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PRESERVATION OF ARCHIVAL MATERIALS

An archives is the memory of the nation or community or institution whose record is safeguarded, and "the physical defence" of the materials in its custody is easily it's primary responsibility. Archives is the golden mine into which the historian dig for material for his narrative of the times he is interested in, to which the administrator turns for precedents for any action he contemplates, in which the diplomat and the minister seeks for authentic information about some diplomatic or political transaction of long ago. They are thus as much of strategic as of scholarly value and so merit all the care that can be lavished in preserving them.

Archives are having a great variety of collection of records. These records of the past are important because they impart today the historical importance of those days. The role they play in furthering human knowledge is unsurpassed. Archives is the custody of these precious records and their directors, technicians and their assistants have the responsibility of its care and preservation. The archivist can certainly protect the records from destruction if he knows the properties of records in his care, their chemical behaviour and the effects of the environment and other causes of deterioration upon them. To the modern archivist the perishable quality of his materials is a matter of real concern.

General Principles of Preservation :

For proper work of preservation certain principles should be followed. Archival materials are so delicate and present a number and variety of problems that we have first to arm ourselves with some principles of a general nature to guide us constantly. They may be summarized as follows:

1) Examinations of the object thoroughly and isolation of all deterioration factors must be the starting point. We must know the material, the alternation it has undergone the extraneous materials like those of strains that have been deposited on it.

2) Then the course of treatment for its various maladies must be charted out. The methods and materials chosen must be such as would have the least damaging effect on the archival material itself.

3) Only standard materials must be used. If any new material is to be used, it is better to have it tested and its suitability established before using it.

4) All commercial products whose composition is unknown must not be used. It is better to use pure reagents. If a commercial product is well recommended, then its' effect on a specimen archival material has to be found out before it is brought into regular use.

5) Caution is to be employed in deciding on restoration or cleaning. It is not always absolutely necessary that restoration or cleaning is done on an archival material. It may be that a particular discoloration or stain is much less undesirable than process and chemicals used to remove it. The least drastic methods should also be tried first and then only we must proceed to more drastic methods, stronger solutions, longer exposure to reagents.

6) It is always necessary to prepare for each archival materials concerned a brief record of the deterioration observed and the methods used to counter it.

Agents of Deterioration:

The modern archivist must consider two factors that affect the preservation of the materials in his custody. These have been referred as internal and external agents of deterioration. The internal agents are those within the materials themselves. The external are those introduced by conditions of storage and use. In general that light, adverse temperature and humidity, acidic pollution of the air, and impurity in the paper are indicated as deteriorative agents.

Internal Agents of Deterioration:

The internal agents of deterioration are those within the materials themselves. They are found in the substances on which records are made and the media used in recording on them. Both the substances and the media used have become more perishable in the course of history. Ancient and medieval documents were made of clay, papyrus, parchment and vellum, which were strong and durable. Even documents of modern period, until about the middle of the 19th century were made of paper from rag (cotton flax and hemp) which was also comparatively strong and durable. Writing inks used were the so called Indian ink, nutgall ink and sepia ink, all of which were fairly permanent. But modern archives are produced on wood pulp papers and written with inks produced from coal-tar dyes. They carry within themselves the agencies of their own destruction.

Perhaps the best way to ensure the preservation of archives is to have them made with permanent materials, this is the preventive measure that can be taken only at the

time when records are first created. It is a measure that can be prescribed by law and by regulations issued in pursuance of law, requiring the use of permanent papers and inks for records of permanent value.

I. PREVENTIVE MEASURES

a) Selection of Record Materials:

Specifications of writing ink and paper for permanent records:

Record Ink:

The blue black ink containing not less than 0.4gm of iron per 100 cc of the fluid ink is recommended for permanent records. Specifications for such an ink are given in IS:221-1962 (revised): specification for Fluid ink for registration and for cheques and records, issued by the Bureau of Indian Standards.

Writing Paper for Permanent Records:

The following specification have been prescribed by the Indian Standards Institution ISI: 1774-1961: Specifications for paper for permanent records.

Chemical Requirements:

1) Rag content (Cotton, and linen singly or 100% mixed)

2) Alpha cellulose content ... 85% minimum.

3) Copper number ... 2% maximum

4) Ash content ... 2% maximum

5) Rosin content ... 1.5% maximum

6) pH ... 5.5% minimum.

Control switches for lighting or power points should be outside the room and the mains are to be invariably switched off when the stack area is closed. For the same reason, the use of steel shelving in the stack area is recommended because it prevents the spreading of fire unlike wooden shelving. Another very good method of limiting the spread of fire is to partition off the stack area into different portions with metal partitions having metal doors and to isolate them from one another through shutting the doors in case of fire. This will check the spreading of the fire and help in its control.

Fire fighting apparatus must be installed at convenient points in the stack area. Fire - fighting apparatus consists of (1) buckets of water or sand, (2) strirrup pump for water, (3) Fire extinguishers. Any fire-fighting apparatus leaving a residue of acid must not be used in archives. Automatic water sprinkling system must also be avoided for the reasons that the records may be dampened and spoilt. The points of installation of the fire-fighting equipment must be area so that one would readily know where to go for setting the apparatus in case of fire.The telephone number of the fire brigade must be prominently displayed at each point.

