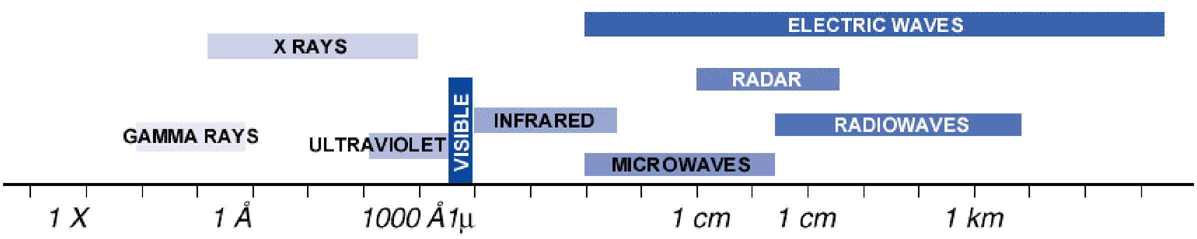
Especially audiovisual documents are extremely sensitive against dust, which influences not only the integrity of the carriers by abrasion, but also deteriorates the retrieval of the signals in the replay process. In severe cases a total signal breakdown can be observed.

To air pollution we may add the liquid contaminants present as plasticising agents in synthetic materials or as fatty matter or sweat deposited on the surface of a document while it is being handled.

Light, Infrared and Ultraviolet Radiation

Light, that is the part of the spectrum of electromagnetic waves which is visible to our eyes, also constitutes a serious factor for deterioration of collections. Light, which gives rise to particle and wave phenomena, transmits energy which is inversely proportional to the wavelength. Light sources, daylight as well as electric lights, all emit in variable proportions electromagnetic waves which are invisible to us. On either side of the visible spectrum there is ultraviolet radiation and infrared radiation.

Figure 1 : electromagnetic spectrum (logarithmic scale)



Ultraviolet radiation, of higher energy than visible radiation, causes photochemical deterioration. Infrared radiation causes deterioration by heating of matter itself or of its immediate environment particularly by affecting the level of relative humidity of the environment. Visible radiation itself carries certain dangers, as it still carries enough energy to cause changes at molecular level.

Temperature and Relative Humidity

Temperature and relative humidity are linked parameters. Relative humidity is defined as the relationship between the quantity of water vapour contained by a given volume of air at a given temperature, and the maximum quantity of water vapour which this same volume can contain at the same temperature. This relationship is expressed as a percentage

RH = AH / S x 100 AH : absolute humidity (g of water / g of air)

S : humidity at saturation (g of water / g of air)

RH : relative humidity (%)

The relationship between the temperature and the quantity of water vapour in a given volume of air means that the higher the temperature the greater the quantity of water vapour which a volume of air can contain. Heating a volume of air containing a given quantity of water lowers the relative humidity. This is what happens during the period when a building is heated. Conversely, cooling the same volume of air increases the relative humidity. This results in certain circumstances in the condensation of water on cold surfaces.

Because of the interdependance of temperature and relative humidity it is imperative to always control both parameters simultaneously.

Temperature	5° C	10° C	20° C	30° C
Humidity at saturation	7 g/m^3	9 /m^3	17 g/m^3	30 g/m^3

Materials are hygroscopic in varying degrees - a parameter which should be considered when monitoring storage conditions. One should also watch for microclimates. A badly ventilated building will not be able to eliminate fast enough any excess water vapour accidentally brought in. In this case the water vapour is absorbed by the books which only release it slowly. This may explain the development of micro-organisms even when the temperature and humidity in the bookstacks seem to be correct.

