GUIDELINES FOR CARING SCIENCE MUSEUM OBJECTS

CENTRAL RESEARCH AND TRAINING LABORATORY

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ABSTRACT

Right from the beginning, NCSM laid down the following as its priority area of functioning:

- *To collect, restore and preserve important historical objects which represent landmarks in the development of science, technology and industry.*

- *To preserve the relics of industrial archaeology as site museums.*

- *To collect, restore and preserve records and documents relating to the development of science, technology and industry with special reference to India and set up an archive for the above purpose.*

With these in view, an attempt has been made here to provide information for people who are interested in caring their collections but who have little or no training in museum conservation and generally have only limited equipment and funds. It is expected this booklet will enlighten them more on 'What one ought not do to museum objects' rather than 'What one ought to '.

INTRODUCTION

Museum objects are the major medium to document and interpret our scientific, technological and cultural heritage. Caring for the collections and simultaneously exhibiting them for public understanding are the principal and conflicting responsibilities, the museum professionals of today are confronting with. The first function concerns physical conservation i.e. to maintain in good physical condition the objects in the collections, while the second involves movement, handing, and transportation of exhibits in internally and externally organized exhibitions.

Objects in the collections deteriorate while in storage or in exhibition even when adequate collection management procedures are in force. Conservation, as a separate concept, comes into being in the study of the deterioration processes. When properly understood, realistic protective measures can then be taken so as to reduce the harmful effect of deterioration to a minimum.

Museums have a large variety of objects comprised of diverse materials and structures in various stages of physical conditions and there is obviously no general standard solution to conservation control. One class of objects may require one set of environmental conditions of humidity, temperature or light levels to maximize their preservation which may not be suitable for other categories. It is, therefore, important to take into account the environmental history of the objects in the collections before embarking on any sort of conservation endeavour for them.

1. CONSERVATION

Conservation is a multi-faceted concept. It starts with acquisition of an object including transportation, handling and continues up to its accessioning, documentation, storage and display. The aspects of cleaning and maintenance, protection from environmental factors and use/abuse of the object come under its purview.

Conservation of objects is done at two levels: *Preventative* and *Curative*. Curative conservation concerns treatment of objects while preventive conservation aims at slowing down the rate of deterioration of objects and thereby reducing its risk factors. Curative conservation is a time consuming process and it may take even months to conserve an object. On the contrary, every operation of preventive conservation benefits a large part of collections. Moreover, preventive conservation is needed even after curative treatment has been imparted to an object. It has to be noted that these curative and preventive aspects of conservation are complimentary to each other and the cultural heritage can not be saved without appropriate conservation measures.

1.1 CURATIVE CONSERVATION

Curative conservation, principally a specialized job requiring some amount expertise, is achieved by giving some form of treatment to an object whose stability is impaired and requires specific equipment and materials. It requires the knowledge of science with fineness of an artist. It is labour intensive requireing great amount of patience.

1.11 Methodology of Curative Conservation

It embraces the following steps:

a) Identification of Problem

Anybody, who has interest and keen eyes, can identify the nature of deterioration. It requires very little orientation for people in identifying the different types of problems encountered in an object.

b) Diagnosis of Problem

It is to identify the causes of deterioration and its extent, if possible, to understand the mechanism of deterioration. This requires expertise and specialized equipment where role of science assumes significance.

c) Documentation of Problem

It refers to recording the preservation status of the object e.g. with the aid of photography or by maintaining suitable records. These records help in comparing the results before and after the treatment.

d) Evolution of Possible Treatment

It is a theoretical exercise involving simple or elaborate laboratory tests depending upon complexities of the problem so as to reduce post treatment intricacies and cost overruns.

d) Treatment

It is to execute conservation treatment with utmost care and dedication, which, at times, involves the following steps:

* Removal of deterioration products.
* Removal of causes of deterioration.
* Imparting of strength to the object by consolidation or mending.
* Application of preservative coatings.

While providing a treatment, it is essential to see that the conservator should not lose the ethics of the conservation in regard to the following:

i) *Nature of material* (use of similar, stable and less strong material)
ii) *Nature of process* (reversibility of the treatment, minimum losses, re-integration, process economy)
iii) *Preservation* (context, age and value of the object)
iv) *Whether to restore the whole or the part of the object* (aesthetics, museological values, manpower, time etc.)
v) *Documentation* etc.

f) Documentation of Treatment

It is to record the whole treatment of conservation in data sheets for future reference. Documentation of the process from time to time especially through the Black & White photographs is very useful at this stage.

g) Maintenance

Post treatment maintenance of the object being very important, maintenance schedule should be formulated depending upon storage and display conditions.

1.12 Managing Curative Conservation

To achieve tangible results, the following are the essential requirements:

a) Manpower: Conservation treatment, curative or preventive, connotes to a collective effort. For preventive conservation, it is teamwork amongst different levels of museum staff right from the lowest to the highest level and even general public or visitors. For curative conservation, a specialized team of defined number of personnel is put to work according to the demand of the type of conservation process to be undertaken.

b) Laboratory: A proper workplace that facilitates unhindered work opportunities to a conservator with proper security arrangements is a pre-requisite. In majority of the cases, the treatment being a prolonged one, it may not be possible to remove the object under treatment after each day's work. The laboratory area, therefore, should have proper facilities required for successful conservation work.

c) Conservation Literature: For keeping a conservator abreast of the latest development in the field of conservation and for providing updated information regarding newly developed materials and methods, the accessibility of conservation literature to the professionals should be a prime consideration.

1.2 PREVENTIVE CONSERVATION

This is an area, which requires the utmost attention at NCSM in the present-day scenario. Here the basic aim is to slow down the rate of decay by way of adhering to good housekeeping practices and by maintaining equilibrium between the object and its environment. Albeit labour intensive, the steps involved are economic and simple, do not require any specialized training and achievable without much expenditure. However, regular attention and sustained action are the prime requisites in this type of conservational effort. This is one area where the teamwork is the most necessary aspect involving all and sundry in the organization.

1.21 Method of Preventive Conservation

Preventive conservation can be achieved anywhere and everywhere. However, for the sake of convenience, these are classified into the following categories:

a) During Display: Preventive conservation during display usually considers relative humidity (RH), temperature and lighting conditions vis-à-vis the nature of object displayed. It also involves consideration of the material of the showcases, general aspects of the housekeeping of the display area and the duration of display.

b) During Storage: Most of the time, bad storage is a very potent cause of deterioration of the objects. Therefore, proper maintenance of climatic condition, permissible illumination levels, proper area for circulation, timely removal of deteriorating agencies and fumigation, regular dusting and inspection in the storage area can arrest the deterioration process to a great extent.

c) During Handling & Transportation: Proper care exercised during handling of objects and their transportation saves a lot. For example, the use of RH buffers for transportation to long distances especially may take care of fluctuation in RH during transit.

2. DETERIORATION OF MUSEUM OBJECTS

The museum fraternity all over the world is concerned about the deteriorating condition of exhibits and collections. The condition of an object depends upon two main factors: (1) the material of which the object is made up and (2) the condition to which it is subjected.

2.1 MATERIALS OF MUSEUM OBJECTS

Three classes of museum objects are available:

a) *Inorganic* – Metal, Stone, Ceramic, Glass, etc.
b) *Organic* – Paper, Textile, Bone Ivory, Leather and Wood
c) *Composite* – Paintings on paper, wood, textile, wall.

The natures of decay observed in different objects are diverse dependent on the types of materials the objects are made up. The following may be mentioned in this context:

1) Fading of colours,
2) Yellowing,
3) Stains,
4) Splitting,
5) Flecking,
6) Cracks,
7) Weakening,
8) Brittleness,
9) Powdering,
10) Pits and Holes,
11) Dust and Grime,
12) Microbial growth,.
13) Folds,
14) Corrosion,
15) Salts etc.

As is mentioned beforehand, the specificity of nature of deterioration in respect of specific materials amongst the museum objects brings out the following classifications:

Oil Paintings- yellowing, tears, flecking of painting, bulges etc.

Paper- yellowing, stains, folds, fungal growth, insect holes, embrittleness etc.

Textile – holes, fading of colours, loss of strength, grime, dust, strains, folds, tears etc.

Leather – powdering, cracks, fungal growth, loss of flexibility etc.

Wood- holes, cracks, bulges, insects, fungal growth, dust and dark, weakening etc.

Metal – corrosion, biting, tarnishing, patination, soiling, accretion.

Stone – powdering, accretion, brakes, chipping, salts, crust formation.

2.2 CLIMATIC CONDITIONS OF MUSEUM OBJECTS

Climatic conditions bring about deterioration to the body leading to its total or partial damage. Though deterioration is primarily of three types: physical deterioration, chemical deterioration and biological deterioration, it occurs with synergetic effect involving a number of combined factors.

a) Mechanical Deterioration: Many substances particularly cellular ones (paper, bone, ivory, wood, textile etc.) are hygroscopes. Rapid changes in humidity level of the atmosphere can cause breaking down and excessive & prolonged dryness may cause permanent damage. Soluble salts may crystallize on drying leading to flaking or disintegration of the material.

b) Chemical Deterioration: Most of the chemical changes, such corrosion of materials, discolouration of tissues, dissolution of material etc. in the artifacts require water and are accelerated at higher temperatures.

c) Biological Deterioration: The primary cause of damage, if humidity is controlled, is the formation of moulds (fungus growth). The mould formation is generally agreed to be at a relative humidity level of about 65%.

2.3 FACTORS OF DECAY

On analysis of the entire spectrum of deterioration process in the museum objects, it is found out that the following factors are responsible for such occurrence:

2.31 Temperature: Temperature affects the objects of cultural property in different ways. In a direct manner, the rise in temperature can change the dimension of an object when exposed to heat rays. This dimensional change being proportionate to rise in temperature produces unwanted stress in the body of the object and in fragile objects, this is extremely fatal. Even in sturdy objects, the cyclical expansion and contraction with rise and fall in temperature can produce irreparable stress, which might lead to ultimate breaking down of the object. Indirectly, the rising temperature can as well increase the rate of decay by enhancing the rate of chemical reaction that doubles with every 10-degree centigrade rise in temperature. Temperature variation also induces water related hydration-dehydration cycles in which water gets into the body of an object at lower temperature and comes out of it at higher temperature.

2.32 Humidity: Contrary to the popular belief that temperature is more injurious to the cultural property, this humidity and moisture content in the atmosphere cause massive damage to the objects by a significant proportion. The rate of decay also depends on the nature of object i.e. whether it is organic or inorganic. Inorganic metals like stone, ceramic, glass metals are more durable than the organic metals such as paper, leather, textile etc. Water being an essential component of all living beings, the organic objects are more prone to damages due to humidity and this rate of decay is usually exponential in nature.

HUMIDITY TOLERANCE FOR MUSEUM OBJECTS

Material	Acceptable humidity limits high to low		Effect of rapid humidity changes	Susceptibility to mould at high humidity
Paper	65% R.H	40-45%R.H	Rapid. Loose leaves tolerate moderate changes	Extreme. For safety 60% R.H. should be adopted as upper limit.
Stretched paper	65% R.H	45% R.H	Paper screens, drawings, pastels stretched on frames will tear from shrinkage in dry atmospheres.	Extreme
Fabric (Natural Fibres)	65% R.H	45% R.H	Rapid	Marked
Parchment Vellum	A steady state near 55% R.H		Extremely rapid, Dryness causes loss of flexibility.	Moderate because of inherent alkalinity.
Leather	65% R.H	45% R.H	Variable according to tanning process.	Variable. Marked for many fine leathers.
Bone Ivory	65% R.H	45% R.H.	Very slow, except in thin sheets. Avoid hot lamps in cases for emphasis lighting.	Negligible except at very high R.H.
Wood	65% R.H.	45% R.H. (Critical)	Slow, depending on massiveness and surface Coatings. Affected by weakly cycles and especially by seasonal cycles.	Negligible except at very high R.H.
Painted Wood	65% R.H.	45% R.H (Critical)	Dryness causes shrinkage of wood and is especially damaging to objects in which wood is the structural support for other materials. A painted wood panel is typical. Wood sculpture, furniture, models, musical instruments and decorative objects may be coated with a gesso plaster, then painted or gilded. These rigid coatings are more or less unaffected by humidity but if the supporting wood shrinks the coatings are compressed, causing them to buckle or blister and flake off.	
Metal, Stone, Ceramic Plaster	Not normally responsive		Some polished metals, notably steel, corrode at humidity above 45% R.H. Bronze, Stone, Ceramic and Plaster long buried may have been infused with or corroded by salts, which behave hygroscopically. These should be examined and treated if possible. Cases of bronze disease can be kept benign in a dry atmosphere.	

2.33 Light: Light is necessary if the object is to be seen and appreciated. But the light may be a major source of deterioration of the objects, when illuminated non-proportionately. In general, objects like stone, metal, ceramic, wood, bone ivory etc. are relatively unaffected by light whereas those like textiles, photographs, papers, animals and plant specimens and all organic metals are susceptible to it. Types of museum objects that may be considerably deteriorated by light are: 1) Pigment and Dyestuff (including ink), 2) Textile, 3) Paper and cellulose material, 4) Thin film of organic materials used as varnish, adhesive etc. 5) Various other organic metals.

Pigment and Dyestuff

a) Water Colour : Water colour paintings with very little binding metal and non-protective coating of varnish when exposed directly to light, the pigment particles fade away. In direct contact with atmospheric oxygen, fading aggravates.

b) Oil Paintings: Although the oil medium and varnish coating provide protection to the pigment, some serious colour changes do occur. Light often bleaches the brilliant colour to its pale form. The natural resin varnish is subject to discoloration and beyond a certain point, varnish becomes too coloured to be tolerable.

c) Dyes in Textile and Textile Fabrics: Textile as a whole is very much sensitive to light. Its main constituents being cellulose (in vegetable fibre) and polymeric protein (in animal fibre), it derives its strength from the size of the cellulose and protein molecules; higher the size of the polymer molecular, greater is the strength of the fibre. Under the influence of light, a complex series of reactions take place breaking the long molecules into weak/tender small molecules of fibre.

d) Materials of artificial fibres are also more or less sensitive to light as cellulose range of synthetics resemble similar characteristics as to cotton. Some other materials such as nylons, PVC, are light sensitive too.

e) Paper and other material in sheet form

The base material of paper is cellulose. Therefore, embrittlement and discoloration of paper is almost similar to that of cotton.

Light Sources: All light sources, natural or artificial, emit ultraviolet, infrared radiation in addition to the radiation in the visible range. It is now universally accepted that UV radiation is the main cause of degradation of museum objects. Since ordinary glass absorbs UV having wavelength up to 325 nm, radiation in the wavelength between 325 nm to 760 nm should be of principal consideration for museum purposes. The damage caused to the different objects due to radiation energy is not always physical. In fact, they are mostly chemical and hence irreversible. Radiation initiates chemical changes in a metal and therefore energy content of the radiation is quite important.

It is widely accepted that UV radiation should be removed from the light as much as possible. Therefore light intensity and length of exposure are to be brought to the minimum. The damaging effect of the light depends on the following:

1) Spectral characteristics of light
2) Intensity of light
3) Duration of exposure to light
4) Susceptibility of objects to light
5) Certain external factors like humidity, temperature and oxygen content influence the rate of deterioration by light.

2.34 Micro-organisms, Insects & Pests: Various kinds of airborne micro-organisms under conditions of tropical climate or in stagnant or enclosed environments, thrive causing moulds and mildew stains on objects. Pests found in the home vary widely in nature and size, from insects to rodents. Wood, textile, paper, photographs, books, leather, feathers and especially organic substances with foodstuff are very attractive to insect populations. High relative humidity may encourage the propagation of insects. Low temperature may make them dormant but probably will not kill them.

Protection of museum objects from insect deterioration is very essential. In fact, only a small percentage of insects has propensity to become a serious pest. These few can wreck havoc on the collections within a short span. Some of the major insects causing damage to museum objects are:

a) Silver Fish – They prefer to live in dark places feeding on carbohydrate and protein rich materials like paper, fabrics, glue and pest book binding etc. Humid situation is favourable for attracting Silver Fish.

b) Cockroach – Being fond of starchy material, they live on leather, hair, wallpaper, animal skin and dead insects. Damages caused by cockroaches are holing, and notching of edges, staining as a result of vomiting and depositing faeces.

c) Book Worm Beetle – They feed along the backs of the book covers, cutting the threads that binds the book together.

d) Wood Boring Beetle – These insects are of prime importance so far as bio-deterioration of museum objects are concerned. The first sign of injury in case of beetle is the presence of small holes on the surface of the wood. Some of the common and active beetles for museum objects are as follows:

   i). Furniture Carpet Beetle;
   ii). False Powder Post Beetle;
   iii). True Powder Post Beetle;

e) Leather or Hide Beetle – They feed on leather articles, hair, fur, feather specimens, skin of mammals.

f) Termites – Termite devour materials rapidly and silently feeding on anything of cellulose nature.

g) Cloth moths – The most common pest of textile is webbing cloth moths.

INSECTS CAUSING DETERIORATION TO COLLECTIONS

Insect	Form of Deterioration
Wood borers (Anobium)	Bores into wooden objects, causing weakening of structure; sometimes into bookbinding.
Dermestid beetles: Carpet beetle (Anthrenus) Hide beetle (Dermestes Vulpinus)	Feeds on hair, wool, feathers, entomological collections, protein materials. Affects leather, natural history specimens, e.g. birds' skins
Silver fish (Lepismatidae)	Surface and interior damage to paper, books, documents, photographic plates and herbarium specimens.
Cockroaches (Blatta orientalis)	Damages wool, leather, paper, books
Termites (Isoptera)	Irreparable loss or damage to wooden objects, furniture, books, paper and cellulosic materials.
Case-bearing clothes moth (Tinea pellionella)	Destroys mainly woolen fabrics, but also damages hair, fur, feathers, bird skins.
Book lice (Liposcellis)	Surface damage to paper, leather, watercolours, gelatinous materials, e.g. photographic film and plates.