Fire extinguishers are of three types : (1) Soda- acid extinguishers use the pressure of carbon dioxide generated through the reaction of sulphuric acid and sodium bicarbonate to force a jet of water. These are generally cylindrical or conical in shape and have a capacity of nine litres. The throw of the jet is about thirty feet and will last for about two minutes. These should not be used for electrical fires as they may lead to an eletric shock.

(2) Foam extinguishers look like the soda acid extinguishers but give off a foam instead of water. The principle of these

extinguishers is that a fire goes out when oxygen supply is cut out. These are useful for fires involving petrol, oil, paints. varnish and spirits. These may not be used in archives.

(3) The C.T.C. fire extinguishers are generally cylindrical metal cases of brass containing carbon tetrachloride which can be pumped out with the help of a pump embodied in the extinguisher itself.These are particularly useful for small fires and may be used for putting out electrical fires.

Carbon dioxide cylinders containing liquid carbon dioxide under pressure are also very useful for putting out fires. The carbon dioxide released by it may be directed against any type of fire which is put out by the suffocating action of the gas. It has a range of eight to ten feet. The cylinder is kept mounted vertically on a trolley and can thus be readily moved to any point for use. Care must however be exercised in using it as the effect of the gas may be dangerous, especially in a confined space.

e) Space:

To preserve records space is first essential. When the quantity of records produced by a government is so great that more space must be found to hold them, the operating function of an archival institution require space for work rooms for receiving, fumigating, cleaning, repairing, binding and duplicating records, custodial room and search rooms.

f) Racking, Shelving and Storing:

It is not enough that the ambient atmosphere in an archives is ideal or is made to converge towards the ideal. It is equally important that the actual racks, shelves and containers also confirm to the exigencies of good storage, that is be resistant of dirt, dampness, fire, micro-organisms and rough handling. Proper choice of material and design of racks, shelves and containers would go a long way in

averting the dangers that threaten archival material. It is necessary to bear in mind the following general principles in arranging the storage of archival material.

a. The racks should be positioned away from the walls. Similarly the lowest shelf should be at least 6" from the floor.

b.It is desirable to have a book-shelf full or atleast to use book supporters to keep the volume eract. Similarly containers is which documents are kept should be full so that the lid keeps the sheets pressed.

c. No shelf should be out of reach. Otherwise when a document is being taken, especially a heavy one, there are many possibility of damage to it.

d. The containers for documents should not be very large. It has been suggested that the depth of the Boxes should not be more than 5". If there are too many documents in a single large box handling them becomes difficult and opens out possibilities of damage to them.

e.It is essential that sharp edges and ends are avoided in racks and shelves; otherwise the materials if documents may got torn by mischance in removing or keeping them back.

f. Moreover cleaning space must be provided on every floor for keeping documents while the place is being cleaned. It is suggested by Jenkinson.

Racking :

The racks may be of steel. They may be arranged breadth - wise along the length of the rooms. It is good to have them made in such a way that the position of the shelves could be easily altered at will. The steel rack may be suitably painted to avoid risks of rusting. Stove enamelled slotted

angles of a medium size answer these requirements very well. Flat dishes of metal may be placed under the legs of the racks and filled with water or an insecticidal solution to prevent insects from going up the racks from the floor. This cuts off effectively one access to the contents of racks.

Shelving :

It is preferable to have shelves of wood as wood does not condense moisture and does not rust. The shelves should be made of batterns so that air flow is maintained underneath the archival kept on them. The shelves may be slightly inclined away from the front so that any number or title written at the back of the container or spine of the book may be easily read without bending low.

For long rolled documents, Jenkinson suggests cantilever brackets built into the wall and provided with teak battens. "These racks, may be placed close together one above another, each taking one layer of rolled maps etc. of any length up to five feet."

A number of firms making office equipment have generally a very good range of filling cabinets to offer for several purposes. These include also manilla folders or envelops with facilities for noting the classification of the documents stored. These cabinets may be most conveniently employed for storage of documents or containers of documents.

Containers :

All containers are devised in such a way that the documents are kept well - pressed to avoid fraying and wrinkling. The containers may be of metal in which case they have the advantage of being fire - resistant, damage -

proof and long - lasting; the disadvantages are sharp edges and the possibility of rusting, if the metal is steel. The more common containers are of millboard or strawboard; these are economical, but susceptible to all the maladies of wood. Foil - clad pressboard is another material for containers; this is resistant to fire and water.

Documents in the form of Rolls may be protected at their ends with fine unbleached line as and kept in a leather board box of square section.

The outsize documents may be kept in port folios or folders of suitable size, if available. Otherwise their ends may be protected with unbleached linen and they may be wrapped around a four-inch strawboard cylinder slightly longer than the width of the document.

Foolscape files may be sewen together at the left margin. They may be mounted on guards before filing.