The main degradation factors for documents of all kinds

Carriers	Deterioration										
	Temperature		Relative Humidity			Uncontrolled Lighting	Dust	Pollution	Chemical or Biological Factors	Magnetic Fields	Shock
	high	fluctuating	low	high	fluctuating						
traditional documents											
papyrus	speeding up of chemical reactions		drying	mould growth	tearing	yellowing and fading ; catalysing of photochemical reactions	stain	hydrolysis and oxidation	hydrolysis and oxidation		tearing
parchments	idem		idem	idem	deformation	idem	idem	idem	idem		deformation
papers	idem		idem	idem	tearing	idem	idem	idem	idem		tearing
photographic documents											
B&W negatives and photographies	speeding up of chemical reactions		drying (if RH<20%)	mould growth	deformation, speeding up of chemical reactions	fading ; catalysing of photochemical reactions	scratch, stain	hydrolysis and oxidation	hydrolysis and oxidation		deformation, tearing
coloured negatives and photographies	idem		idem	idem	idem	idem	idem	idem	idem		idem
negatives on glass plate	idem		idem	idem	idem	idem	idem	idem	idem		break, scratch
audiovisual documents											
cylinders	deformation	crack		mould growth, chemical reactions			scratch	oxidation			break
mechanical discs	deformation	dilamination (flaking-off of lacquer)		idem			idem				break, scratch, loss of material
magnetic tapes (audio and video)	degradation of the signal		static electricity (if RH<20%), embrittlement	idem	deformation		idem			degradation of the signal	
CD (replicated) CD (recordable)	thermo-oxidation of the varnish					affect dye layer (recordable CD)	idem				

Monitoring preservation conditions

Vital Measuring Instruments

For monitoring of ambient conditions it is essential to take measurements to quantify the phenomena. Measurement of lighting levels with a luxmeter, measurement of UV radiation from light sources with a UV-meter, continuous measurements of temperature and relative humidity with a thermohygrometer and a thermohygrograph. In addition, measurements of air pollution and biological contamination may be carried out. These latter should however be done by specialists, whereas the former can be done by library staff provided certain instructions are followed.

The measuring instruments, whether mechanical or electronic, must be kept in good working order. Instruments for measuring temperature and humidity also need frequent calibration.

When a library acquires measuring instruments to monitor climatic conditions, it should possess :

– a psychrometer (Assmann type electronic psychrometers are more reliable than mechanical psychrometers) to adjust the mechanical thermohygrometers,

– an electronic thermohygrometer, which can be calibrated either with the aid of supersaturated solutions of salts sold together with the apparatus, or at the factory by the manufacturer,

– a stock of mechanical thermohygrographs or electronic sensors to record climate data in the different stacks over periods of a week or a month.

Location of instruments for measuring climate

The choice of location of the thermohygrograph in a stack or exhibition room must be made in accordance with certain criteria. To obtain good measurements, the apparatus must be placed :

- near the collections to be monitored,

- accessible for taking readings,
- away from the public,
- far from any undesirable microclimate (air vent, for example),
- in a typical climate zone,
- sheltered from pollutants and dust.