Bio-deterioration of museum objects due to fungal attack is extremely far-fetched unless timely intervention is taken:

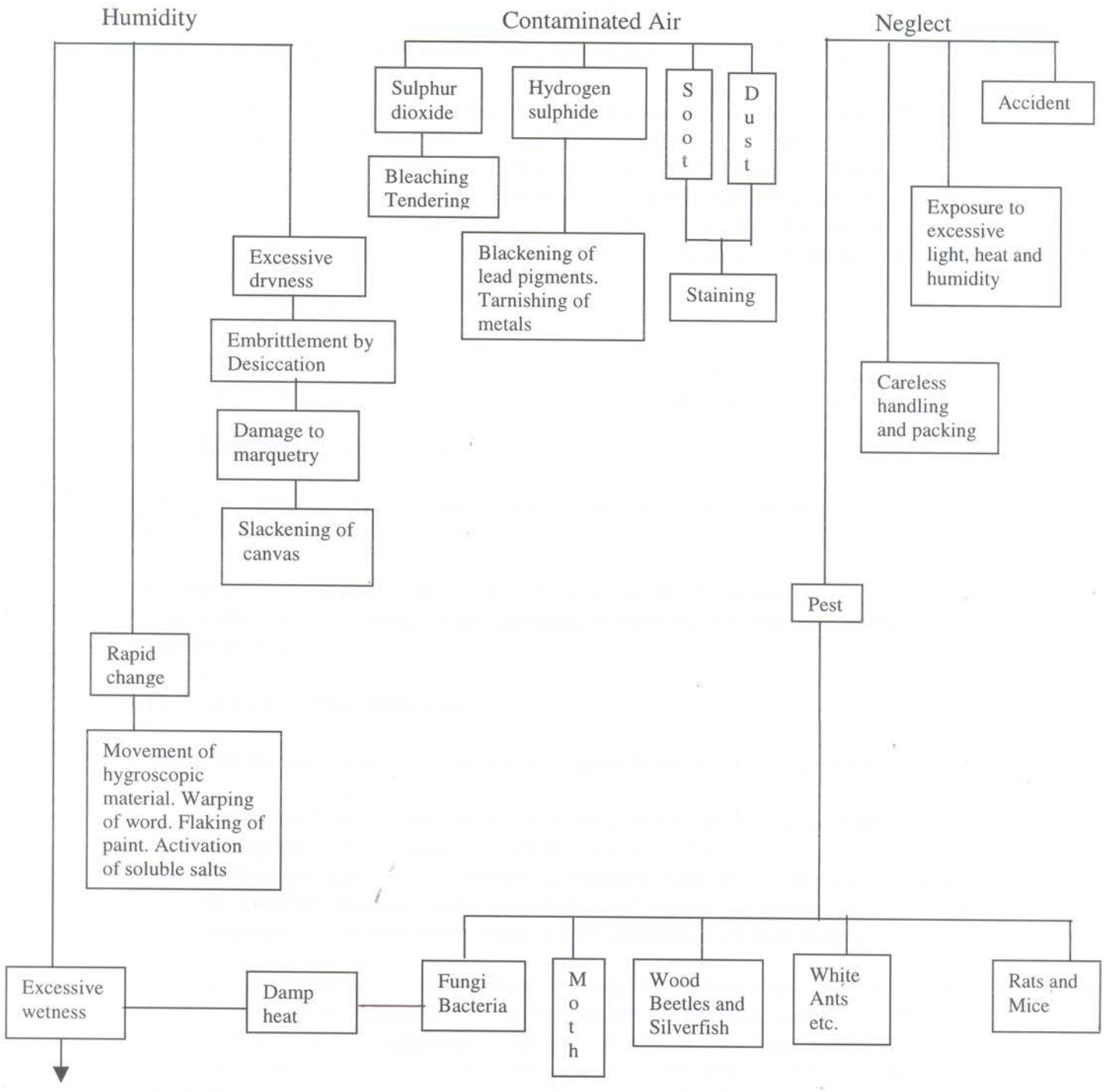
Nature of Material	Materials	Symptoms of Deterioration
Organic	Paper	Causes stains, change in mechanical characteristics (feltis & fragile), foxing (brown spots)
	Wood	Stains, Change of wood colour, softening, cracking, change in mechanical characteristics
	Textile	Stains, Discolouration, Fibrillization, Im-penetrations, loss of strength, development of odours etc.(Mildewing Textiles)
	Parchment & Leather	Spots, Stains, Whitish flecks, loss of tensile strength, increased stiffness
	Fur	Falling of hair, sticking of hair, loss of strength
Inorganic	Glass	Black spots, Opaqueness
	Metals, Stones and related materials	Corrosion. Coloured stains and patches, Exfoliation, pitting.
Composite New Materials	Paintings	Stains, Softening, Cracking
	Synthetic materials (Plastic & PVC etc)	Spots, Stains, Discolouration, Softening

2.35 Negligence and Vandalism: Human error and vandalism also affect the long-term preservation of museum objects. Mishandling leads to irretrievable loss. Breakage is the most obvious form of damage, but one may also see fingerprints etched into highly polished material surfaces, smudged pigments, torn canvasses, pulled or torn textile fibres and accidents that could be prevented with forethought. Certain standard guidelines for protection against theft, fire, flood, disaster etc., as suggested by noted bodies, may be had in the APPENDIX-I.

2.36 Museum Buildings: Poorly designed, built or maintained buildings create environmental problems. The most common problem is the entry of water into the building with the resultant high humidity levels. Water entry might be from

1) leaking roofs, walls or windows while allowing entry of rainwater,
2) porous walls and / or ineffective damp courses facilitating entry of ground water,
3) poor positioning of gardens and garden watering systems causing sections of the building be frequently wet,
4) poor ventilation of service areas and bathrooms allowing water into the gallery areas.

This chart illustrates the main causes of damage to museum objects



Weakening of adhesives
Rotting of size
Staining of paper, vellum etc.
Blurring of inks
Mildewing of leather
Metallic corrosion encouraged
Loss of adhesion of illuminations
Adhesion of loaded papers
Tightening of canvas

3. CONTROL OF DECAYING FACTORS

3.1 CONTROL OF HUMIDITY & TEMPERATURE:

Control of relative humidity (RH) is very significant in tropical countries like India where temperatures are generally hot and RH variations are pronounced. RH should be maintained within tolerable limits that may vary from object to object. Yet it is possible to work out a value which is tolerable for a majority types of objects with a few exceptions. After considerable study, it is recommended that RH in museums should range between 45-65% and temperature variation should be between 20-25 degree centigrade.

For maintaining RH in display room, showcases, storage area or during transit various types of materials are used to keep it within the desired limit. Inside a room, both humidifying and dehumidifying equipment are used to control humidity.

3.11 *Humidifying Equipment*

Humidifiers work on the principal of converting liquid water into water vapor. These are of two types:

*Atomizing type – room coolers or desert cooler fall under this category.
*Evaporative type – working on the principle of blowing air over absorbent materials soaked with water.

3.12 *Dehumidifying Equipment*

It works on the principle of removing water vapor from air. These are of two types:

I) Desiccant type - Here moisture is removed from air by blowing moist air through drying or desiccant materials such as silica gel.
II) Refrigerant type – Like domestic refrigerator, here the room air is first cooled by passing through coils containing refrigerant materials so that water condenses. This condensed water is then drained away thus reducing humidity.

An ideal solution to this problem is complete air-conditioning of the area for all the 24 hours round the clock which is difficult to maintain in reality. The usual tactics of switching air conditioner at the time of opening of office and switching off when closing the office will cause more damage to the objects than a system of no control measures. The reason is that with no airconditioner, the object remains in equilibrium with the environment and the changes are less abrupt and thereby the chances of damages are far less.

However, there are some cheaper options, which are quite effective. Use of buffer or some specific salt solutions, materials like cotton, paper, sawdust, silica gel etc. act as buffer between the objects and air. Silica gel is the most common buffer used in display and packing cases. Generally, 0.5-1 kg. of silica gel is considered sufficient for maintaining RH in sealed show cases of dimension of one cubic meter. It has to be noted that these materials need recharging from time to time. It is easy to

identify when the silica gel would require recharging as these turn pink upon saturation. To recharge, it is advisable to heat the pink silica gel at 65 degree centigrade when these again turn to blue colour. Silica gel is thus ready for reuse.

In some cases, certain saturated solution of specific rates can provide specific RH. Say, a saturated solution of magnesium nitrate keeps RH of 50% whereas that of sodium bromide maintains an RH of 58%.

In some rooms, relative humidity can be increased by keeping the potted plants or by using khus screens kept moist with water. In fact, RH is a matter of compromise, which is always worked out keeping in view the conditions and facilities available for storage/display of the cultural objects.

3.2 CONTROL OF LIGHT

3.21 *Choice of Appropriate Light Sources*

For general lighting, tungsten fluorescent or metal halide lamps may be used.It gives out light from a tungsten filament heated to about 2700 degree centigrade converting only 6% of the total energy to light and rest to heat. A reflecting surface inside a bulb of this variety reflects all the heat back and allows only light to pass through. During heating of the filament, some amount of tungsten vaporizes and settles on the glass leading to blackening of the glass.

3.22 *Elimination of Ultraviolet Radiation (UV)*

Although damage by light due to ultraviolet radiation (UV) can never be entirely eliminated, it can be reduced by 1) UV filter, 2) Low UV emitting light, 3) reduction of illumination level. However, it should be reduced to the minimum, necessary for comfortable viewing in the following way:

1) Eliminate natural light in favour of using controlled artificial light.
2) Use defused light instead of direct lighting.
3) Use of time switches on showcases/ storage areas containing objects.
4) Alternate between display and storage for that material which is particularly light sensitive.

Ultra violet filters prevent UV radiation of 400 nm but allows the passage of visible light. There are some synthetic materials with UV absorbing properties. If we try to filter out all UV content, some of the bluish radiation will be filtered out as well and resultant effect is light yellowness in the light. The safe limit in UV radiation in museum is around 75 w/lumen. UV filters can be used on the glass cover of showcases or as cover of light sources. Its thin foils can be sandwiched between two glass sheets so as to be used in exhibits. Varnish on the glasscover of showcases shields UV component from reaching the objects. Indirect form of lighting e.g. light reflected from a surface coated with zinc oxide or titanium dioxide is a good methodology of controlling UV radiation to the safe limit.

3.23 *Elimination of Visible Radiation*

Notwithstanding the fact that UV radiation is principally responsible for damage, once the degrading process sets in, it may get aggravated by visible radiation as well. So it is enough to remove UV radiation only from falling on objects.

3.24 *Regulated Illumination*

It is an acceptable factor that the detrimental factors of light can not be eliminated altogether. However, damage may be minimized by carefully chalking out lighting arrangements and balancing the two factors: 1) Proper viewing of objects and 2) Damage caused by light.

In limiting the brightness of the museum lighting, it has to be seen that the effect of illumination level will be such that one is able to see small but significant difference in forms of colour and objects. It is often found that an object looks better in some lighting situation than in others. One needs to find out the best possible situation. The following is a useful guide for museum lighting:

a) Object insensitive to light such as metal, stone, glass and ceramics, stained glass, jewelry, enamel bones etc.: Illumination level is **unlimited** subject to display requirements and heat radiated from light source.

b) Object sensitive to light where colour changes are not of great importance e.g. wood, oil painting, undyed leather, horn, oriental lacquer etc.: Illumination Level is **150 lux**.

c) Objects highly sensitive to light e.g. textiles, costumes, water colours miniature paintings, manuscripts, wall paper, dried leather, ethnography specimens containing furs and feathers (basically organic objects): Illumination level is **50 lux**.

At 50 lux, artificial lighting is preferred, as it is difficult to control daylight at this level. 50 lux from incandescent lamps appears brighter than 50 lux of defused daylight. For 150 level, modified UV free natural light compensated by artificial lighting is recommended.

3.25 *Rational Planning of Galleries*

For comfortable viewing, our eyes should be fully adopted while entering into the galleries and therefore, planning should be such that the visitors pass gradually from higher level of illumination to lower levels. Objects insensitive to light and illuminated brightly should be placed first at the entry of the museum followed by the galleries displaying modestly sensitive objects and the most sensitive objects requiring low level of illumination should be placed at the last.

3.26 *Adoption of Other Control Measures*

Material should be exposed to light for as short period as possible. The following are some general measures for reducing exposure to radiant energy:

1) Limited exhibition of material
2) Use of curtains
3) Illumination only while on viewing
4) Use of replica
5) Security aspects – for security reasons, light in the gallery should be on overnight, but the illumination level in no way should be more than 10 lux.

6) Position of sources of light is another important aspect for safer lighting arrangement. A sculpture is better seen by direct lighting from above at around 45 degree and keeping ceiling and wall light toned but the floor of neutral colour.

7) For tapestries, hangings, paintings etc., light should be as close as 30 degree to the vertical for excellent viewing at times. To soften the edges of shadows of contours, the light source should be extended to make an angle of 8 degrees.

8) Window-Windows in museums need special attention. It is often found that windows are kept due to a wrong notion that colour rendering suffers under artificial lighting system. Moreover, some do not like to get totally closeted without any window facilities in the gallery as well. It may be noted here that windows should be provided in the galleries for purposes anything other than as source of light. Exhibits kept by the side of windows may be victim of hazardous ultra-violet radiation. If it is at all required that in any area of the gallery window is to be used for lighting, light may be let in after reflection i.e. indirectly from a surface painted with zinc oxide or titanium trioxide.

Measurement of Radiant Energy

For proper control of radiant energy inside the gallery, it is often required to measure ultra violet and visible radiation. Luxmeter measures the light of the visible spectrum. The ultraviolet monitor is suitably designed to measure the proportion of ultra violet radiation in the light and is expressed in terms of energy of ultraviolet radiation in the luminous flux. A convenient unit to measure ultra violet radiation is μw / lumen.

3.3 CONTROL OF BIO-DETERIORATING AGENTS

3.31 Control of Fungi Attacks in Museums

1) Keep RH below 65%, this will prevent fungal growth on museum objects.
2) Monitor the RH throughout the museum to detect damp areas. Exterior wall and floors should receive special attention.
3) Do not store exhibits directly against outside wall.

4) Storage rooms built with floors on grade (level with the outside ground) or below grade are particularly vulnerable to flood water.
5) Lowest shelves and cabinets should be raised at least 10 cms. above the floor.
6) Examine collections for fungal growth often specially in damp seasons.
7) Maintain proper air circulation in storage and display areas to prevent high RH zone formation. Fans and dehumidifiers are recommended.
8) Instruct the cleaning staff to avoid splashing cleaning agents on exhibits/exhibit cabinets etc.
9) Keep collections clean and free of dust with sealed cases cabinets or dust covers.
10) Do not drape plastic cover over artifacts resting on sources of moisture e.g. slab or grade concrete or earth floors.
11) Make prompt repair in roofs, gutters, pipes etc.

Use of Fungicidal Paper

1.Dip white blotting sheets or tissue paper in 10% alcoholic solution of thymol or orthophenyl phenol.
2.It may be used in packing (non-painted materials).
3.Interleaving the books.
4.Between the layers of costumes, leather objects etc.

Precautions for the Use of Biocides

1.Biocides should be stored with proper labels.
2.Check corrosion or leakage.
3.No drinking water, tea etc. in that area.
4.Putting on gloves, goggles and apron while working with biocides.
5.Gas mask should be used.
6.Always have a first-aid box.
7.After completing operations, hand and face should be properly washed.

3.32 Control of Insects

Control of museum pest is a specialized job. Out of wide range of available insecticides, only a limited number can be recommended for use in museums. Thus, the toxicants used for such purpose should be non-staining and should not in any way affect the original texture of the specimen and other museum objects. After all, such chemicals have to be harmless to human being, but lethal to insects even at low doses. Chemical methods for insect control are practiced when infestation has already taken place.

Preventive Measures for Insects

*The showcases and display boxes dried with insect repellant such as Chloroform, creosote, Naphthalene (CCN) or Paradichlorobenzene, creosote and benzene (PCB) in equal quantities are very effective against dermestids, clothes moth, cockroaches, termites and silverfishes.

*Baits are also very effective control measure against silverfish. The following baits may be noted:

1) Oatmeal powder – 86 part by weight, sodium fluoride 7 part by weight, salt 2 part by weight, sugar 5 part by weight.

2) Sodium fluosilicate 1 part, flour 5-8 part by weight, pyrethrum (powder) 0.25%, Boric acid, simply sprinkled, controls cockroaches within 3-4 days. They die of desiccation in contact with boric acid.

*Natural plant products used in prevention of objects from insect attacks

1) Neem leaves and seeds
2) Custard apple seeds
3) Kharanja seeds

Neem leaves are shade dried and placed in muslin bags between the textiles. Deoiled seed powder is used in showcases as antifeedants.