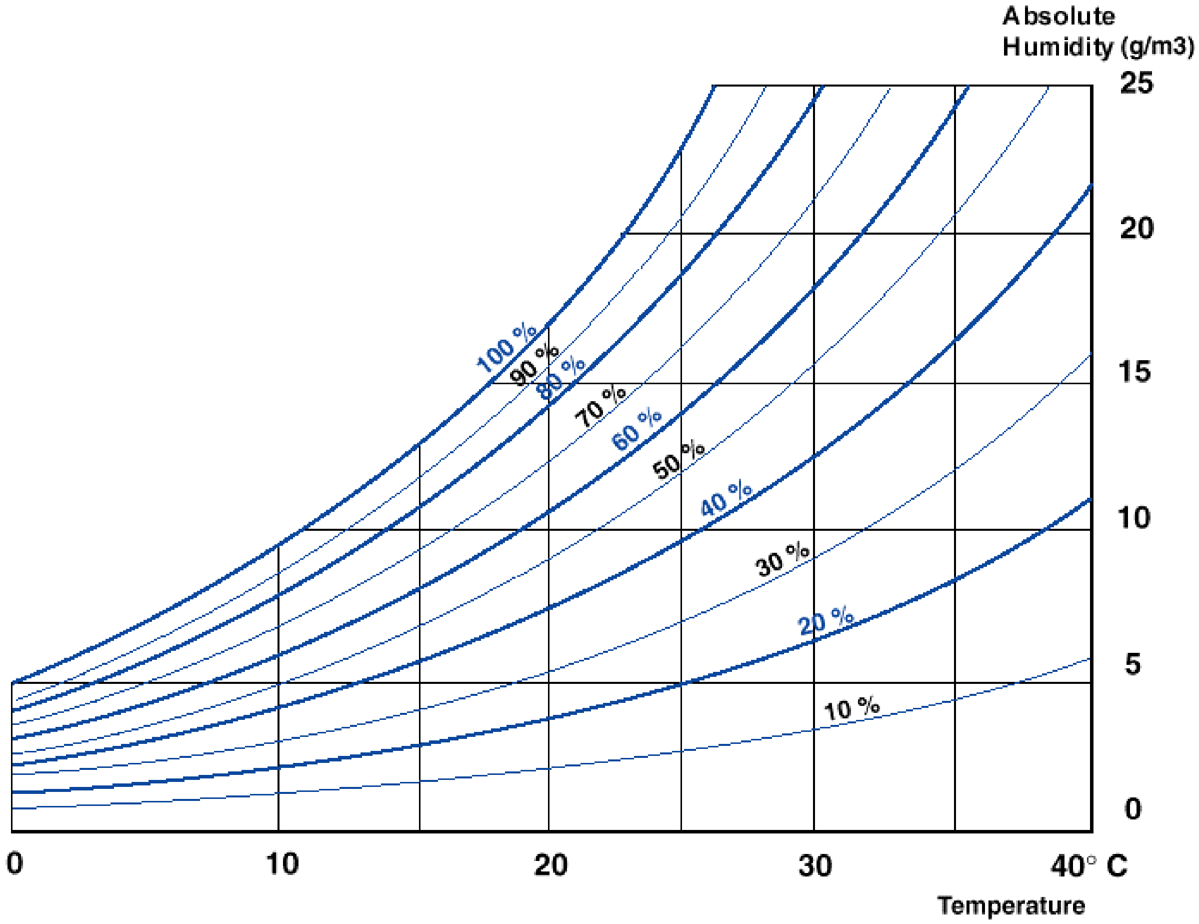
A good awareness of climate conditions in the building over the course of a year makes it possible to :

- dialogue constructively with other specialists (administrators, architects, climatologists),
- better understand the thermic inertia of the building,
- select stacks according to the stability of their climate,
- place the most fragile collections in stacks with the most stable climate,
- find out if a glass case is airtight,
- correct climatic conditions by having air conditioning installed or by using additional humidifiers or dehumidifiers.

Modification of climatic conditions

It may be that analysis of the thermohygrographic readings shows that the climatic conditions inside the stacks are not good. In that case what action should be taken to alter the temperature and relative humidity ?

Figure 2 : psychrometric chart (simplified representation)



From the humid air diagram it can be seen that there are six possibilities :

A) to increase the relative humidity while keeping the absolute humidity constant, the temperature must be reduced (= cooling the air),
B) to reduce the relative humidity while keeping the absolute humidity constant, the temperature must be increased (= heating the air),
C) to reduce the relative humidity while keeping the temperature constant, the absolute humidity must be reduced (= dehumidify the air),
D) to increase the relative humidity while keeping the temperature constant, the absolute humidity must be increased (= humidify the air),
E) to keep the relative humidity stable if the temperature goes down, the absolute humidity must be reduced (= dehumidify the air),
F) to keep the relative humidity stable if the temperature goes up, the absolute humidity must be increased (= humidify the air).

– air conditioning plant

If a building or part of a building is air conditioned, these six operations are carried out by the central air conditioning facility. These facilities have four functions :

- control and stabilise the temperature,
- control and stabilise the relative humidity,
- purify the air by filtering out dust, mould spores and gases,
- ventilate.

The disadvantages of these systems are the high capital and running costs, and the risks to the collections in case of breakdown. For the latter reason, it is preferable to have several small air-conditioning plants serving different parts of the building rather than a large facility serving the whole building.

– independent regulation of relative humidity

If the building is not equipped with an air conditioning facility, small appliances may be used such as air humidifiers and dehumidifiers to regulate seasonal variations : a dry climate in winter during the heating period and a humid climate in summer.

There are various types of humidifiers and dehumidifiers. It is very important not to place the appliances too near the collections (just beside a bookshelf or a glass display case, for example), to avoid the risk of creating microclimates. Similarly, it must be possible to detach the humidistat – which regulates the operation of the appliance – from the main body of the appliance and place it in the area that needs to be monitored, i.e. near the collections. The appliances can be connected directly to the piping (fresh water and waste water) which avoids the need to empty the water reservoir of the dehumidifier or to fill the reservoir of the humidifier. However one should ensure that the pipes are in good working order.

– passive regulation of relative humidity

In contrast to the active solutions for changing climatic conditions which have been discussed so far, in the case of glass display cases it is preferable to adopt a passive solution. For this, so-called "buffer" substances are used. These have the property of regulating the climate inside a closed volume (box, glass case, cupboard) by absorbing water vapour when the ambient relative humidity rises and releasing it when the ambient humidity goes down.

Organic materials (paper, textiles, wood) have these characteristics, but their reaction time is slower than that of silica gel which is normally used for this purpose. Having been preconditioned to the right relative humidity (for example, 50 %), silica gel will stabilise the relative humidity inside a glass exhibition case. The quantity of buffer substance to be placed inside the case depends on its volume and how airtight it is. For efficiency, it is advisable to make the case as airtight as possible.

Preventive Measures

It is possible to slow down deterioration of documents by acting on factors such as temperature, relative humidity, light, biological agents (mould, insects or rodents) chemical and mechanical agents (pollutants and dust particles). It is possible also to avoid or limit deterioration caused by human action.

The ideal environment for collections is one where the temperature and relative humidity are controlled, which is free from pollutants, which has good ventilation, where light is controlled, which is free from mould, insects and rodents, magnetic stray fields, and where good maintenance and security practices (fire, water, theft) are applied.

The best suitable preservation conditions

Carriers	Environmental Conditions											
	Temperature		Relative Humidity		Lighting	Dust	Pollution			Chemical or Biological Factors	Magnetic Fields	Shock
	level	fluctuation	level	fluctuation	intensity		sulphur dioxide	nitrogen oxides	ozone			
	°C	°C	%	% per 24h	lux *	class	parts/billion/volume				A/m	
traditional documents												
parchment and leather	18	2	50-60	5	50-200 **					isolation of the contaminated carriers, good house-keeping		appropriate protection, good handling
papyrus	18	2	50-60	5	50 **					idem		idem
paper	18	2	45-55	5	50-200 **		5 à 10	5 à 10	5 à 10	idem		idem
photographic documents												
B&W negatives and photographies	<21	2	25-35	5	50 **					isolation of the contaminated carriers, good house-keeping		appropriate protection, good handling
coloured negatives and photographies	<2	2	25-35	5	50 **					idem		idem
negatives on glass plate	<21	2	30-50	5	50 **					idem		idem
audiovisual documents												
cylinders	18	2	40	5						isolation of the contaminated carriers, good house-keeping		appropriate protection, good handling
mechanical discs	18	2	40	5		filter				idem		idem
magnetic tapes (audio and video)	18	2	30	5		<100 000				idem	<400 AC <800 DC	idem
CD (replicated) CD (recordable)	20	3	40	5	very sensitive	<10 000				idem		idem

Prevention of deterioration caused by humans

Damage due to human action can be minimised. Negligence is often the result of lack of training in the techniques of preventive conservation and lack of understanding of the consequences of poor conservation conditions and handling. Especially with the ever-growing importance of machine readable formats, and the enormous progress of technology, the training of staff must be organized as an ongoing, continuous process. Damage from vandalism and theft must be reduced by the installation of suitable systems for protection and surveillance.