*Miscellaneous non-chemical methods for prevention of insect damage include the following:

1) Reducing moisture contents of items and buildings.
2) Trapping with sticky traps, light traps or jars traps.
3) Screening pest entry points.
4) Sealing or removing pest harborages.
5) Physically removing pests e.g. by vacuum cleaner brushing.
6) Cleaning attractant stains from fabrics etc.
7) Use of attractant or repellant lighting.
8) Use of ultrasonic.
9) Removing surfaces preferred by pests (e.g. German cockroaches like Bare wood).
10) Plastic bags used for protecting museum items during transit and storage, which are resistant to insect than paper or cardboard packing.
11) In order to prevent the infestation of museum objects it is suggested that all items brought into museum, whether from expedition, new purchases or travelling exhibition must be fumigated before being preserved.

Documentation of Treatment

This is an important aspect in the entire conservation process which helps keep records for future reference. Different types of records of treatment and examination formats are used by museums depending upon the type of artifacts in collection, some of which have been referred to the APPENDIX-II.

4. CARING AND PRESERVING MUSEUM OBJECTS

4.1 FURNITURE AND WOODEN OBJECTS

Furniture and Wooden Object can be maintained for years provided some basic care and attention is given as a part of preventive measures. The following fact sheet helps understand and minimize or eliminate conditions that are detrimental to this type of objects.

4.1.1 Causes of Damage & Remedial Measures

a) **Handling:** The prime cause of wooden objects is careless handling and use.

b) **Environment**

Light Levels: Wood finishes, stains and some paints are susceptible to darkening and fading from exposure to high light levels. For this, wooden objects should be exhibited and stored in a dim area where bright light is not allowed to fall on them. Excessive light can also accelerate the aging and degradation of finishes resulting in a cracked, brittle or alligatored appearance. The heat generated from high light levels can cause damage to finishes by softening them.

Temperature and Humidity: A porous material like wood swells on absorption of moisture when humidity levels are high. Conversely, wood shrinks in a dry environment leading to formation of structural cracks, lifting veneer and inlays, gaps in joints and the embrittlement of adhesives. The fluctuations in temperature result in similar damage. Damage should be minimized by ensuring proper temperature and humidity.

c) **Cleaning**: Extensive cleaning of severely damaged or darkened finishes should be carried out at the earliest. Porous or unfinished wood should be left to a professional. The following are some of the recommended procedures for wooden objects on which finishes are in good condition (not flaking) and for items that do not have damaged veneer, inlays, etc:

i). Remove dust using a soft brush or vacuum cleaner, nozzle with a soft brush attachment. For objects having rough or unfinished surfaces that could be snagged by dusting with a cloth, it is well recommended. Unfinished wood should never be wet cleaned.

ii). If wet cleaning is absolutely needed, the safest method of cleaning is the use of dilute detergent, which should be diluted to a concentration of approximately of 1 percent in water.

iii) After the surface is completely dry, a high quality wax could be applied with a rag or brush. Upon drying approximately for 15 minutes, the waxed surface should be lightly buffed with a diaper or soft brush. Wax should be applied occasionally (Once in a year).

d) **Structural Repairs:** Repairs to wooden objects should be as unobtrusive as possible. The addition of mechanical metal attachment such screws and mending plates should be avoided since they can constrict the movement of wood leading to cracking.

e) **Pest Damage:** Insects that can cause damage to wooden objects include carpet beetles and powder post beetles. Carpet beetles generally subsist on protein based material that are often present on adhesive. Carpet beetles are often commonly found at joinery and in drawers. The presence of tiny black beetles is an indication of infestation.

Powder Post Beetles characteristically bore small holes into wooden materials. These holes are usually the first visible evidence of infestation. The underside of legs, drawers, etc should be inspected since insects hide in inconspicuous places. If the infestation is found, the object should be quarantined for tests by professionals.

4.2 WORKS ON ART OF PAPER

Work on art of paper can be preserved for years of use provided some basic care is resorted to for preservation.

4.2.1 Causes of Damage

a) Careless Handling: It is by far the most prevalent cause of damage. To prevent damage caused by salts and oils from human hands, clean white cotton gloves should be used during handling. Oils and salts may cause damage in the form of staining and may also transfer dirt to the paper surface. All workspaces and tabletops should be neat and free of dirt. While moving a paper object, support it from below, never lift a piece of paper by its edges. Stacked paper objects should never be dragged or slides across each other. This causes abrasion or smudging of their surfaces. Never eat smoke, drink in the vicinity of works of art. Accident may lead to irreparable staining or burns. Stains can also be caused by ink pens and markers. Use only pen or pencil while working. Paper clips, binder clips, etc may corrode and leave rust stain on paper surface.

b) Environment

Pollution - Common pollutant like sulphuric acid, nitric acid, ozone and formaldehyde originating either from outside air or from materials in the environment degrade the work of art on paper by way of fading its dyes and pigments. Wood and leather are common sources of acid as are some rubber and plastic materials. Air filtration is the most effective way to minimize such damage due to pollution. Measures should also be taken to eliminate shortage or display of art in the vicinity of materials that emit hazardous gases.

Light – Exposure to light leads to fading of media, discolouration of paper and embrittlement due to heating. UV radiation causes the maximum damage. UV filters for windows and frames can reduce the damaging effect of radiation. In addition to UV visible light can also damage this type of object.

Temperature & Relative Humidity – Low humidity levels caused drying out and embrittlement of paper materials. High humidity level causing swelling of paper materials leads to planar distortion. RH level beyond 60% is favourable to mold growth. Ideally cold shortage is desirable for works of art on paper.

c) Pests - A wide variety of insects can damage paper artifacts. The prime insects that pose threat to paper are silver fish, firebrats and the book louse. Good housekeeping is the best method of deterrence. Regular inspection of the objects provides the cheapest and safest method of safeguarding. Screening on windows and doors will help in keeping out larger pests. In addition, flowers and plants should be inspected before taking them inside the gallery. When infestations are suspected, sticky insect traps can be kept under cabinets and cupboards. Maintenance of moderately low humidity levels that are unfavourable for insects is essential. Insecticides should not be used on or in vicinity of such objects.

4.2.2 Storage, Exhibition and Framing

Storage: Proper storage can ensure keeping the paper clean and free from dust. Most works of art should be stored in clear plastic envelopes or in acid filled folders. All storage boxes, folders and tissue paper should be acid free with neutral pH. Severely degraded paper should be stored with buffered boxes that contain an alkaline reserve. Alkaline reserve buffers are chemicals that act as scavengers absorbing acid generated by the degraded paper. Shortage of such material with materials such as leather, plastic, or metal should be avoided.

Display: Display of objects in the vicinity of air dust, window should be avoided as dirt and soot can be deposited on objects. Display on walls that are outside the building be avoided.

Matting and Framing: Framing works of art on high quality acid free matboard is recommended. Paper object should always be framed using a window mat. The use UV filtering glass and Plexiglas helps reduce damage from UV light.

Inherent Vice: Some materials degrade at an exceptionally rapid rate due to their chemical composition. These materials are said to have inherent vice.

4.2.3 Repair and Cleaning

a) Surface Cleaning - Prints, watercolour and pencil drawings can be lightly dusted with a soft brush to remove surface dirt. Proceed with caution for cleaning. Over cleaning can cause damage than the dirt itself.

b) Mold Removal - Paper materials in damped environments are highly susceptible to damage by mold growth. The safest method of its removal is to brush the mold off the surface of the artwork. After mold removal, the artwork should be placed in a stable environment with moderately low humidity level. The condition of the object should be monitored periodically.

4.3 TEXTILES

Textile part of exhibits/textile artifacts can be maintained for years provided some basic care and preservation is given. Most antique textiles are composed of natural fibres that include wool, cotton, linen and silk.

4.3.1 Causes of Deterioration:

a) Environment

Light: Exposure to both natural and artificial light can threaten the longevity of textile. Both visible and UV light are responsible for textile damage. Textiles are highly susceptible to fading and structural degradation due to exposure to light and therefore these should not be exposed to direct source of light. UV filtering and indirect lighting are some of the recommended methods of illuminating textile objects in museum. In some cases, these are displayed for a very short period of time to minimize light damage.

Temperature and Humidity: Extremes and fluctuation in humidity and temperature around the year cause extensive damage to textile fibres. Embrittlement due to low humidity in dry season, permanent staining from mold growth when humidity levels are excessively highly, damage the textile fibres. Expansion and contraction of fibre due to changes in temperature and humidity impair resilience, elasticity and strength of fibre. Heat can embrittle and discolour textile. Synthetic fibres such as rayon, nylon, polyester and acetate become permanently deformed when exposed to high level of heat.

b) Pests: A wide variety of pests caused structural damage to textiles. These are cloths, moths, carpet beetles, silver fish, firebrats, and mice.

***Pest Prevention*:** Good housekeeping is the best method of pest deterrence when infestation is suspected. Sticky traps should be placed on the floor near the storage or display area to monitor the type and numbers of insects present. Periodic inspections and cleaning of storage and display provide the cheapest and safest method of prevention. If an infestation is detected, the object should be suitably isolated and sealed in a plastic bag for professional conservators' intervention.

c) Pollution: Pollutants from outside like acid rain, ozone and a number of chemical compounds or from objects in the indoor like cigarette smokes, aerosol spray can degrade the textile fibres. Such objects may get affected by wood, plastic, rubber, wood based paper, newly painted surfaces also. Objects should be kept away from all those agents.

d) Inherent Instability: Antique textiles are at times inherently unstable due to chemical processes (called weighting) followed at the time of their production. In order to minimize damage due to weighting, certain storage procedures are recommended.

e) Handling: The following guidelines should help protect textiles from damage due to handling:

i) Textile should be laid out on a cleaned flat surface while examining, cleaning or preparing them for storage or display.

ii) Eating, drinking or smoking in the vicinity of the textile objects should be avoided.

iii) Use clean gloves while touching textiles

iv) Jewelry, belts and buckles likely to sang or tear textiles should not be worn during handling.

v) Use pencil in the vicinity of textile to avoid accidental staining.

vi) Don't place any object on the textile.

vii) The entire objects should be supported from beneath while transporting

4.4 PHOTOGRAPHIC PRINTS:

Photographic materials are among the most unstable and difficult collectibles to preserve. Despite their fugitive nature, the life of photographic materials can be prolonged provided some basic care and attention is given to their preservation.

4.4.1 Nature of Photographic Materials

Photographic prints are composed of at least two distinct layers: the uppermost layer i.e. the emulsion layer consisting of metallic particles or dyes held in binder such as gelatin and the lower layer i.e. the support layer, usually composed of paper, glass, metal or plastic. The emulsion layer forms the image of the photograph.

a) Black & White prints

As the oldest photographic process, the emulsion layer consists of fine particles of silver embedded in a layer of binder i.e. gelatin, while other binder materials include albumen and collodian.

b) Colour Prints

There are a large variety of colour processes, which involve different materials, but the most consist of dyes suspended in a gelatin layer.

4.4.2 Causes of Deterioration & Guidelines for Care:

a) Environment

Temperature & Humidity: High and/or fluctuating temperature and relative humidity levels, combined with relative humidity levels, combined with pollution and contaminants cause fading of photographic images. Excessive low humidity levels may cause photographs to curl due to dryness. Conversely, high humidity can lead to mold growth. Fluctuations of more than 5 degree per day should be avoided. Cold storage at low relative humidity level is the ideal storage environment for photographs.

Light: Photographs are prone to damage due to light in the form of fading. Colour photographs are more sensitive than B&W prints. For this reason, colour photographs should be displayed under low light levels (approximately 50 lux), while B&W photos can be displayed under slightly higher levels, Ultra-violet radiation should be minimized as far as practicable due to its damaging properties on photographic prints.

b) Pollution:Silver particles in B & W images are prone to degradation through metallic corrosion. Whenever possible, contact with pollutants like Sulphur, Ozone or peroxides should be avoided. Since rubber and leather contain large amount of sulphur, they should not be stored in closed containers. The dyes in colour photographs can also be damaged by contact with chemical pollutants.

c) Display: Proper framing with acid-free, lignin-free rag mat board helps increase the life of antique photographs. It is a common commercial practice to mount photographs directly to the mat board using head seal dry mount tissue. While the long, term stability of this process is not certain, it is not advisable for antique photographs since future conservation work could be complicated by this process.

4.4.3 Storage & Handling:

Photographic prints can be stored in clear Mylar (plastic) envelopes. For added protection, acid-free envelopes and boxes are available. While purchasing plastic sleeves, make sure they are uncoated Mylar or polyethylene. Other materials like polyvinyl chloride can damage photographs.Use only pencils to write on photographs, that too along border or on the backside.

Cleaning & Conservation:

Surface dirt should be removed using a soft brush. More extensive cleaning and repairing should be done by a professional.

4.4.4 Photographic Reproduction

An inexpensive alternative to treatment, this process involves taking a photograph of the original print and producing a copy. The process often involves retouching the new negatives to eliminate flaws that are present in the original print.

4.5 SILVER OBJECTS

4.5.1 Causes of Damage

a) Tarnish: Tarnish (silver sulphide) is a form of corrosion characterized as a dense, thin black layer which disfigures the surface of an antifact when exposed to air containing sulphide gases. Humidity is also required for the corrosion to progress.Tarnish itself does not pose threat to antifacts. Most damage occurs as a result of the polishing required to remove the tarnish.

In rare cases, when exposed to air borne salt concentrations, `horn silver', characterized as dirty purple or slate gray, may develop on the surface of such object. It is dense, compact and quite difficult to polish off.Old lacquers may wear or peal off in some areas. This leaves the exposed silver to tarnish, while the rest may remain bright.

b) Abrasion, Denting: Silver being soft metal is prone to damage by rough handling. Lift the object from the centre of gravity, never by any protruding part.

4.5.2 Cleaning Silver

a) Polishing: In most cases, fine calcium carbonate, CHALK, worked into a slurry or runny paste with equal amounts of ethanol and distilled water. The paste is rubbed across the surface, with cotton balls or clear cotton rags. It is important to remove all residual polish with distilled water.

b) Coating: After cleaning the object properly with acetone or tri-chloroethane to remove old lacquer if there be any, spray lacquering is done on the object for protection against tarnishing.

4.5.3 Handling & Storage

Use gloves to handle polished silver. Salts and oils from skin can etch into the polished metal causing permanent damage. Maintaining low humidity levels, silver objects may be stored in a bag, preferably of Mylar, after wrapping them with Silver Tarnish Inhibiting Cloth.

4.6 HISTORICAL BRASS & BRONZE.

4.6.1 Causes of Damage

a) Corrosion

Safe corrosion- Uncoated copper alloy artifacts, kept clean and dry, develop stable surfaces, which may appear reddish, black to brown, or green to blue. The brownish and black colours may result from natural, non-destructive oxidation of the copper. This corrosion actually protects the object if they are left intact. Purposely applied, "Patinas", which may be of any variety of colours usually acted as a protection to the metal.

Problem corrosion- It refers to development of small spots of light green powder growing rapidly on the artifact, also known as "bronze disease", which, if left untreated, wrecks havoc on the object. It is caused by the presence of salts in the air or by deposits left behind from inappropriate cleaning or handling and progress when the air is humid. High levels of ammonia pollution in the air cause bluish deposits of corrosion.

Corrosion progress on copper alloys at RH level of 70% and above. Dust and grime left to accumulate on metal artifacts actually hold moisture to the surface and may induce corrosion even when the humidity is not that high. Varnish or lacquer brass and bronze can withstand corrosion as long as the coating is not broken.

b) Abrasion & Denting

Objects with thin walls, raised areas and handles are susceptible to denting and joint failure on account of improper handling.

4.6.2 Caring for Brass & Bronze

a) Handling

Don't handle with bare hands. Salts and oils from skin can etch into uncoated metals and may even cause permanent damage.Lift objects from centre of gravity and avoid lifting by any protruding sections.

b) Storage

Store in an area with low RH (55%) free from rapid fluctuations of temperature and humidity.Don't allow dust to accumulate on stored objects. Protect objects by storing it on shelves padded with inert foam. Drape plastic or cloth curtains around storage shelves, but don't place metal artifacts in sealed plastic bags; the danger of moisture condensation outweighs the benefit of dust protection.

4.6.3 Cleaning & Polishing

a) Cleaning: Stable or painted surfaces should be kept dust free. Vacuum clean all stable artifacts regularly. A bristle brush or toothbrush is helpful in raising dust from crevices. Surface grime may be removed satisfactorily with soap and water. Wet cleaning should be carried out in deionized or distilled water only.

b) Degreasing: To dispense with degraded oils and grime on artifacts, degreasing is at times carried out with mineral spirits. Be very certain to rinse the object finally with clean mineral spirits to remove residual detergent. However, this method is not recommended for old copper with rich surface accumulations.

c) Polishing: Some brasses are traditionally polished to a bright finish, but not all. Attaining original surfaces may reduce the historical value of an object. So, it needs to be decided as to what degree the object should be cleaned and polished.

Method I: For most of the cases, fine Calcium Carbonate, CHALK, worked into a slurry or runny paste with equal amounts of ethanol and distilled water. The paste is rubbed across the surface, working a small area at a time with cotton balls or clear cotton rags.

It is important to remove all residual polish with distilled water. Drying may be accelerated by adding ethanol to the rinsed water or by giving the object a final wipe with ethanol.

Method 2: For thick oxidation layers, a more abrasive method needs to be followed with the prescribed brand of polishing paste as recommended by the conservator. To begin with, try applying this on a small inconspicuous part of the object. Buff on the polish with a clean rag. Rinse the surface with mineral spirits after polishing to remove polish residues. As ammonia causes long-term damage to the copper alloys, the polishing agent should be totally free of that compound.

d) Coating: Polishing exposes fresh, reactive metal to the atmosphere and, therefore, to further oxidation. It is advisable to coat the objects with lacquer and wax that mitigates the need for frequent polishing – a process that inevitably wears away the metal surface if done frequently.

4.7 HISTORICAL IRON

Iron is found in a variety of alloys, comprising wrought iron, cast iron and steel. Galvanized or tin-plated sheets are also familiar materials in museum collections.

4.7.1 Causes of Damage

Corrosion, poor handling and inappropriate storage are the major cause of damage to iron artifacts. Active corrosion causes a continuous loss of metal from the object. Mishandling can result in breakage, bending or cracking. Cast Iron is relatively a brittle material. Salts, oils and moisture lead to metal corrosion.

Corrosion: Uncoated ferrous artifacts, kept clean and dry, develop blue-black to brown stable surfaces, which are not scaling, flaking or peeling. This dark, stable, protective surfaces may be considered as 'patinas'.

If there is ongoing rusting and changes to the surface appearance, including paint loss, chances are there that the iron is actively corroding. Pits develop at active corrosion sites. Bright orange droplets or "Sweating" forming on the surface indicates advanced stage of corrosion induced by high atmospheric humidity (above 70%) and the presence of salts. Dust and grime left to accumulate on metal artifacts will actually hold moisture to the surface and induce corrosion even where the humidity is not that high.

4.7.2 Caring for Iron Artifacts

a) Handling: Don't handle the objects with bare hands. Lift objects from their centre of gravity and avoid lifting by protruding sections.

b) Storage: Store properly at low-humidity, ideally below 55% RH. Rapidly fluctuating temperatures will cause coatings to fail as the metal expands and contracts.

c) Cleaning :

Cleaning: Stable or painted surfaces should be kept dust free. Vacuum clean all stable artifacts regularly.

Degreasing: Degrease the most uncoated metal artifacts with mineral spirits. Be certain to rinse with clean mineral spirits to remove residual detergent finally.

Corrosion Removal: For objects such as Cast Iron, rusty machinery etc, it is sometimes possible to remove encrustation of corrosion products by rubbing with steel wool pad or nylon synthetic steel wool pad and a light lubricating oil or mineral spirits.

Corrosion Inhibition of Bare metal: It is possible to protect the surface with a variety of corrosion inhibitors like machine oils etc. 'Rust Converters' are another kind of commercial product designed to work on rusty metal by converting unstable corrosion into a stable protective layer with the help of a latex-based coating.

Polishing: Polishing may be undertaken with a compound recommended by a professional to return a steel object to its original & polished appearance. At the end of the process, surface should be rinsed with mineral spirits to remove any polishing residues.

d) Coating: Choosing the appropriate surface finish is an important step in the presentation of iron artifacts as iron is very reactive and needs an added protective coating. The inhibitors and converters act as coatings.

(i) Lacquering: It requires the use of volatile solvents and spraying equipment. It is, therefore, recommended that this type of work be earmarked for specialists.

(ii) Painting: It is inappropriate to repaint an original artifact. Museum professionals recognize the value of preserving as many original surfaces as possible, even on old tools and machines. Original paint tells a great deal of the usage of objects and may retain decorative detailing under darkened varnish layers. In certain cases, (i.e. those in outdoors), when the object has lost almost all of its finish, painting may be an appropriate method of preservation.

(iii) Waxing: For iron objects, the best recommended technique for coating is waxing. It provides a relatively flexible coating that is easily applied which can be renewed. An inert wax like microcrystalline wax is suitable as it will not yellow over time.

4.8 GLASS AND CERAMICS:

The first step towards the care of collections is to understand what can minimize or eliminate conditions that may cause damage. And the second step is to follow the basic guidelines for case, handling and cleaning.

4.8.1 Cause of Damage:

The most common form of damage observed in this class of objects is breakage, stains and discolouration.

Ceramics:

It gets permanently stained due to inappropriate cleaning, repairs or careless use. Porous, unglazed or cracked ceramics develop stains as a result of being soaked in water during cleaning. Absorption of coloured materials like foodstuffs, soil from potted plants, rust from contact & poor quality adhesives and paint used in restoration process may result in irreversible discolouration. Objects exposed to heat beyond room temperature may get cracked.

In case of archaeological ceramics, presence of salts absorbed into the object from soil leads to cracking or de-lamination of ceramics as these salts absorb moisture from air when humidity level is high.

Glass:

A damaging condition in glass called "Weeping glass", refers to formation of droplets of moisture on the surface of a glass object. These droplets leach out unstable components of the glass producing an alkaline solution. If this phenomenon persists for long, the surface will develop a fine network of cracks, called "Crizzling". Both crizzling and weeping are basically due to improper formulation during glass manufacture. Glass, buried in the soil for long, develops a matte, scaly and iridescent surface.

4.8.2 Guidelines for Care:

a) Handling: Careless handling results in breakage, chips and scratches. The following precautions need to be taken during handling:

(i) Use two hands when lifting or moving.
(ii) Be careful to lift them from their strongest points, not by handles or sprout.
(iii) Stack objects with proper cushioning using felt, soft cloth or polyester padding to avoid abrasion.

b) Cleaning Ceramics: Use only dilute cleaning solutions, applied with soft cloths during cleaning. Antique ceramics should never be soaked in any liquid. Prolonged soaking and uneven drying can lead to staining.

Recommended materials for cleaning ceramic objects include mild detergents in water. A mixture of ethanol (ethyl alcohol) and water in 1:1 proportion can also be used for cleaning. Dilute detergents (approximately 1% in water) should be applied using a soft cloth. Residual detergent may be removed by rinsing with distilled water applied also with a soft cloth.

c) Cleaning Glass: It may be cleaned in the same manner as in ceramics with the addition of dilute ammonia as a cleaner.

d) Ceramic Repair: Properly chosen adhesive that depends upon the porosity and overall condition of the object may be used for repairing, that too preferably by a conservator.

e) Glass Repair: The most commonly used adhesive for the repair of glass objects is epoxy. However, it discolours with time on exposure to light. While repairing, avoid abrading broken edges at the time of realignment. Clear adhesive tape or strapping tape works well to hold fragments together as the adhesive cures. The adhesive should be allowed to set for at least 72 hours prior to removal of the adhesive tape. A glass object repaired with epoxy should be kept out of direct light as radiant energy accelerates yellowing of the adhesive. The repaired object should not be soaked in liquids as they may loosen the mended area although epoxy is a strong adhesive.

4.8.3 Environment:

Avoiding extremes in temperature and humidity should minimize damage. So it has to be ensured that objects are kept away from heat sources as far as practicable.

Weeping glass	Temperature Relative Humidity	18-21°C 40%
Crizzling glass	Temperature Relative Humidity	18-21°C 55%`
Archaeological Ceramics	Temperature Relative Humidity	18-21° C 45%

4.9 OIL PAINTINGS

4.9.1 Causes of Damage & Guidelines for Care

a) Environment

Light levels: Excessive light levels cause fading and/or darkening of painting. In order to avoid such damage, paintings should be displayed in dim areas where no direct light is allowed to fall on them. High light level also cause damage due to excessive heat build-up. Diffused spotlights mounted 10 ft. away from the painting may be useful to avoid potentially damaging heat build-up.

Temperature & Humidity Levels: Extreme fluctuation in temperature and humidity cause damage to paintings due to expansion and contraction of wood and fabric components of the paintings. Paints may crack and flake off due to cyclical expansion and contraction of the underlying wood and fabric structure. These dimensional changes can cause slacking and sagging of canvas during winter. Most fabric paintings are, therefore, secured to a wooden frame, commonly known as stretcher or stainer that is equipped with expandable corner joints.

The proper display and storage of paintings should be achieved by monitoring the environment as well. Acceptable temperature and humidity levels for oil paintings are-

Winter : Temperature 18-21^0 C
Relative Humidity 40%-45%

Summer: Temperature 21-24^0 C
Relative Humidity 45-55%

Excessive humidity, on the other hand, is injurious to paintings as it encourages mold growth that leads to staining the surface of the painting.

b) Dirt: Dirt, in addition to unsightly appearance on a painting, serves as a host for fungal growth and the absorption of pollutants and moisture onto the surface of a painting. These obscure the image of the painting. Paintings should be kept out of smoking areas and of candles or fireplaces as these might deposit nicotine and soot onto the surface of the painting.

c) Improper cleaning: Use soft brushes to remove dust from paintings and frames. While dusting, care needs to be taken not to flex the canvas or to dislodge paint chips by bumping the paintings. The back of the painting should be kept clean by brushing or vacuuming.

It surface dirt can not be removed by dusting, cotton swabs, dampened with distilled water can be lightly rolled on the surface to remove dirt. If there is flaking paint, no attempt at cleaning should be made.

d) Insects: Carpet beetles and powder post beetles cause damage to oil paintings. Holes in the canvas or the presence of worm-like insects or furry carcasses, especially at the back of the painting between the canvas and stretcher are an indication of carpet beetle problem. Appearance of small holes on wooden parts give first visible sign of power post beetle infestation.

Frass, a substance that looks like sawdust, is also a good indication of active infestation. Paintings should be routinely taken down and examined for pests. In the event of infestation, service of a professional conservator is to be requisitioned.

e) Careless handling: Remove all jewelry, belts, buckles etc. prior to handling paintings. While moving a painting, grasp the painting from both vertical sides. Don't hold a painting at the top of frame or by its hanging wire.

4.10 PLASTICS COLLECTIONS

Contrary to the popular belief that plastics are inert & everlasting materials, it may be noted that plastics are inherently unstable in the long term. Light is harmful to plastics. However, with well-planned and intensive conservation practices, the life of plastics in museums can be prolonged. The first step in a conservation programme is to identify the base polymer used to make the plastic object.

4.10.1 Causes of Damage

Mechanical or thermal stress can cause physical damage to a plastic material and latent stresses can be induced at manufacture and released at a later date. This results in shrinkage, crazing or the appearance of surface deposits, sometimes because of loss or migration of additives. More serious are chemical changes, usually caused by excess light and other unsuitable environmental conditions, poor manufacturing or harmful materials or contaminants such as cleaning solvents. Symptoms include colour change, brittleness, weakness, softness, surface 'blooms' and the release of gaseous breakdown products. Metals in close contact with glass, ultra-violet radiation in light in presence of high moisture or heat levels accelerate chemical degradation in plastics.

4.10.2 Caring for Plastics

Plastic items benefit from stable temperature and relative humidity conditions. Light of all wavelengths should be kept at the lowest possible level consistent with staff and public safety and access. UV filters and screens should be used to keep this UV in check and these need regular checking and periodic replacement.

Keep strong cleaning materials and solvents (including their vapours) well away from stored or displayed plastic items. Inspect all plastic objects on a regular basis for signs of degradation, say as a part of the routine cleaning programme.

4.10.3 Cleaning & Handling

Dust and dirt should be removed with a soft brush or cloth where possible. Avoid scrubbing or rubbing. More persistent staining can be removed by washing the object in warm water containing a few drops of non-ionic detergent.

Severe soiling can be removed with white spirit or isopropyl alcohol, but only where the polymer has been identified as safe for treatment. Always use a soft cloth moistened with a minimal amount of solvent, don't rub or stress the object.

Polishing rarely helps, though a light application of a non-spray hard wax polish enhances the appearance of Bakelite surfaces. There are proprietary polishes designed to remove scratches from acrylics such as perspex.

Name of Polymer	Proprietary Name	Environmental Guidelines
Shellac (With slate filler, shellacs formed the basis of 78 rpm gramophone records of the pre-vinyl era)	Vulcanite & Ebonite	Horn:60% RH, not above 20°C Vulcanized rubber: 50% RH, not above 20 °C Shellac Plaster: 60%RH, not above 18 °C.
Celluloid	Celluloid	Cellulose nitrate: Not above 40% RH at 18 ° C Cellulose acetate: Cool & dry as for cellutose.
Bakelite	Bakelite or Catalin (phenol formaldehyde) Melanine (melanine formaldehyde)	Avoid long period of high humidity Avoid boiling water, as it may be discolor melamin.

Caring Thermoplastics

Polystyrene (including high impact grades and ABS)

Keep polystyrene objects away from strong light, which will rapidly degrade them. Avoid contact with alcohol, paraffin, while spirit, as they may accelerate environmental stress cracking.

Acrylics (Perspex)

They are stable and show good resistance to moisture and light through coloured acrylics may fade in strong light. The polishes designed to remove scratches from acrylics are abrasive, so can not be recommended for conservation.

Polyethylene: It is resistant to water. However, it can induce photo-oxidation, an accelerating form of degradation that first appears as brown discolors.

Nylons: It is prone to photo-oxidation as well, which makes yellowing of while nylon fabrics. So, this type of material needs to be protected from light (especially UV) and keep RH levels stable.

Polycarbonate: It remains in stable condition if light and humidity are stable.

PVC: It is perhaps the least stable material. PVC objects should be kept below 20 °C away from other plastics and from metals such as iron, zinc and copper and fully protected from sources of UV light. It shows up signs of degradation as a brownish or purplish tinge. Degrading PVC gives off acidic gas (hydrogen chloride). This material is, therefore, risky to museum objects.

So, with so much varieties of plastics available in the market, it is at times difficult for museum professionals to choose the best one. However, it is established that polyester, polyethylene and polypropylene are the best choices.

4.11 ARCHIVAL DOCUMENTS AND BOOKS

Preservation of documents and books is very much required for eliminating and minimizing the condition that can damage them.

4.11.1 Composition

a) Documents

Documents generally consist of three basic components: paper or parchment support upon which information is recorded, a sizing material or ground layer that covers the surface of the paper or parchment, and the media applied to the support for creating the document.

1) *Paper and Parchment Support*: Most paper consists of cellulose materials. Prior to the 19th century, paper consisting of cotton, hemp, linen was made by hand. Generally called as rag paper, these are very durable and preservable for hundreds of years.

   However, since the 19th century onwards, wood-based paper, abundant, inexpensive and alternative to costly rag paste papers (at the cost of durability) came into being. These are prone to degradation due to presence of lignin which, if not removed during manufacturing stage, degrades to form acidic compounds, thereby becoming yellow and brittle.

   Parchment and Vellum are made from skin of small animals, treated with slaked lime that acts as a preservative. Generally, parchment refers to the skin of sheep and goat while vellum refers to fine quality skin obtained from calves or lambs.

2) *Sizing and Ground Materials*: Unsized paper, being highly porous and absorbent, is unstable for use with media such as ink and watercolour paints unless sizing is done by applying adhesives such as gelatin, plant gums or starch to the surface of

a sheet of paper in order to prevent the bleeding and blurring of media and to provide additional strength. In early 16th century, potassium aluminum sulphate (called alum) was used as additive with gelatin for sizing. This alum, as the goes by, degrades to form sulfuric acid that leads to eventual degradation of paper support.

Processes like printing require papers with extremely smooth surface, which is, generally provided by applying a ground layer sizing of clay, chalk or pigmented materials, held together by a stable adhesive.

3) *Media*: This refers to the materials like watercolour paints, pencil, chalk and ink applied through a variety of printing or writing techniques for creating documents. Iron gall ink used in medieval age degrades fast due to its chemical composition. Manufactured from oak gall and ferrous sulphate, this ink emits sulfuric acid with the passage of time eventually degrading the underlying paper support.

b) Book

Books have got three basic components i) pages, ii) protective covering made from leather, parchment or fabric & iii) the media used to create document.

Book covers

Flexible and rigid book covers making use of leather, parchment and fabric are in use for years. For rigid covers, cardboard, pasteboard and wood are used as the underlying support. Pasteboard, a rigid material, is made out of lamination of leather and parchment scraps.

Leather, used as book covers since medieval time is made from a variety of animals like cattle, pig, deer and sheep. For book covering, tanned leather is generally used. The type of process of tanning has its effect on the longevity of the leather. Leather prior to the 17th century is highly stable due to vegetable tanning processing. However, vegetable tanned leather of 19th century is found to be unstable and prone to the development of Red rot (powdering red degradation effected by presence of sulfuric acid in the leather). However, since mid eighteenth century, high demand for leather books gave fillip to new processes with stable varieties of the item.

Parchment and Vellum

Like leather, parchment and vellum, manufactured from animal skin, are extremely strong and durable. However, they are highly sensitive to moisture changes too. It leads to formation of wrinkles and puckers. When utilized as covering, this unstability leads to warping and distortion of book cover.

Fabric

In recent times, use of fabric and paper has increased manifold replacing leather as book cover. Sized linen or cotton fabric is frequently used.

4.11.2 Factors Causing Damage

a) Careless handling: This leads to tears, wear, loss of the document/image, creases and staining In the prevention of damage, the following should be adopted:

a) Wear clean white cotton gloves while handling books and documents.
b) Keep work places and tabletops free from dirt.
c) While moving a paper or document, support it from below.
d) Never lift a piece of object by its edge.
e) Stacked paper objects should never be dragged or slid across each other may cause aberration or smudging of the surface.
f) Grasp books by both hands, not by the upper edge of the book. This may lead to damage and tear of the binder.
g) Never eat, smoke or drink near the books or documents.
h) Use only pencil with work on or around documents and books.
i) Do not use paper clips, binder clips, marker clips for books or documents.
j) Avoid extensive photocopy of books and documents as this may lead to damage in the form of fading. The compression of books during photocopy can also break binding and spine of the book.

b) Environment

Pollutants

A variety of pollutants like sulfuric acid, nitric acid, ozone and formaldehyde from the outside air or from materials in the environment may lead to fading a dyes or pigments and thereby overall degradation of documents and books. Wood and leather as well as some rubber and plastic materials produce acid vapor with the passage of time.

Damage due to pollutants may be minimized through air filtration. Measures should be taken to eliminate storage or display near those materials emitting hazardous gases. However, for composite objects like books, incompatible materials such as leather book can not be separated.