Disaster Prevention

As for disasters (fire, flooding, earthquake…), the aim of any preservation policy must be to limit the potential risks as far as possible and increase the chances of rescuing materials in case of disaster. It can be helpful to prepare a disaster plan in advance, to save time in an emergency. For that it is vital to know which procedures to apply, to test them and include them in periodic security exercises involving all the library staff. An up-to-date address list must be kept indicating who to call in case of disaster (the fire brigade, companies specialising in refrigerated transport, freezing and freeze-drying, for example).

Prevention of pollution

When storage areas are air-conditioned, air pollution can be reduced by using efficient air filters. However, electrostatic filters should be avoided, as they give off ozone, a powerful oxidising agent. In all cases, regular maintenance of the stacks and collections by dusting will minimise deterioration. It is essential that the vacuum cleaners used for dusting be fitted with absolute filters, to avoid dispersing the spores of micro-organisms into the air.

Prevention of damage caused by light

As we have seen, natural light, fluorescent lamps and tungsten-halogen lamps all emit a not insignificant quantity of ultraviolet radiation which is disastrous for the organic materials which go to make up the great majority of our documents. For this reason it is essential to eliminate such radiation. This can easily be done using self-adhesive film for glass surfaces, organic filters for fluorescent lamps, and mineral filters for halogen or metallic halide lamps. It should be noted that laminated glass used in the building industry cuts out 95 % of UV radiation and that there exist tungsten-halogen lamps and metallic halide lamps with anti-UV treated bulbs.

Similarly, infrared radiation must be reduced. In the case of natural light, this can be done both by the design of the building, and by using additional equipment such as shutters and sun blinds, films, or - even better - special glass for solar protection. In the case of artificial light, the best solution is to keep light sources away from documents. Fibre optic technology offers an excellent solution, provided that the source of light (and heat) is kept well away from the documents on display. For stacks and stores another solution worth considering is the "light guide" technique (not to be confused with optical fibre, which is a different technology).

Naturally, visible radiation must also be controlled. It must be eliminated in all places where there is no human activity. For an exhibition, the light exposure level (i.e. the lighting level multiplied by the number of hours of exposure) must not exceed 84 Klux hours/year, and must even be reduced to 12,5 Klux hours/year for certain documents made of very sensitive paper (wood pulp base). These levels are important because the photochemical action of electromagnetic rays is cumulative and because, for example, the damage caused to a document by lighting at 50 lux for 10 000 hours (3 years at 8 hours per day) is the same as the damage caused by lighting at 1 000 lux for 500 hours (2 months approximately). There too, glass, blinds, film and other systems help to counter the action of light.

Among all heritage materials that are the most sensitive to light, graphic and photographic documents are to be found in the first place. They can be divided into three categories depending on their constituents, state of conservation and sensitivity to light :

- highly sensitive documents (B&W photographs, etc.),
- very highly sensitive documents (B&W prints on resin coated paper, etc.)
- extremely sensitive documents (colour prints, etc.).

Depending on these categories, the levels indicated below should not be exceeded. These levels are called Total Amount of Exposure (TAE). They can be obtained by multiplying the intensity of light by the total duration of exposure. It is expressed in lux.hours (lx.h).

Levels of light sensitivity	**TAE**
insensitive	---
sensitive	600,000 lx.h/year
very sensitive	150,000 lx.h/year
highly sensitive	84,000 lx.h/year
very highly sensitive	42,000 lx.h/year
extremely sensitive	12,500 lx.h/year

Note 1 : levels dealing with graphic and photographic documents are shaded.
Note 2 : light has a cumulative effect : the same amount of damage will result from exposure to light at 50 lux per 250 hours every year as 150 lux per 250 hours every three other year.

Prevention of damage due to magnetic stray fields

Stray magnetic fields are the natural enemy of magnetically recorded information. Sources of dangerous fields are dynamic microphones, loudspeakers and head sets. Also magnets used for magnetic notice boards etc, possess magnetic fields of dangerous magnitudes. By their nature, analogue audio recordings, including audio tracks on video tapes, are the most sensitive to magnetic stray fields. Analogue video and all digital recordings are less sensitive. For the safeguarding of analogue audio recordings is necessary to keep to the following maximum magnetic stray fields :

- AC fields : 5 Oe (Oersted) = 400 A/m (Ampere per metre)
- DC fields : 25 Oe = 2000 A/m.

It should be noted that normally a distance of 10-15 cm is enough to diminish the field strength of even strong magnets to acceptably low values.

Prevention of damage due to temperature and relative humidity

Though most of the causes of deterioration can be minimised or even eliminated, it is often difficult to correctly control the "temperature" and "relative humidity" factors. These are indeed interdependent parameters which have more variable and complex effects on documents than do other parameters.

– influence of temperature

Materials which are generally sensitive to temperature fluctuations are composite objets where the constituent materials have different extention factors depending on the temperature (enamels, for example).

Excessively low temperatures may make plastic materials fragile : they become vitreous and increasingly friable. Excessively high temperatures speed up the deterioration of unstable materials (acid paper, nitrate films, cellulose acetate films and colour films). Film archives are used to store films even to - 18° C. It is increasingly becoming customary to distinguish between access storage, which holds materials at temperatures which are acceptable for human beings as a working environment and preservation storage which keeps the materials at much lower temperatures (and lower humidities), to slow down the degradation process. Theoretically, each reduction in temperature of 10° C will double the life expectancy of these materials. However it is often not very economical to keep materials continually below the ambient temperature. Should the cooling system break down, considerable damage can be caused by condensation of water vapour on the cold surface of the materials.

– influence of relative humidity

In the case of organic materials, the majority components of library and archive documents, the levels and fluctuations of relative humidity have a much greater impact on the preservation of collections than the levels and fluctuations of temperature (95 % against 5 %). What then are the acceptable levels and variations of relative humidity ? There are no standards for relative humidity, only recommendations.

Most museums, archives and libraries in the United States and Europe have adopted the level of 50 % ± 5% relative humidity. Museums in countries with cold winters (Scandinavia and Canada) recommend levels of 40 % ± 5%, as higher levels risk causing condensation on the cold surfaces of buildings (panes of glass, walls). In fact, these figures were adopted on the basis of technical feasibility more than on knowledge of the impact of these levels of humidity on the preservation of collections.

Levels of relative humidity to be avoided fall into three categories : too high, too low, and fluctuating.

1) <u>excessively high relative humidity</u>

Excessive humidity (over 65 %) leads to the proliferation of mould and rapid corrosion of metals. The risk grows rapidly with each rise above this threshold. For example, at ambient temperature, mould will develop in a few weeks at 75 % relative humidity, but in a few days at 90 % relative humidity.

2) <u>excessively low relative humidity</u>

Humidity plays an important role in the process of chemical change in materials. In theory these processes can be halted only at 0 % relative humidity. On the other hand, excessively low relative humidity leads to dehydration of organic materials which then become fragile.

Excessively low relative humidity also furthers static charges of polymers, which is annoying in the replay of mechanical carriers and magnetic tape.

3) <u>fluctuating relative humidity</u>

Fluctuations in relative humidity should be avoided for most collections, as they lead to mechanical stresses of varying degrees (extention, shrinking). One cycle of a sudden change in relative humidity can cause visible cracking in objects (ivories, for example). Some recently restored objects are particularly sensitive to variations in relative humidity. Repeated cycles of variations in relative humidity lead to mechanical fatigue which makes the object in question progressively more fragile.

Currently, the recommendations vary greatly according to the types of materials – organic or minerals – and the composition of objects – homogeneous or composite. For a collection made up of a variety of materials, as is generally the case, either a compromise must be found, or the most fragile documents must be taken out and placed in stores with a specially controlled climate, or "microclimates" must be created for these documents (air conditioned glass cases, boxes or frames containing "buffer" substances regulating the relative humidity).

It is generally observed that the recommended level of relative humidity ± 5 % tends to be broadened to a variation of ± 10 % either side of an average value. Thus, for many collections, levels of relative humidity between 40 % and 60 % are perfectly acceptable (i.e. 50 % ± 10 %). These new environmental recommendations offer museums, archives and libraries some margin for balancing financial restrictions, the effects of the often historic character of the building, and requirements concerning relative humidity.