Temperature & Relative Humidity:

Rapid fluctuations and extremes in temperatures and humidity levels are detrimental to documents and books. Temperature and humidity levels are interrelated.

Low humidity level can cause:

* The drying out and embrittlement of materials
* The shrinkage of vellum and parchment covers, resulting in Warpage.

High humidity levels can cause:

* The swelling of paper and parchment materials, resulting in planar distortions.
* Coated papers to stick together

* The transfer of inks from one surface to another
* Mold growth in RH levels above 60%

Ideally cool storage in desirable, which is not possible practically. However, keeping the items away from heat sources, avoiding humid areas like basements, possible preservation can be ensured.

Recommended temperature and humidity levels for storage and display of collections are as follows:

Temperature: 20°C ±1°C
Humidity: 47% ± 2%

Light:

Exposure to high light levels leads to fading of media, discolouration and embrittlement due to heating. Measures are to be taken to minimize UV proportion in lighting by suitable arrangements.

Even visible light is detrimental to documents and books. The recommended light levels for display of paper materials in museum is very low i.e. 50 lux (that too for a period of only 6 months). Coloured inks are among the most susceptible to light damage and should be displayed in dim areas, free from bright light sources.

c) Pest

A variety of insects like silverfish, firebrats, carpet beetles and book louse can damage paper and leather. In general, good housekeeping is the best method of deterrence. Regular inspection of collections, cleaning of windows and doors, inspecting fresh flower and plants being brought into the gallery are some of the measures that should be taken. Insecticide should not be used on or near the documents or books as these cause fading and discoloration of paper leather or parchment.

4.11.3 Storage, Exhibition of Documents of Books

Paper Documents: Encapsulation of documents within a clear plastic (mylar) envelope so as to allow for viewing of both sides of the documents is a method for protecting the collection from dirt, dust and tearing.

Items that are not handled often can simply be placed in folders and boxes which should be acid-free, lignin free and have a neutral pH. Poor quality wood-based cardboard boxes and folders should be avoided as they generate obnoxious acid products causing degradation of items stored within.

Severely degraded documents of paper should be stored in buffered boxes containing alkaline reserves, which absorb acids generated by degraded paper.

In general, good housekeeping is the most essential aspect for preservation. Routine inspection and cleaning of boxes and folders can aid in extending the life of collections.

Parchment Documents: Mylar folders are not recommended for parchment. Rather this should be stored in unbuffered acid-free folders or boxes.

Books: To minimize damage on books, overcrowding of books on shelves should be done away with. They should rather be packed loosely on shelves. The use of book ends help provide even support. Large books should be stored flat on shelving units. Rare and fragile books should be placed in individual protective enclosures.

4.11.4 Repair & Cleaning

Apart from obscuring text, dirt can attract moisture, mold spores and pollution. Dirt having got an abrasive quality weakens the structure of leather and paper.

Although repairing and cleaning of this kind of items comes within the purview of a professional conservator, surface cleaning may be carried out by others, that too adhering to the following guidelines.

Surface Cleaning

* Inspect carefully to ensure that there is no loose or powdery media or surface that could be brushed away during cleaning.

* Use a soft brush to remove surface dirt for paper and parchment documents.

* Always be cautious while cleaning. Overcleaning is more damaging than the dirt itself.

Cleaning of Books

The covers and edges of book can be brushed to remove surface dirt. They may be vacuum- cleaned also.

Mold Removal

The safest method of mold removal is the use of brush and a low-suction vacuum cleaner. Mold spores spread through air and must be controlled so that other paper and documents don't get contaminated. Frequent cleaning of brushes is essential.

It is always advisable to keep archival materials in stable environment with moderately low humidity level and monitor its condition from time to time.

4.12 VIDEOTAPE

As an information storage medium, videotape is not as stable as photographs. It is a fragile medium subject to damage and deterioration from exposure to poor

environmental conditions and inadequate handling practices. Even if properly cared for, it may last for a few decades.

4.12.1 Composition

Videotape is composed of three components: magnetic (metal oxide) particles, polyurethane – based binder and a polyester base material.

The metal oxide record and stores magnetic signals. Changes in the magnetic properties of these materials leads to an irretrievable loss of color, saturation and sound clarity. The polyurethane binder holds the magnetic particles in place. This binder is subject to a type of chemical deterioration called hydrolysis, due to which the videotapes become soft and sticky and clog recording heads. The polyester base material provides a flexible support, which is susceptible to physical deformations due to excessive tape pack stresses and poor wind quality.

All components, therefore, are subject to irreversible deterioration, due to extremes of temperature and humidity as well as physical damage from poor handling and storage practices.

4.12.2 Environment

Videotapes should stand in an environment where temperature and relative humidity do not fluctuate abruptly. Ideally a dust free environment with 68 ^{o}F temperature and 20 – 30% relative humidity is recommended.

Direct Sunlight causes them heat up and wraps the reels or cassette housing. High temperature also results in tape-to-tape adhesion, degradation of the binder and permanent distortion of the tape backing leading to severe image deterioration. High humidity level encourages fungal growth as well.

4.12.3 Handling

Minimize handling at all times. Don't touch the surface or the edge of the tape. Avoid contamination from dirt, dust, food, cigarette smoke and airborne pollutants. The frequent appearance of dropouts is an indication that the tape is contaminated with dirt. It is good practice to avoid exposing tapes to any magnetic fields. A few feet separation from a magnetic source will unusually provide sufficient protection.

4.12.4 Storage

When not in use, store them on end to prevent deformation. Don't store them lying flat. When kept in horizontal position, pressure from other tapes may cause distortions. Rewind tapes after recording or playback. Tape should not be left threaded in the video recorder for long. Tapes should be inserted/ejected only at blank, unrecorded sections. Never eject a tape at the middle of a recording. After recording, rewind the tape before ejecting it.

4.13 MOTION PICTURE FILM

4.13.1 Causes of Damage & Guidelines for Care

Film should always be held by its edges to avoid learning fingerprints on picture and sound areas. As with all other materials, films, especially colored types, are subject to fading due to chemical as well as physical deterioration, which are impossible to stop entirely. With proper care, handling and storage, the rate of deterioration can be slowed and the usable life of a film can be extended significantly, over several decades.

For 16-mm nitrate based film, as for all other materials, the rate of deterioration depends largely on the conditions under which it is stored, how it is handled and on the ingredients and care used in manufacturing its base. If a film is not marked as safety film, it should be considered to be nitrate.

Nitrate Films: Nitrate film should be copied onto a new base before deterioration starts. Cans of nitrate film that have remained closed for sometime should be opened in unconfined and well-ventilated space as they can ignite at temperatures above 38^0C, Nitrate film is highly inflammable. Ideally temperature and humidity levels for storage should be kept constant and at a maximum of 10 °C and 50% RH.

Acetate Films: Acetate film, like nitrate film, is subject to continuous deterioration if kept under poor storage conditions. Eventually acetate-based film will suffer from the so-called "Vinegar Syndrome" derived from the storing acetic acid (like vinegar) smell the film emits as it deteriorates.

Polyester-Based Films: Polyester-based film is chemically more stable than nitrate and acetate film. The emulsion layer on film base shrinks over time especially for nitrate and acetate films. Since polyester bases do not shrink as much as the emulsion layers, expansion & contraction of the emulsion layer on the polyester base might eventually cause it to separate from the base.

Storage & Handling: For optimum long-term storage of colour films, keep them at temperatures of less than 0^o C and with an appropriately low level of relative humidity. Although fading is less of a problem for black-and-white projection copies on acetate or polyester film base, deterioration can begin within little more than a decade. At the minimum, printed copies should be kept under conditions that do not exceed 10 °C and 20-30%R.H.

Films should always be wound evenly and never too tightly, with the emulsion side out. Metal film storage cans or plastic boxes should be uniform in size, stored flat and never stacked more than twelve inches high. Never put paper or any other loose material in the film storage can or box. Decomposing nitrate films and acetate films suffering from vinegar syndrome must be stored separately from one another and apart from other films.

Common sorts of film damage are shrinkage, brittleness, buckling, scratching and perforation damage. Nitrate and acetate films can shrink or become brittle or

both, through loss of moisture, solvents or plasticizer. Shrinkage and brittleness can be reversed temporarily, buckling is difficult to cure. Scratches can be minimized.

Perforations are always under considerable stress. Two or three perforation can be patched with a special polyester adhesive tape made for the purpose. If more than a few perforations are missing and if the original film is shrunken, it can only be patched by cementing in an undamaged section from a film with the same shrinkage level.

5. CARING SPECIAL COLLECTIONS - BASIC GUIDELINES

With information galore, let us take a glance at what a museum professional needs to follow in general for caring the objects in the collections:

5.1 Minimise the Effect of Light

a) Avoid displaying organic materials in direct sunlight even for short period.
b) Block ultra violet light from fluorescent bulb and windows with ultra violet filament transparent films.
c) Use incandescent light whenever possible. Halogen light is higher in UV radiation than incandescent light but much lower than daylight.
d) Do not put exhibit objects close to incandescent bulbs, which give up heat.
e) Avoid using frame with attached incandescent lamps on your paintings as damage by light is cumulative and irreversible.

5.2 Provide Stable Environment

a) Extremes in temperature and relative humidity probably occur most often in basements, attics and garages. Store important collections elsewhere, such as, in an internal closet.
b) Do not place sensitive objects next to heating or coolers vents or in direct sunlight.
c) Prevent growth of mould and mildew to discourage insect activity.
d) Keep organic materials in stable condition at around 50% relative humidity.
e) Provide cooling and good air circulation in the hotter months; use dehumidifier in humid areas.
f) In fact, in dry climate and during the hot seasons, use a portable evaporative type humidifier
g) Make sure frameworks of art are not in direct contact with the glass by using window mats made of archival quality (rag) paper products.

5.3 Minimize the Effect of Air Pollution

a) Reduce the amount of dust in your museum by upgrading and cleaning the filters in heating and air conditioning units regularly.
b) Framing works of art on paper and small textiles behind glass will protect them from acidic, abrasive effects of dust.
c) Avoid exhibiting objects where any form of combustion takes place. Limit the use of new wood products, adhesives, new carpeting and chemicals around collections.
d) Avoid using coatings, sprays, polishes, commercial cleaners or products containing silicon on important objects.
e) Use paste wax not more than once a year on furniture and wooden cabinets.
f) Slightly damp cotton cloths, magnetic wiping cloths or safe natural bristle brushes are appropriate for routine dusting.

5.4 Minimize Pest Activity

a) Good housekeeping and proper storage can help keep collections free of pests.
b) Display or store organic materials away from sources of food and excessive dampness.
c) Inspect objects both on display or storage at least once a year for the signs insects activities: adult insects, small warmlike juvenile insects, powdery deposits and small holes or missing areas.
d) If evidence is found, place the object in an airtight plastic bag immediately and take professional advice for conservation.

5.5 How to Handle Objects

Many objects are much more fragile than they appear. Observe the carefully condition and size of the object before any attempt to move it. Be sure that one may carry it along or arrange for help. Before beginning, clean space to set the object down. Always handle objects with clean dry, lotion-free hands or preferably with clean cotton or plastic gloves.

Lift three-dimensional objects by the base or body, never by handle or protruding elements. Lift furniture by structurally sound elements such as sheet frame or base, never by appendages such as arms or legs. Move framed works of art in a vertical position by handling secure areas of the frame, supporting the bottom and side. Support paper or textile objects from underneath or on a sheet of acid free white mat board or white blotter paper.

Do not touch the front or back surfaces of the oil paintings as it may cause cracks or other damage. Never use cleaning solutions, sprays, alcoholic, insecticides near any work of art. Use a safe natural-bristle brush to clean objects and paintings when the surfaces are in good condition. Feather dusters are not recommended as they can catch in small cracks and dislodge fragments of paint or surface.

Remove jewelry and watches before handling the collection. Make sure button, belt buckles and other accessories will not contact the object during handling. Avoid the presence of food and drink. Keep work surfaces clean and free of extraneous objects such as keys, paper clips, tools and writing implements.

5.6 How to Display Objects

a) Be sure, hanging devices on paintings and other framed pieces are strong and secure.
b) Use wall hangers appropriate to the weight of the work and nature of wall on which it will hang.
c) Locate fragile and breakable objects away from areas of activity where they may be bumped or knocked over.
d) Protect objects in vitrines or under glass or acrylic.
e) Avoid using sticky substances other than microcrystalline wax to secure unstable inorganic objects on shelve or other surfaces.

5.7 How to Store Objects

Choose the materials to be used for displaying and storage carefully to ensure that they are compatible with the objects. Wood, wood products and many paper products made from wood containing harmful acids and should not be used with artifacts because they can accelerate damage. Archival-quality storage boxes, mats and rapping tissues made from cotton fibres (rag) or from purified wood pulp are better choice. These products are available in buffered or unbuffered form; both are acid free, but buffered products contain a reserve calcium carbonate or chalk, which can neutralize acidity in the object or the environment. While buffered products are the best choice for the many paper objects, unbuffered products should be used for photographs, wool, silk and leather which are somewhat acidic by nature.

Use archival quality materials as recommended by conservators. Insist framers on using archival-quality mat board for following archival frame procedures. House photographs in archival albums or inside inert plastic envelopes.

Some varieties of plastic store products such as page protectors, photo sleeves and albums can be harmful to photographs, slides and negatives. Choose suitable materials such as polyester (Mylar D), polyethylene, polypropylene and polycarbonate. Avoid polyvinyl chloride plastics and self-adhesive photo pages. Photo corners on archival paper are a better choice. Object should not be in direct contact with rubber bands, paper clip, rubbers, cement or other adhesives; self-adhesive levels on paper; plasticine or other clays. Do not use bubble wrap, rubber polyurethane foam rubber, newspaper to wrap or pack objects. Safe polyethylene foams are available through conservation suppliers.

Store three-dimensional objects in labeled boxes that are sufficiently large. Do not overcrowd the objects in a box. Separate them with neutral pH tissue or with unbleached cotton muslin that has been machine-washed in hot water (once with soap and once without) and dried. Place heavier and less intricate on the bottom. Pad the folds with tissue to prevent permanent creasing in textiles.

Protect large unboxed objects in storage with soft, prewash muslin cloth or neutral pH tissues and drape them loosely with polyethylene sheeting. Frame paintings and framed works of art on paper can be stored vertically, edges protected with padding and protected from one another with archival cardboard.

Store metals under dry conditions. To retard tarnish, store silver wrapped in Pacific silver cloth (available at jewelry and departmental stores) or in acid free buffer tissue.

6. FREQUENTLY ASKED QUESTIONS ON PRESERVATION

1) How should I store my books?

Store books out of direct Sunlight with proper air-circulation. Store them away from windows and don't put them on shelves against outside walls.

Store books on flat, smooth shelves, strong enough to support their weight. Books should not be in contact with unsealed wood as it can release damaging acidic vapour. Stand books vertically side by side. Keep similar sizes together. Use bookends to keep the book from falling over.

Avoid storing book in hot and humid environment as in attics or basements. Keep books out from under plumbing and water pipes.

2) How should I display documents or works of art on paper?

Protect such items by hinging them into mats that have both a backboard and a window board. Use picture frames, free of acid (alkaline, ideally pH 7 pH 9) and coloured with non-damaging dyes that don't run if they get wet. Poor quality mats can damage the pictures. The most common damage is dark yellow staining, particularly around the edges of the window mat that frames the picture.

While mounting the document or picture in the mat, it should be attached to the backboard of the mat with long-fibred paper hinges (Japanese paper, usually) and cooked starch paste.

Alternatively, secure the item in the mat with photocorners (of high quality polyesters)

Never hinge pictures with pressure-sensitive tapes. Never use rubber cement, stick glue, spray adhesives or dry-mount adhesives.

Use a good frame with glass or acrylic used as glazing. Glazing should never touch the work of art.

Take precaution for guarding the object against damaging effects of light.

3) Can I save wet books? What if the books are moldy?

Books can be air-dried, or frozen and then dried at a later date.

The most important thing to do for saving wet books is to take action immediately as mold growth begins within 24-28 hours.

As the book dries, turn it upside-down. Humidity levels should be maintained below 75% RH with dehumidifier. Low temperatures assist in the avoidance of mold problems.

4) How can I preserve photographs?

Store photographs at 20 degree centigrade at 30-40% R.H. in a closet or air-conditioned room. Store photographs in proper enclosures made of plastic or paper materials, free of sulphur, acids and peroxides.

Avoid cheap, readily available photo albums, instead buy albums made of high quality materials. Use photo covers. Avoid albums with sticky adhesive pages.

5) Have an infestation. How can I get rid of bugs in my books?

Isolate the affected books and place them in a tightly sealed plastic bag. Fumigation has to be carried out by professionals under controlled conditions. Non-chemical preventive measures against insects include:

a) Seal entry points including windows, doors and put filters on vents.
b) Keep room temperatures and humidity levels low (insects need water, too)
c) Keep environment clears and dusted and do not store books near food or rubbish etc.

Desiccant dusts like silica can be used around the perimeter of the room, but will not be effective for insects with a winged portion of the life cycle.

6) How can I preserve newspaper clippings?

The only way to preserve the original is to store them properly:

1) Place clipping in a polyester film folder with a sheet of alkaline buffered paper behind it.
2) Put the polyester folders in file folders and boxes of high quality acid-free, alkaline buffered materials.
3) Store in a cool and dry location, such as a closet in an air-conditioner room.