In temperate regions, the optimum levels of temperature and relative humidity for traditional collections are around 18° C and 55 % respectively. Fluctuations are generally accepted in the ranges 16-21° C and 40-60 % relative humidity. In contrast, for collections of photographs, microfilms, mechanical, magnetic and optical carriers, the recommended levels are lower : no more than 16° C nor more than 40 % relative humidity in the storage areas.

preservation in extreme climatic regions : the case of libraries in tropical zones

The preservation of heritage collections in geographic regions where the climatic conditions are widely different from the conditions prevailing in a part of the Northern Hemisphere is a difficult problem to resolve, as can be imagined in the light of the above recommendations. Maintaining ideal temperature and relative humidity levels would require high-performance air conditioning systems which themselves would have implications both for operating and maintenance costs and for the risk of thermic shock – two problems with significant consequences.

The further the outside temperature and relative humidity are from ideal conditions, the more difficult it is to keep the inside temperature and relative humidity close to recommended levels. To do so, a lot of energy must be expended, resulting in high operating costs. It also assumes the installation of a particularly efficient and reliable air conditioning plant, which in turn requires regular and costly maintenance. Also, for comfort, the difference between the outside and inside temperatures cannot be too great (a difference of more than 10 % causes discomfort to the human body) : to adopt "ideal" preservation conditions means either subjecting documents to significant thermic shocks when they are moved from stacks to reading rooms (with damaging condensation forming on cold surfaces like films and magnetic tapes), or forcing users to subject themselves to thermic shocks when they enter the library or the reading rooms, which is unacceptable.

The recommended solutions fall into two categories :

- a sophisticated technical solution using air conditioning throughout the buildings which must be adapted to avoid any loss of energy, with the financial consequences referred to above ;

- a compromise solution using methods which take advantage as much as possible of the qualities of certain materials (brick, earth, etc. ; commonly used in many tropical countries, for example), using architectural techniques which permit constant circulation and renewal of air in the storage areas to avoid the stagnant air that encourages mould, using buffer zones (air locks) for aligning temperature and relative humidity. While the collections may not "benefit" from ideal conditions as they would in a temperate climate, at least they are not subjected to the sudden variations in temperature and humidity which are one of the chief threats to the preservation of materials.

The solution chosen must be supplemented by a strict policy of monitoring the building : monitoring climatic variations (with recording thermohygrometers) and monitoring the development of mould and the spread of insects.

The final recommendation is to carefully consider the desired objective and the means available, in order to find a solution which, though not the most satisfactory for preservation of the collections, is the most acceptable. A cautious approach is needed, avoiding hasty conclusions and taking account of all the factors which make each case unique.

Conclusion

The basic aim of any preventive preservation policy is to reduce impacts on objects and collections. Environmental and storage conditions have a decisive effect on preservation of collections. In order to provide good preservation conditions, it is essential to plan regular checks of environmental and storage conditions, paying particular attention to methods of handling works.

Standards

Standards in preparation :

ISO / DIS 11799	Document storage requirements for archive and library materials.
ISO / WD 16245	Archives boxes and file covers for paper documents.

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Available in English, in HTML and PDF formats.
http://www.nedcc.org/manhome.htm

Preservation of Archival Records : Holdings Maintenance at the National Archives
Manual by Mary Lynn Ritzenthaler (National Archives and Records Administration - United States).
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http://www.nara.gov/nara/preserva/maintena/hm1.html

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(Preservation and Conservation of Heritage Collections in Libraries : recommended methods)
Technical specifications developed by the "Direction du Livre et de la Lecture" of the French Ministery of Culture and Communication, brought together in one volume, published in 1998. Full text version online, in French, in PDF format.
http://www.culture.fr/culture/conservation/fr/preventi/guide_dll.htm

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The Physics of the Museum Environment
Thesis and documents by Tim Padfield.
http://www.natmus.dk/cons/tp/

CALIPR - Preservation and Planning Software
An MS Windows programme for assessing the preservation needs of book and document collections for international or national planning.
http://sunsite.berkeley.edu/CALIPR/

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