7. CONCLUSION

Conservation is not a one-time objective that one can achieve and take one's hands off. It is a continuous process that needs to be amalgamated with even the menial chores of museum activities. Museums, in general, along with other objectives, have to pursue the cause of preserving culture for the posterity. Science museums, moreover, depict how the society interacts with science and technology over a much longer period than the life span of a human generation. Accordingly, the design, manufacturing, decoration, modification and adoption of museum and science museum artifacts are to be planned and implemented in a way that might pass the torturing test of time. This makes imperative that conservation becomes an attitude for the professionals who work for the distant future to come. True, that curative conservation requires the intervention of the expert conservators. Yet, this text endeavours to inculcate that preventive aspects of conservation can be taken up by all in the profession, even with limited resources and elementary interest in the physics and chemistry of conservation. The very individual objective and practice of caring for the collections may work wonders. Institutions like National Research Laboratory of Conservation of Cultural Property (NRLC) have already enumerated some parameters for preventive conservation of museum objects (Appendix -III). But to bring about proper coordination, control and monitoring in the process of artifact maintenance, auditing, solely based on self-assessment, may prove to be a very powerful tool (APPENDIX-IV).

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APPENDIX-I

Standards for protecting larger objects from theft

11.1 Standards for physical protection

11.1.1 **The structure of the building or the perimeter of an open site should be designed and/or defended to a degree that will deter an attack by a thief or vandal.**

11.1.2 **Windows, doors and perimeter gates should be designed, constructed and secured so that an intruder is deterred from trying to get in, or is delayed long enough to allow a supporting intruder alarm to trigger a response before the intruder can enter, steal and escape.**

Guidelines and notes

11.1.3 Further advice on these standards and guidelines can be obtained from the Museums & Galleries Commission's Museums Security Adviser. The difficulties in achieving the above standards of physical protection on some open sites and historic buildings are well understood. Indeed, it may sometimes only be possible to counterbalance physical weaknesses by the use of supervisory regimes involving people or equipment.

11.1.4 The structure of any building in use should be such that penetration through the walls and roof is difficult and time consuming. Even relatively weak buildings, eg of wooden construction, can be improved to meet this requirement.

11.1.5 The number of windows should be reduced to the essential minimum (though necessary ventilation must be maintained). Windows no longer required should be filled in to a similar strength and appearance to the surrounding structure. Windows in use, and those in historic buildings, should be protected by a means agreed with the Museums Security Adviser.

11.1.6 Doors to the outside should be reduced to the minimum, leaving only those required for entry or as Emergency Exits. Unused doors should be filled in as with windows, or blocked by other methods agreed with the Museums Security Adviser. Remaining wooden doors should be of at least 2" (50mm) thick solid construction and fitted with security standard mortice deadlocks. Emergency exit doors should be fitted with modern quick release door furniture which must be capable of being deadlocked when the building is unoccupied.

11.1.7 Pitched roofs of slate or tile should be fitted over close-boarded timber. Measures to modify roofs constructed of other materials should be agreed with the Museums Security Adviser. Unauthorised access to the roof should be limited by physical barriers, such as fencing, anti-climb paint or anti-vandal barriers.

11.1.8 The risk to objects on display will vary enormously, and in the case of open-air museums may be increased by weaknesses in the site perimeter. Other factors which should be considered are value, both as a collectable item and for use as recycled scrap material. Larger objects are also at risk if small parts can easily be removed, or are themselves collectable items. These risks need to be assessed and countered by the mode of display which may sometimes involve the use of replica parts or objects.

11.1.9 Modification of historic buildings may require Listed Building or other consents.

11.2 Standards for perimeter alarms

11.2.1 **All openings in the building fabric, such as doors, windows and rooflights, should fall within the protected zone of an intruder detector. Detectors appropriate to use on an open site are available and can be used to detect entry through the perimeter defences and the gates. An intruder detection system which qualifies for a National Approved Council for Security Systems (NACOSS) certificate and is to BS 4737 specification should be fitted by a company recognised and approved by NACOSS for such installations.**

Guidelines and notes

11.2.2 The system should be as simple as possible to avoid an unacceptable false alarm rate and should depend upon suitable sensors fitted to doors and other openings. Separate movement and body heat detectors are prone to false alarms, but newer devices which combine both techniques are more reliable.

11.2.3 The signalling of an alarm condition should be by means of a monitored line to an alarm company's central station. This will give an alarm if the line is cut.

11.3 Standards for invigilation

11.3.1 **The level of invigilation must be appropriate to the risk.**

11.3.2 **The bona-fides of all researchers and others with access to objects should be checked and recorded, and they should be adequately supervised.**

11.3.3 **Nobody should be allowed into museum stores unless accompanied by an authorised person.**

Guidelines and notes

11.3.4 The risk to items on display should be assessed and an appropriate level of invigilation be provided. This level should never be reduced; if sufficient invigilators are not available the gallery or even the whole museum should be closed. Special care should be taken at unusual times, for example while an exhibition is being installed or during evening events.

11.3.5 Researchers have, unfortunately, been responsible for serious thefts from museums. Everyone using the collections should be made aware that access is subject to Guidelines; even the most senior researchers should be obliged to follow them.

11.3.6 The Museums Association's *Guidelines on Security When Using Outside Contractors* should be observed.

11.3.7 Any larger objects which fall within the legal definition of firearms or prohibited weapons (for instance artillery or tanks with functional armament) must at all times be under the control of an authorised member of the museum's staff. It is extremely doubtful in law whether an unpaid volunteer, let alone a member of the public, can be left in 'possession' or control of such objects. This could for instance affect the use of unsupervised volunteers for conservation.

11.4 Standards for key security

11.4.1 **A strict policy regarding the possession of keys should be devised and enforced.**

Guidelines and notes

11.4.2 There should never be more keys than is strictly necessary and the number of people in possession of keys should be kept to the barest minimum. All keys, other than the external doorkeys held by keyholders, and keys to safes, should remain within the building in a secure key cabinet or safe, and should be identified by a coding system. An issue system against signature should be used as a security measure.

Sources of advice and help

- The following publications are useful:

Burke, R. and Adloye, S., *Basic Museum Security*, 1991 (2nd edition), International Council of Museums, Paris.

Hoare, Nell, *Security for Museums*, 1990, Committee of Area Museum Councils.

Kluwer Handbooks, *Handbook of Security*, Updated periodically, Croner Publications Ltd, Kingston on Thames.

A leaflet published by the Museums & Galleries Commission, *Museum and Gallery Security*, 1989, Museums & Galleries Commission, London.

Museums Association's *Guidelines on Security When Using Outside Contractors*, published annually in Museums Yearbook, Museums Association, London.

Thompson, J. M. A. et al (eds), *Manual of Curatorship*, 1992 (2nd edition), Butterworth-Heinemann/Museums Association, Oxford.

- Advice is readily available from the Museums & Galleries Commission's Museums Security Adviser (Tel 071 233 4200) and from the Area Museum Councils.

Standards for protecting larger objects from fire

12.1 Museum buildings should be designed or adapted to minimise the risk of fire and to prevent its spread. On an open site the risk of fire should be considered when deciding what grass, plants, bushes and trees to have where. In open-air museums, picnic areas where visitors smoke or use small stoves can be a particular risk. Depending on the use of a building and the number of people working in it, a fire certificate as required by the *Fire Precautions Act 1971* may be needed.

12.2 Areas housing collections should be rigorously insulated to a high standard (not less than half an hour protection, but preferably one hour) from fire spread from areas of risk, eg workshops, laboratories, kitchens, boilers or chemical stores. The degree of risk from 'risk areas' must be reduced as much as possible, eg by using an external chemical store. If chemicals are kept within the building, it must be in accordance with the advice of the local authority's Fire Officer and must comply with Control of Substances Hazardous to Health (COSHH) Regulations. A suitable COSHH assessment must be made and a copy kept in a convenient place for passing to emergency services on arrival at an incident (see also 14.5).

12.3 Larger industrial objects themselves can constitute a significant fire hazard. Rendering objects safe may require a significant compromise of their historical integrity. These should be taken into account before the decision to acquire them is made.

12.4 Appropriate precautions must be taken for each type of object (see 12.13).

12.5 In museum buildings all electrical wiring and equipment (including portable equipment) must be installed in accordance with the appropriate British Standard, the Institution of Electrical Engineers' Regulations, and the Electricity at Work Regulations. Electrical installations should be regularly maintained and checked as required by those regulations, preferably by someone familiar with that specific installation. Mechanical equipment must also be installed in accordance with appropriate British Standard and statutory instructions, and be regularly maintained. A Register of each piece of equipment should be established which should contain maintenance records and inspection certificates.

12.6 Mechanical installations should be maintained in accordance with the Heating and Ventilating Contractors Association guidelines on *Standard Maintenance Specification for Mechanical Services in Buildings*, published in 5 volumes.

12.7 The advice of the Building Control Officer and Fire Officer should be sought on the selection of all materials used in displays and storage areas. Normally all such materials should be fire-retardant, class O or A. Quite apart from their statutory responsibilities they should be invited to inspect the premises at least once a year, and be made aware of the particular requirements of museums. Their recommendations should be reported to the museum's Board of Management. A formal application for Building Regulation Approval is normally required for any structural work.

12.8 All contracts for work on the premises should be on a 'Permit to Work' basis and no hot work should normally be permitted. If hot work has to be done it should be to the safety regulations contained in Section 31(4) of the *Factories Act 1969*.

12.9 Wherever possible buildings housing objects should be covered by an automatic fire-detection and alarm system, installed and maintained in accordance with *BS 5839: Fire Detection and Alarm Systems in Buildings*. Consideration should also

be given to fitting such equipment to vulnerable objects, such as wooden boats permanently displayed ashore.

12.10 **The premises should be equipped with fire-fighting equipment as recommended by the Fire Officer and complying with *BS 5423: Portable Fire Extinguishers* and *BS 5306: Fire Extinguishing Installations and Equipment on Premises.***

12.11 **Fireproof cabinets should be provided to house the primary records and museum documentation, and wherever possible copy records and backup computer disks should be kept in a different building.**

12.12 **All staff and volunteers should regularly attend training in fire prevention and response. The level and standard of this training should be at least consistent with Part 1 (18) *Fire Precautions Act 1971.***

Guidelines and notes

12.13 Different types of larger object present different risks and demand different precautions. The following notes may prove useful:

STEAM VEHICLES:

Vehicles in use:

Steam powered vehicles are not inherently a fire risk if certain basic precautions are observed:

- the vehicle should never be left unattended when in steam;
- spark arrestors should always be in place and should be regularly checked and maintained;
- ash pans should be regularly and carefully cleared;
- drivers should be particularly vigilant near dry vegetation, thatched buildings or other easily combustible materials;
- disposal of hot ash or smokebox char should always be at an appropriate place - and well wetted if necessary.
- all the fire should be cleared out before an engine is left;
- engines should be cool before being covered;
- oil lamps should not be over-filled, and oily rags should be destroyed;
- excessive deposits of lubricants and coal dust etc should be removed from fire box, ashpan and foundation ring;
- Lagging that will come into contact with very hot surfaces, eg the smoke box, should be non-combustible.

Exhibits in the museum:

- all combustibles should be cleaned out;
- a safe cabinet should contain all lubricants, rags etc.

STATIONARY STEAM ENGINES IN USE:

There should be relatively little fire risk in any well maintained stationary steam engine.

- where lubrication is by gravity feed, lubricators must be turned off when the engine is stopped;
- where the steam raising plant is modern, operators must remember that the engine it runs - particularly a reciprocating steam engine - may impose unusual operating conditions on that plant;
- where the steam raising plant is itself historic, detailed operating procedures, including safe procedures for shutting down the plant, will be needed (see Section 22).

MOTOR VEHICLES:

Vehicles in use:

There should be relatively little fire risk in any well maintained historic vehicle.

- normal precautions should be taken to inspect fuel tanks, pumps, lines and carburettors, and electrical wiring and apparatus that may pass close by them;
- an on/off switch in the fuel line is an advantage;
- the battery should be properly secured and if possible covered with an insulated covering; it should have an on/off switch, and the terminals should be shrouded in insulating material;
- wiring should be regularly checked and any faulty wires changed in their entirety;
- fuses should be of the correct rating, specified by the manufacturer;
- the ammeter should be regularly checked as a means of detecting wiring faults;
- a CO_2 fire extinguisher should be kept in the vehicle as well as nearby. In vehicles with their own firefighting systems (eg tanks) these must be operational;
- pyrotechnics should be safely stored.

Exhibits in the museum:

- there is no agreement over whether it is more dangerous to leave petrol in a fuel tank, or to drain it and leave a vapour. Ideally, any vehicle coming in to the museum should be entirely drained of fuel, and the fuel lines disconnected to allow the whole system to be flushed or blown through so that the vapour is dispersed;
- fuel pumps and carburettors should be emptied;
- batteries should at least be switched off or disconnected, and ideally removed;
- if possible the vehicle should be able to be wheeled out of the building in the event of a fire, eg not on jacks, nor with flat tyres;
- vehicles fitted with magnetos should be earthed to a nearby earthing point.

BOATS:

Gas:

- gas is a frequent cause of fires in boats; bottled gas is heavier than air and readily settles in bilges. If gas is used a gas detection system and alarm should be fitted;
- where possible, gas bottles should be situated in a sealed containment fitted with a vent to discharge overside of the vessel;
- any gas bottles not required should be removed; any required but not in use should be switched off at the bottle.

Electricity:

- electricity should only be used if absolutely essential;
- all supplies to water-borne craft should be through an isolating transformer (110 volt if possible) and via an earth circuit leakage breaker;
- the rating of fuses should be only just sufficient for the anticipated load. This may be less than in operational use and potential danger can be reduced by keeping the fuse rating to a minimum. This is particularly important where old wiring is still in use.

Fuel:

Boats are normally powered by either diesel or petrol, and a few craft still use coal. Diesel or coal can be relatively safe, but petrol is almost as dangerous as low pressure gas. Heavier-than-air fuel gas is a major hazard on boats; bilge-gas explosions form a high proportion of boat fires.

- unless the engine needs to be working, all petrol should be removed from the tanks which should be well ventilated;
- when filling tanks, avoid spillage into the bilges or on to adjacent water. If there is any spillage in the boat, ensure the hull is well ventilated;
- no smoking or naked lights should be allowed in the vicinity of the boat when it is being refuelled with petrol.

Precautions:

- all boats should be equipped with dry powder or CO_2 type extinguishers;
- no smoking should be permitted in any part of preserved craft;
- large boats should have smoke/fire alarms fitted throughout interior accommodation. Very large boats open to the public should have an emergency evacuation plan;
- regular checks should be made for leaking fuel lines, old rags and other potential risks;
- bilges should be frequently ventilated;

- pyrotechnic flares should be regularly renewed if required, and safely removed if not;
- all buoys and standing and running rigging should be regularly checked.

AIRCRAFT:

Aircraft in use

Maintenance and fire safety procedures for live aircraft are strictly governed by the Authority on whose register they appear. In the UK this is usually the Civil Aviation Authority, although some aircraft may be registered with foreign authorities such as the United States Federal Aviation Authority.

Exhibits in the museum

- the entire fuel system should be drained and purged with air or, better still, with nitrogen. Draining alone is not adequate because there may be a residue of vapour, or pockets of liquid in awkward corners of some fuel tanks;
- pyrotechnics (cartridges) should be removed, eg ejection seats, engine starters and Very pistols;
- pressure vessels, especially oxygen cylinders, should be drained;
- batteries should be removed, or disconnected by removing the earth strap and taping up the terminal;
- aircraft fitted with magnetos should be earthed to a nearby earthing point.

Wood and fabric aircraft are high risk items which need special care, for example during any work being carried out nearby which might generate a spark.

ELECTRICAL AND ELECTRONIC EQUIPMENT:

- all equipment should be installed by suitably qualified electrical engineers, as required by the Joint Industries Board, Institution of Electrical Engineers and National Inspection Council for Electrical Installation Contracting;
- installation should be provided with switchgear as defined in Chapter 53 of current IEE Regulations, so as to eliminate danger from arcing and overheating;
- electrical installations within exhibits or equipment should be constructed to ensure that heat generated by the electrical systems does not transfer to combustible materials;
- where a risk of overheating exists, the enclosure should be force-ventilated and a high temperature cut-out fitted to isolate the electrical supply;
- lamps used in displays should comply with BS 4533 and BS 3456 and should be well ventilated;
- exhibits to which the public has access should use low voltage switching on the public interface;
- foolproof precautions are required against unauthorised switching on.

12.14 A survey is needed to decide the type, number and location of fire-detection sensors appropriate to the premises. Indeed, a wider ranging survey can be undertaken to identify specific risks and precautions required, to provide a fire precautions manual containing checklists and Disaster Response Plans (see Section 14) and to set out a reporting procedure. Both specialist companies and many major security firms can give such advice.

12.15 A major cause of fires affecting larger objects in museums is vandalism. Good site security is essential (see Section 11). General tidiness is also vital; inflammable material and rubbish left lying around an open-air site is an invitation to vandalism.

12.16 Smoking should be forbidden in all parts of the site or premises which contain collections.

12.17 Public events pose a particular fire hazard. Careful thought should be given to fire prevention when planning events, and emergency procedures planned and practised.

12.18 Any original firefighting system, in an aircraft, vehicle or boat, which incorporates methyl bromide, should be rendered safe or replaced with a CO_2 or other modern approved system. Note that an aircraft which is only taxied, and not flown, must still have an operational firefighting system.

12.19 Some larger objects bring with them their own protection against fire or excessive escape of heat. This often takes the form of asbestos, for example on boilers, pipework, and even in the chimneys of hot tube ignition engines.

12.20 A sprinkler system should be considered; they can be highly effective in the event of fire. Museums have sometimes avoided sprinkler systems in the past because of a fear of water damage. However, modern systems are reliable and selective if well planned and well maintained.

12.21 Historic buildings pose particular problems over fire precautions, as they do over security. Compromise is, however, very often possible, and specialist advice should be sought. Modification of historic buildings may require Listed Building or other consents.

See over for sources of advice and help

- The Local Authority Fire Prevention Officer and the Local Authority Building Control Department will both be glad to give advice.

- Information about UK fire authorities and companies offering prevention and detection services is given in the Security & Fire Prevention Yearbook, available from:

Paramount Publishing
17-21 Shenley Road
Borehamwood
Herts

- Other useful information such as safety data sheets can be obtained from:

Fire Protection Association
140 Aldersgate
London EC1

and

Fire Prevention Information
Aldermary House
Queen Street
London EC4N 1TJ

- Some advice on preventing fire in preserved aircraft is included in:

Fitzgerald, L. and Storer, J. D. (eds), *Stopping the Rot: the Passive Conservation of Aviation Collections*, 1991, The British Aviation Preservation Council/The Museum of Science & Industry.

- Many museums are in or include historic buildings, whose adaptation to meet fire prevention and security requirements often causes problems. *Fire Safety in Historic Buildings*, 1990, published by the Fire Protection Association is a useful source of advice. Area Museum Councils can also give advice - directly or through consultants - on possible solutions.

- Useful information on the interpretation of the Fire Precautions Act 1971 can be found in *Code of practice for fire precautions in factories, offices, shops and railway premises not required to have a fire certificate*, 1989, HMSO, and in *Fire Precautions Act 1971: guide to fire precautions in existing places of work that require a fire certificate*, HMSO.

Standards for moving larger objects

18.1 **The handling and movement of objects should be kept to an absolute minimum.**

18.2 **Trained personnel and suitable equipment must be available for the safe lifting and transporting of objects.**

18.3 **Every move of an object should be carefully planned in advance, adequate personnel and equipment provided, the route agreed and cleared, and the supervision of the operation agreed.**

18.4 **Objects being moved should be protected from physical shock, vibration and from hostile environmental conditions.**

18.5 **Objects and parts of objects being moved should be kept sufficiently apart from one another to prevent abrasion, crushing and contamination.**

18.6 **Staff and volunteers should be trained in the handling and moving of objects and should be aware of the potential risks to objects and to themselves.**

18.7 **Contractors used for lifting and heavy haulage work should have proven experience in the field and must work closely with museum staff to ensure best practice in care for the object.**

18.8 **Wheeled and tracked objects should only be moved on their own wheels after appropriate engineering advice has been obtained on the mechanical condition of all the moving parts, the suspension, if any, and particularly the bearings. Proper lubrication is essential before a wheeled or tracked object is moved on its own wheels.**

Guidelines and notes

18.9 Larger industrial and social history objects may pose particular problems when moved because of their size and weight. Some may be able to move on their own wheels; some, though having wheels, may be too fragile, old or delicate to move in that way. Others may be so large or heavy, even when broken down into component parts, that specialist heavy hauliers and crane operators have to be engaged.

18.10 Moving larger objects, whether manually or mechanically, requires careful planning to ensure that it is done successfully and without danger to people or object.

18.11 Collecting larger objects in the field often raises the most severe difficulties of following proper procedures. The more difficult the job, the more important it is to entrust it to highly experienced people.

18.12 The following guidelines should in every case be followed:

- One experienced, capable person should be in charge of the whole operation.
- Everyone involved should be trained and know their responsibilities. The team must ensure that control is maintained throughout the operation.
- Assess the load: can it be moved? What are its weak points? What is its condition? The original specifications may give its weight: check that they accord with the object as built or as found. Original specifications may also give lifting points/lifting advice. Are the original lifting points still strong enough? Has the

object been moved before? If so, are there records of the move? How was it done? What difficulties were met?

- Modify the object. Can it be reduced into smaller and lighter units? But dismantling should be kept to the minimum necessary, and must be fully record at each stage.
- Does the object need a supporting frame/structure during transit? If so, prepare one.
- Drain all fluids.
- Choose a route and means of transport to minimise disruption to the object. Inspect the beginning, middle and end of the route. Note any obstacles or problems and make necessary preparatory arrangements.
- Check the floor loadings on the route, and provide plates and boards as necessary. Point loadings through wheels of trucks can be very high.
- If taking an unusual load on the roads, inform the police.
- Consider the advisability of a courier or accompanying member of staff.
- Follow the Government Indemnity Scheme "yellow guidelines" (available from the Museums & Galleries Commission) where applicable.
- Ensure security against thieves and vandals throughout the move.

18.13 Special problems attend the moving of some types of object. Aircraft for example have a relatively fragile external skin, which may look more robust than it is. When lifting an aircraft the appropriate manual should be consulted to determine the correct procedure. The aircraft must be lifted at approved jacking points or trestle locations. When lifting by crane, hoisting points and, in some cases, special slings or lifting beams will have to be used. When transporting an aircraft in a dismantled state, the correct cradles for the components must be used. Holding-down straps must be adequate, especially for lightweight items, and must be correctly placed.

18.14 When moving a computer, each cable end must be labelled, and heads of disk drives must be secured.

18.15 When moving unpowered wheeled vehicles, care must be taken to avoid an 'out-of-control' situation. A tug vehicle must have adequate weight and braking capacity for its load. If using a push pole, beware of jackknifing which could cause the load to overtake the tug vehicle.

18.16 For certain larger objects such as carriages, cars and boats, special adjustable trolleys can be designed, making their movement very much easier.

Mechanical handling

18.17 Moving larger and/or very heavy objects poses particular problems; contractors will almost certainly have to be used. It is important to check the experience and competence of such contractors, to develop a good working relationship with them, to talk through their proposals and the needs of the museum (and the object) and to oversee the operation. A crane company should be insured against damage to 'load under hook'.

18.18 Lifting other than from floor to vehicle should be avoided if possible; crane-hire is costly and greatly increases the risk to the object. If lifting is necessary, correct slinging is

essential to avoid damage to the object. Cranes and slings are subject to particular regulations under the Factories Acts.

18.19 Loads must be properly secured on or in vehicles; even the heaviest machine may move en route if it is not rigidly fastened down. Choose an air suspension vehicle.

18.20 The use of pallets and pallet movers, both manual and motorised, is key to the management of larger objects. Objects should be secured to their pallets by strapping devices, web netting or polythene wrapping sheets. Everyone who uses such equipment should receive appropriate training.

18.21 Object should be protected with appropriate packing materials. These will depend on the object, the type of transport, climate (at both ends and microclimate in transit), length of journey and route. Use packing materials that protect the object and do not themselves damage it; for example tarpaulin covers may be dirty and have abrasive fastenings. Suitable packing materials may include medium and high density polyethylene foam, bubble wrap, felt blankets, etc.

Manual handling

18.22 Heavy objects should be lifted and carried by hand as little as possible. Prior to any lifting operation a full risk assessment should be carried out (see Section 23).

18.23 Everybody involved should be aware of their responsibilities under the *Health & Safety at Work Act 1974*.

18.24 The weight alone of a load is no longer considered a sufficient indicator of whether it may be carried by one person without risk of injury. The object's size, stability and the distribution of its weight must all be considered. However, the *Manual Handling Regulations* indicate maximum guideline figures for a load, carried at elbow height close to the body, of 25kg for men and 16.7kg for women. The maximum weight for loads carried in any other position should be reduced by at least 5kg, and by 10kg when lifting from points below elbow height.

18.25 A heavy load should not be carried more than 10 yards (10m). Trolleys should be used, and lifts of adequate weight capacity between floors.

18.26 Floor surfaces should be clear of obstacles (including matting) and should not be slippery; lighting should be adequate and there should be sufficient space.

Sources of advice and help

- Guidance on manual handling will be found in:

Health & Safety Executive, *Manual Handling: Guidance on Regulations (Manual Handling Operations Regulations 1992)*.

Standards for protecting larger objects from flood

13.1 As far as possible no pipework or tanks should be permitted in new buildings in areas where collections are kept; every effort should be made to exclude pipework from such areas in old buildings. Adequate drainage should be provided in buildings where there is a possibility of flooding.

13.2 No object which can be raised (if necessary on a pallet, with lifting gear), should be placed lower than 6" (150mm) above the floor.

13.3 Tanks and boilers on steam engines should be drained before they are laid up indoors.

13.4 Special precautions need to be taken to prevent flooding in larger objects kept outdoors.

13.5 Special precautions need to be taken to prevent flooding in ships and boats kept in the water.

13.6 Appropriate precautions should be taken in museums liable to flood.

Guidelines and notes

13.7 "If a flood can occur, one day it will"; this assumption should guide all arrangements in the museum.

13.8 Compliance with relevant building regulations and recommendations, especially in old buildings, may make complete exclusion of pipework difficult. Every effort should be made, in discussion with the appropriate technical consultant, to find a satisfactory compromise solution. In areas where objects can be raised off the floor, one solution may be to run the pipework at ground level rather than ceiling level. Automatic cut-off valves should be installed, and leak detectors are desirable.

13.9 All pipework and stop-cocks should be labelled in accordance with *BS 1710 Identification of pipelines and services*, should be noted on the building plan in the museum's Disaster Response Plan (see 14.4), and should be very frequently inspected during frosts.

13.10 Adequate drainage to cope with flooding should be provided; drains should have non-return traps.

13.11 All taps to sinks should be of the spring-loaded automatic turn-off type.

13.12 The danger of water damage as a result of fire should be considered in Disaster Response Plans (see Section 14), and should be regularly discussed with the Fire Brigade.

13.13 As extra protection from water leaking from above, larger objects may be protected with polythene sheeting. Waterproof boxes, cabinets, etc should be used whenever possible, though the danger of condensation should be considered.

13.14 The Local Authority and local Water Authority should be asked for advice on the likelihood of flood; long-resident neighbours should also be consulted. Bund walls, stop boards, sandbags and other precautions may be appropriate in some museums.

13.15 If the museum site includes a body of water, eg a mill pond, the facilities and arrangements for controlling overflow, draining and dealing with emergencies should be regularly

reviewed with representatives of the National Rivers Authority and the Fire Brigade. Where the museum is adjacent to a body of water it does not control such a regular review is equally essential, and clearly needs to involve the owner.

13.16 All staff and volunteers should receive regular training in flood prevention and response.

13.17 A portable water pump should be available for emergency use.

13.18 Boats are subject to particular risks of flooding, and require special precautions (see also Section 21):

- craft should be regularly pumped out, to prevent rainwater increasing the weight of the craft and possibly bringing a damaged seam below water level;
- boats on tidal waters or rivers should be moored with lines long enough and strong enough to cope with strong tides and surges;
- bilges should be checked regularly; whenever possible automatic bilge pumps should be installed, positioned so that if the vessel lists they do not run dry and overheat;
- a small mark placed at normal waterline will show a change of level, perhaps due to a leak;
- flooded craft should be raised as quickly as possible to prevent damage to equipment and fittings; craft that have been under water should be dried out slowly;
- if there is a risk of sinking, non-essential equipment should be removed;
- water and heating systems should be regularly checked;
- all through-hull openings should be fitted with a 'sea cock' valve, which should be regularly maintained and where possible kept closed.

13

Sources of advice and help

- The Fire Brigade will provide advice on the prevention of flooding.

Standards for planning response to disasters

14.1 **The museum should draw up a Disaster Response Plan for the protection and rescue of the collections in the event of fire, flood or other catastrophe. This Plan should make specific provision for the rescue of larger objects.**

14.2 **All museum staff and volunteers should receive regular training in how to respond to disasters.**

Guidelines and notes

14.3 The Disaster Response Plan is a written document which sets out procedures to be followed in an emergency. Its general contents should be known to all staff through prior discussion and through regular training sessions and emergency exercises. Liaison with the public emergency services over its contents is essential; once written, it requires continued revision to ensure that it remains relevant.

14.4 The plan should include:

- responsibilities of personnel, method of raising alarm and communication to others;
- emergency telephone numbers, including home numbers of staff;
- confidential up-to-date plan of site and buildings clearly showing all services, hazardous stores, etc. A separate copy of this should be available to the fire brigade on arrival;
- priorities in limiting damage to the collection and to its documentation;
- sources of relevant expertise, including conservators and nearby museums, archives, etc as agreed beforehand;
- list and locations of material and equipment, (every museum should have a 'disasters box' containing mops, buckets, cloths, overalls, etc);
- list of suppliers and services (eg freeze-drying, haulage contractors);
- security measures for the collections if the premises are damaged, eg pre-arranged off-site safe storage;
- arrangements for documentation of objects taken off site;
- first aid measures for damaged collections, by type of material, drawn up in consultation with conservators;
- an agreed budget including petty cash/chequebook, with a hierarchy of authority to spend in an emergency. The hierarchy should extend as far as possible in order to ensure that someone present at a disaster is authorised to spend money;
- a safety policy for working in hazardous conditions.

14.5 A complete record of the collection and its disposition within the stores or displays, together with a COSHH assessment, should be available some distance from the collection itself, and a duplicate should be held in another building (see also 12.2).

14.6 It is essential that the Disaster Response Plan be drawn up in close cooperation with the Fire Service, and be regularly reviewed with them.

14.7 The Disaster Response Plan should in every museum be only part of a wider policy for the protection and rescue of people (first) and of the collections (see Sections 23 and 24).

Sources of advice and help

- The following publications are useful:

East Midlands Museums Service, *The Museums and Records Office Emergency Manual*, 1991, East Midlands Museums Service, Nottingham.

Fire Protection Association, *Fire safety in historic buildings*, 1990, Fire Protection Association, London.

Society of Industrial Emergency Services Officers, *Guide to Emergency Planning*, 1986, Paramount Publishing, Borehamwood.

- Advice can be obtained from the Area Museum Councils. In addition, The Conservation Unit of the Museums & Galleries Commission (Tel 071 233 3683, Fax 071 233 3686) maintains a Register of private conservators throughout England, Wales and N Ireland and a list of suppliers of materials. In Scotland this information is held by Historic Scotland's Conservation Bureau.

- In some areas Emergency Conservation Units are available. Area Museum Councils can advise.

- The National Preservation Office video *If disaster strikes* is useful for training. Contact your Area Museum Council for hire or purchase of this video and to organise disaster contingency planning seminars.

Relative humidity and temperature for the storage of records relating to larger and working objects[1]

Materials	Ambient Temperature (°C)	Ambient Relative Humidity	Microclimates[2] (Where needed)
Historical Records:			
Documents on paper	13° - 18° [3]	55 - 65% [3]	Not applicable
B&W prints	15° - 20° [4]	30 - 50% [4]	Prevention of condensation on cooled material important
B&W negatives:			
Cellulose ester base	<20°C [5]	15 - 40% [5]	
Polyethylene terephthalate base	<20°C [5]	30 - 40% [5]	
Glass negatives (silver image photographic plates)	15° - 25° [7] (preferably below 20°C)	20 - 50% [7] (preferably below 40%)	
Modern Records:			
Magnetic recording media	18° - 22°C [6b]	35 - 45% [6b]	
Optical or laser discs	18° - 22°C [6b]	35 - 45% [6b]	
Microform/Film (master & copies):			Prevention of condensation on cooled materials important
Cellulose ester base	<20°C [5]	15 - 40% [5]	
Polyethylene terephthalate base	<20°C [5]	30 - 40% [5]	
Colour slides/negatives	2°C or below [4b2]	25 - 30% [4b2]	Higher than necessary RH accelerates deterioration
Colour prints	2°C or below [4b2]	30 - 50% [4b2]	

Notes

[1] There is great debate about acceptable levels. In general the nearer the minimum figure quoted the better.

[2] Take advice on microclimates. Refrigeration of these materials should include RH buffering with conditioned silica gel. Allow materials to acclimatise to room temperature before use, and provide moisture sorbents, eg bagged silica gel, to counteract any possible condensation.

[3] BS 5454

[4] ISO 6051

[5] ISO 5466

[6b] BS 4783

[7] BS 5687

APPENDIX-II

UCLA Museum of Cultural History: ARTIFACT CONSERVATION RECORD

cession Number:

her Markings:

rief Description:

Nature of Object:

- ☐ Ceramics
- ☐ Glass
- ☐ Iron/Steel
- ☐ Copper
- ☐ Brass
- ☐ Silver
- ☐ Other Metal (Specify)
- ☐ Marble
- ☐ Other Stone (Specify)
- ☐ Wood
- ☐ Textile
- ☐ Skin/Leather
- ☐ Bone/Ivory
- ☐ Horn
- ☐ Other Material (Specify)

Dimensions:

	Height	Width	Depth
INS			
CM			

Condition:

Initial Recording:

- Drawing ☐
- Photographs ☐
- Radiograph ☐
- Other (Specify) ☐

Summary of Treatment:

- ☐ Cleaning
- ☐ Mechanical Scaling
- ☐ Chemical Scaling
- ☐ Electrolytic Scaling
- ☐ Intensive Washing
- ☐ Stabilization
- ☐ Surface Coating
- ☐ Impregnation
- ☐ Repair
- ☐ Restoration
- ☐ Reshaping
- ☐ Biocidal Treatment
- ☐ Spot Tests
- ☐ Analyses, Chemical
- ☐ Analyses, Physical
- ☐ Photographs—
  - ☐ B&W
  - ☐ Colour
  - ☐ I.R.
  - ☐ U.V.
- ☐ Radiographs
- ☐ Report (Final)

DATE	RECORD OF TREATMENT AND OBSERVATIONS
	Received
	Completed Signed:

Photographic Documentation

Abstract of Materials Used

Adhesives/Consolidants	Reagents & Solvents	Biocides	Surface Coatings

1. Strength
2. Brittleness
3. Abrasion, Fraying
4. Hole, tear, cut
5. Wrinkle, fold, crease
6. Missing part, loose part
7. Stain, surface dirt
8. Fading, yellowing
9. Discoloring, bleeding of color
10. Corrosion
11. Mildew
12. Insect damage
13. Mending
14. Former washing or cleaning
15. Finish
16. Distinguishing mark or label
17. Other former treatment
18. Exhibition device
19. Other

EXAMINER_____ DATE_____

VACUUM

VACUUMER_____ DATE_____

COLOR TESTING

water detergent acetic acid NaCl Solvent Glycerine

TESTER_____ DATE_____

WET CLEANING Medium Temp Ph Time Water Color

Soak

Wash

Rinse

Bleach

Dry

CLEANER_____ DATE_____

CONSERVATION/RESTORATION PROCEDURE

Materials Used

Procedure

Length of time

Date finished

SIGNATURE_____ DATE_____

RECOMMENDATIONS FOR FUTURE CARE STORAGE AND/OR EXHIBITION

ACCESSION NUMBER _____

T.R. NUMBER _____

CATEGORY/CROSSREFERENCE _____

_____

NATIONALITY _____

ARTIST/DATES/PERIOD _____

TITLE _____

REFERENCE _____

OWNER _____

ADDRESS STREET _____

CITY _____ STATE _____

ZIP _____ TEL. NO. _____

DIMENSIONS

	Length	Width	Thickness	Weight
a				
b				

DESIGN.

SHAPE

	Media/ Fiber.	Twist/ Make-up	Approx. Diam.	Count	Finish/ Color/Dyes
Warp					
Weft					
Surface Embellishment.					
Backing/ Lining					

FABRICATION TECHNIQUE.

PHOTO DATA

Film type:				
Number:				
Distance:				
In-coming light reading:				
Time exposure:				
F/·				

PEEBLES ISLAND
FURNITURE EXAMINATION FORM

Acc. #

Object Description:

#_____ Site_____ Region_____

ner_____ Examination Date_____ Date Requested_____

T DESCRIPTION

Outside Measurements: Height_____
Side to Side_____
Front to Back_____

pe:_____

pels, Inscriptions:_____

terials: Primary Wood(s)_____
Secondary Wood(s)_____
Finish_____

Hardware_____

Mounts_____
Nails_____ Screws_____
Upholstery_____
Additional Materials_____

plications of Technical Data with Respect to Probable Age, Origin, and thenticity of Object:_____

ments on Construction:_____

PEEBLES ISLAND
FURNITURE EXAMINATION FORM - Page 2

Acc. #

BEFORE TREATMENT (A) PHOTOGRAPHS & RADIOGRAPHY

	B & W	COLOR
Normal		
Detail		
Raking		
U. V.		
I. R.		
Micro		
X-Ray		

EXAMINATION METHODS & CONCLUSIONS

Naked Eye

Hand Lens

U. V.

I. R.

Radiography

Microscope

Chemical Tests(s)

Further Testing Suggested

INSECT DAMAGE

Yes_____ No_____

Acc. #_____

Object Description:_____

SECT DAMAGE - Cont'd

(Major)_____

(Minor)_____

Active_____ Inactive_____ Identification of Insect_____

NGAL DAMAGE

Yes_____ No_____

Active_____ Inactive_____ Identification of Fungus_____

TACHED OR MISSING ELEMENTS

_____

_____

_____

EVIOUS TREATMENT

_____

_____

_____

NDITION OF

PRIMARY WOOD/ELEMENTS_____

_____

_____

SECONDARY WOOD/ELEMENTS_____

_____

_____

VENEER, INLAY_____

_____

FINISH_____

_____

CONDITION OF - Cont'd

METAL LEAF, PAINT, GROUND _____

_____

HARDWARE _____

MOUNTS _____

UPHOLSTERY _____

ADDITIONAL ELEMENTS _____

_____

ADDITIONAL COMMENTS ON CONDITION

Symbol (e) above indicates estimated by examiner/appears to be.

References to left and right are respective to object and not from viewer's location while in front of object.

Other _____

_____

_____

_____

_____

PROPOSAL FOR TREATMENT

_____

_____

_____

_____

_____

_____

_____

_____

_____

Estimate of Date When Object Will be Returned to Site _____

Examiner's Signature _____

PEEBLES ISLAND
FURNITURE LAB TREATMENT RECORD

Acc. #_____

Object Description_____

DATE	OPERATOR	TREATMENT

PELBLES ISLAND
FURNITURE LAB TREATMENT SUMMARY FORM

Acc. # _____ Site _____ Region _____

Examiner _____ Treatment Dates _____

Treated by _____

PHOTOGRAPHIC & X-RAY RECORD

	B & W	COLOR
Normal		
Detail		
Raking		
U. V.		
I. R.		
Micro		
X-Ray		

1. Removal of dirt and grime _____
2. Removal of later elements and/or surface coatings _____
3. Replacement of missing elements _____
4. Reattachment of separated or insecure elements _____
5. Reconstruction of insecure elements _____
6. Consolidation _____
7. Fills _____
8. Cosmetic or inpainting _____
9. Abrasion or scratch removal _____
10. Refinished/surface coated _____
11. Other _____

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COMMENTS ON TREATMENT

RECOMMENDATIONS FOR MAINTENANCE OF OBJECT

Conservator's Signature _____

APPENDIX-III

INDICATORS FOR PREVENTIVE CONSERVATION

INDICATOR 1 - Building

	YES	NO
1.1 Does the museum have space utilisation planning?	☐	☐
1.2 Is the museum building inspected regularly for general maintenance and for seepage & leakage of water and rising dampness?	☐	☐
1.3 Whether general maintenance of the building is satisfactory?	☐	☐

INDICATOR 2 – Plans & Facilities

	YES	NO
2.1 Is there an Annual Action Plan for improving preventive conservation of the objects in the museum?	☐	☐
2.2 Does the staff of the museum is adequately trained in preventive conservation?	☐	☐
2.3 Does the museum have budget allocation for preventive conservation?	☐	☐
2.4 Are the basic equipments like lux meter, UV monitor, thermohygrograph, vacuum cleaner, trolley, etc. available in the museum?	☐	☐

INDICATOR 3 – Collection

	YES	NO
3.1 Is there an inventory listing each and every object of the museum?	☐	☐
3.2 Does the inventory indicate the location of each object in the museum?	☐	☐
3.3 Has it been verified in the last 5 years that each entry in the inventory corresponds to an object and each object has entry in the inventory? (Conduct survey of 15 randomly chosen cases)	☐	☐
3.4 Can an object be found within 5 minutes? (Conduct survey of 15 randomly chosen objects)	☐	☐
3.5 Has a survey been conducted in the last 5 years to assess condition of objects and their preventive conservation needs?	☐	☐
3.6 Has the museum identified the objects that need special preventive conservation because of their importance or vulnerability?	☐	☐

INDICATOR 4 - Storage

	YES	NO
4.1 Is the collection storage separated from other stores?	☐	☐
4.2 Is there enough space in the storage to allow easy access to all the objects and for keeping an extra table?	☐	☐
4.3 Does the storage area include racks and cabinets suitable for the collection?	☐	☐
4.4 Is there a schedule to clean the storage area and is it followed properly?	☐	☐
4.5 Is cleaning of the collection done regularly and properly?	☐	☐
4.6 In case the storage is air-conditioned, whether the AC is run 24-hours?	☐	☐
4.7 Is the storage area opened regularly for air circulation?	☐	☐

INDICATOR 5 – Environment

	YES	NO
5.1 Is the intensity of light falling on the objects in the galleries and showcases within the permissible limits?	☐	☐
5.2 Is the UV content of light in the galleries and showcases within the permissible limits?	☐	☐
5.3 Has it been ensured that no direct Sunlight falls on the objects?	☐	☐
5.4 In case the galleries are air-conditioned, whether the AC is run 24-hours?	☐	☐
5.5Does the museum have an integrated pest management program (Monitoring, prevention and extermination)?	☐	☐

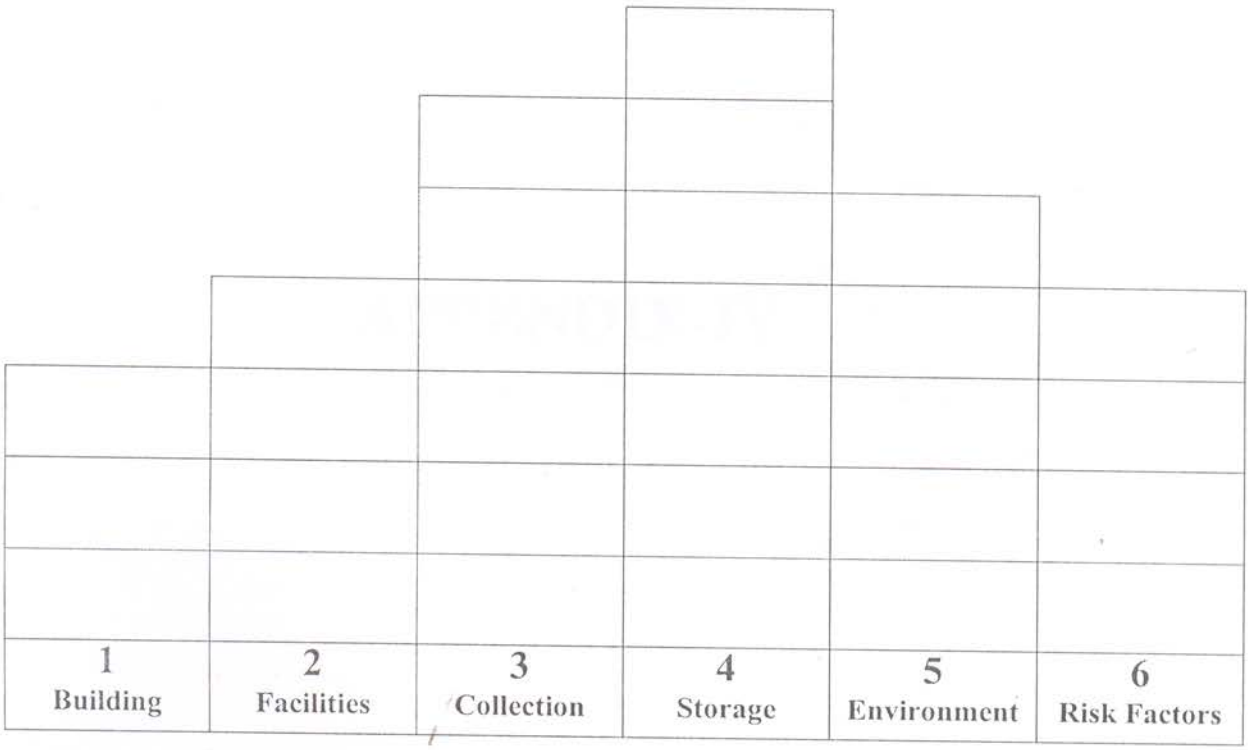
INDICATOR 6 - Risk Factors

	YES	NO
6.1 Has the museum building enough resistance against fire and theft?	☐	☐
6.2 Are there alarm systems for fire and theft and they are functioning well?	☐	☐
6.3 Has the response system to fire and theft alarms been prepared, and does the response system against checked regularly?	☐	☐
6.4 Whether all the staff is trained in fire fighting operations?	☐	☐

SUMMARY CHART OF THE STATUS OF PREVENTIVE CONSERVATION

Name of the Institute:

Date:



APPENDIX-IV

CONSERVATION AUDIT

Tej Singh
NRLC, Lucknow

To know how best we have conserved our objects in a museum, conservation audit of various museums is a present day requirement. Since preventive and curative conservation are complimentary to each other, both need to be included in the conservation audit.

Though audit is an unpleasant exercise but at the same time we know that audit is a powerful tool for development of the program implementing machinery. Similarly the ultimate aim of conservation audit is to improve the state of conservation of the collections. The proposed procedure is based essentially on self-assessment wherein the following parameters may be used for the conservation audit:

1. State of preventive conservation in the museum.
2. State of preservation of the collection.
3. Facilities and expertise available for curative conservation.
4. Quality of performance in the treatment of objects.

Preventive Conservation

All possible causes that may contribute to the deterioration of objects, may be used as indicators of preventive conservation. Answers to a set of questions on indicators can provide information on the state of preventive conservation in an institution. Causes of deterioration may differ from collection to collection, and, therefore, the questions framed for one collection may either not be enough or be redundant for another

collection. A suggestive list of questions as given below may be grouped under the following headings:

1. Building.
2. Plans & facilities.
3. Collection.
4. Storage.
5. Environment.
6. Risk Factors

The list of questions is as follows:

Building

1. Does the museum have space utilisation planning?
2. Is the museum building inspected annually for general maintenance and for seepage & leakage of water and rising dampness?
3. Whether general maintenance of the building is done regularly?

Plans & Facilities

1. Is there an Annual Action Plan for improving preventive conservation of objects in the museum?
2. Does the staff of the museum is trained in preventive conservation?
3. Does the museum have budget allocation for preventive conservation?
4. Are the basic equipments like lux meter, UV monitor, thermo-hygrograph, vacuum cleaner, trolley, etc. available?

Collection

1. Is there an inventory listing each and every object of the museum?
2. Does the inventory indicate the location of each object in the museum?
3. Has it been verified in the last 5 years that each entry in the inventory corresponds to an object and each object has entry in the inventory?
4. Can an object be located within 15 minutes?
   (Conduct survey of 15 randomly chosen objects)
5. Has a survey been conducted in the last 5 years to assess condition of objects and their preventive conservation needs?

6. Has the museum identified the objects that need special preventive conservation because of their importance or vulnerability?

Storage

1. Is the collection storage separated from other stores?
2. Is there enough space in the storage to allow easy access to all the objects and for keeping an extra table?
3. Does the storage area include racks and cabinets suitable for the collection?
4. Is there a schedule to clean the storage area and is it followed properly?
5. Is cleaning of the collection done regularly and properly?
6. In case the storage is air-conditioned, whether the AC is run 24-hours?
7. Is the storage area opened regularly for air circulation?

Environment

1. Is the intensity of light falling on the objects within permissible limits?
2. Is the UV content of light in the galleries and showcases within permissible limits?
3. Has it been ensured that no direct Sunlight falls on the objects?
4. In case the galleries are air-conditioned, whether the AC is run 24-hours?
5. Does the museum have an integrated pest management program (Monitoring, prevention and extermination)?

Risk Factors

1. Has the museum building enough resistance against fire and theft?
2. Are there alarm systems for fire and theft and they are functioning well?
3. Does the response system against fire and theft checked regularly?
4. Whether all the staffs are trained in fire fighting operations as specified for museums?

These are only some of the general questions. The list will have to be modified for each and every institution depending upon the type of collection.

State of preservation of the collection.

As regards the state of preservation of the collection, it is difficult to examine each and every object, and, therefore, examination of 10-15 randomly chosen objects of each type is proposed. The external auditors shall choose the objects, and the concerned institution shall prepare the reports in a prescribed format.

Examination Report on the Objects

1. Type of the Object:

2. Accession No.:

3. Title:

4. Period:

5. Size:

6. Nature & Extent of Deterioration:

7. Priority for Conservation:
   - Immediate
   - Only superficial treatment needed
   - No treatment needed

The reports in respect of each type of objects will then be consolidated in the formats given below for stone and oil paintings, as examples.

Oil Painting:

			Number of oil Paintings in the Collection
1	Total		
2	Dimensions:	(x) (x) (x)	
3	Restored in the last-	1 year 2 years 5 years	
4	On display In reserve collection	--------- ---------	
General Comments:			
5	Storage conditions:	Very good Good Not good Bad	
6	Display conditions:	Very good Good Not good Bad	
7	With frame Without frame Condition of the frame:	--------- --------- Very good Good Not good Bad	
8	Stretcher: Fixed type Stretcher: With keys Without stretcher Condition of the stretcher:	--------- --------- --------- Very good Good Not good Bad	
9	Condition of the Canvas:	Very good Good Not good Bad	
10	Condition of the Paint layer:	Very good Good Not good Bad	
11	Condition of the varnish:	Very good Good Not good Bad	

Stone

			Number of Objects
1	Total		
2	On display In reserve collection		
3	Restored in the last-	1 year 2 years 5 years	
General Comments			
4	Storage conditions:	Very good Good Not good Bad	
5	Display conditions:	Very good Good Not good Bad	
6	General condition of the objects:	Very good Good Not good Bad	

Facilities and expertise available for curative conservation.

Conservation facilities can be assessed by the information provided by the museum on the followings:

1. Broad types of objects present in the collection.

   Stone, Ceramics, Bronzes, Jewellery, Coins, Other metal objects, Oil paintings, Wood, Manuscripts, Miniatures, Paintings on different substrate, Textiles and costumes, Natural history specimen, Other types of objects (Specify).

2. Space available for the laboratory (Number of rooms and floor area of each room).
3. Equipment and tools available in the laboratory (Give detailed list).
4. Conservation material available in the laboratory (Give a list).

5. Equipment, tools and conservation material proposed to be purchased in the next 1 year.
6. Details on the conservation staff (Number of posts, staff in position, training received in conservation, etc.).

Quality of performance in the treatment of objects.

The parameter on quality of performance is rather subjective, however, answers to the following 2 queries should be provided by the institutions.

1. Is there a time bound program for periodic examination of the objects?
2. Have the objects to be conserved during this year been identified, and their priority drawn?