Boxes may be made of glazed leather board or fibre-board. Different sizes of boxes are to be kept for enclosing documents of different sizes. The depth is not to be more than five inches. The lid of a box is always a little larger than the lower half and has thumb holes for facilitating opening and closing of the box.

Maps may be placed horizontally in shallow drawers and protected by heavy manilla sheets. Alternately they may be filed vertically in plain files. They may be mounted on cloth for resistance to wear and tear; or they may be strengthened by lamination. Maps may also be stored, rolled up in vertical containers.

Atlases are usually quite big sizes. They may be stored horizontally on shelves of the roller type for easy withdrawal and replacement of the volumes. Not more than three volumes may be kept on one shelf.

Newspapers must be kept bound into not too large volumes. The bound volumes are best stored individually flat on shelves made with roller bearings for easy withdrawal or replacement. News clippings are more likely to be kept in Archives than the whole newspapers. The news clippings may be filed in steel cabinets of foolscap size. Important clippings may be mounted on thick paper before being filed.Such backings should be of uniform size for all clippings.

Micro-filming has come to stay more and more as a means of avoiding direct and frequent handling of the documents themselves. Microfilm itself has to be stored carefully. This is done by placing the 100 foot rolls of the film in aluminium containers which may be kept in steel cabinets, 30 inches high, 32 inches wide and 28 inches deep containing five drawers.

The ideal conditions for the storage of micro-film have been laid down to be as follows: The storage space must be air-conditioned to give a relative humidity between 40 and 50% with a temperature in the range 15 to 27°C but preferably near 20°c. The air inside should be free of acidic gases. There should not be any pressure on film.

In cases, there are film negatives other than micro-film ones, they may be filed in open manilla envelopes, each in a separate envelope, and the envelopes may be stored vertically in steel cabinets. The storage of the cabinets may be done in an air conditioned room at 40% relative humidity and 70°F temperature.

g). Nursing the Documents:

Nursing the documents also comes under the preventive method.

Dust Removal:

One of the routine items of preservative work in an archives is dust removal. Dust accumulates so quickly in our climate that it is necessary to remove it regularly. Dust is responsible for breeding insects and mildew. It also causes stains. If it accumulates in course of time it is deposited permanently on the records. We should not permit this. Regular work in the archives is dust removing.

But dusting it off with a cloth or sweeping it off with a broom is never completely effective because the dust is not easily removed from corners and crevices. So vacuum cleaners are scientifically recommended for dust removal. The dust is sucked up into the nozzle of the vacuum cleaner, and different types of nozzles with attached brushes obtainable with a vacuum cleaner enable the dust in crevices and between the odges of binding to be reached effectively. Ofcourse, the vacuum created when the cleaner is in operation enhances its effectiveness.

Moreover, the operation of vacuum cleaner is gentle and it involves no violent handling of the documents as may result in tearing of pages, loosening of binding etc. The dust sucked by a vacuum cleaner is also not dispersed into the surrounding air, but is trapped in a collecting bag which may be taken out from time to time and carefully rid of all the dust collected. Inside the stack room, it is preferable and necessary to have the floor also cleaned with the help of the vacuum cleaner.

In case vaccum cleaner is not available; it is necessary that the dust is removed with the help of a brush made up of hair of soft nature. A vaccum cleaner is however a must in any archives. Periodical inspection is also necessary for removing dust.

Control of Insects and Mildew:

Generally records are damaged by insects. Cockroaches and silver fish destroy the records from outside. To prevent this, repellent chemicals like nophtline may be used. It should be placed in every feet. Sodium fluoride or insecticide may also be used. There is a danger of affecting the records by using these chemicals. Small amount will be enough to destroy the insect. It may be sprayed on the floor so as the smell will spread over the entire room.

Book worms, termites and white ants are dangerous to records. So care and attention are needed to destroy these insects.

Meldew are highly dangerous, to records. So the regulation of temperature 75°-78°F would check the growth of these insects. Thymal Fumigation also eradicates these fungus.

Control of Humidity and Temperature:

It is the most important factor in the preservation of archival materials. Too much of relative humidity or too little of it is equally dangerous. So steps are to be taken to humidify the atmosphere as required.

When relative humidity falls below 50% the atmosphere may be said to be dry apropos the preservation of archival materials. In such a case, it is necessary to increase the moisture content of the air, that is to humidify the atmosphere. This can be achieved in several ways. The simplest and most indigenously used method is to keep open pots of water in the room. There is another type of humidifiers, called centrifugal humidifiers in which water is atomised into small droplets which are mingled with air and put into the archival rooms. The droplets must be of such size as would evaporate before reaching the floor.

When relative humidity goes about 65% it is said to be moist or humid. In the rainy season relative humidity easily goes to beyond this limit upto even 95% or more. In such conditions, the excess moisture has to be removed from the air. Thus the air must be dehumidified.

The simplest way of achieving this is to use of desiccant. The best desiccant is silica gel which is a form of silicon dioxide with a highly porous structure capable of absorbing on the surface 40% of its weight of water from a saturated vapour. Of course sillica gel may not be efficient in drying of an open room. It is excellent for air tight containers. So if any precious document is to be kept in proper conditions of relative humidity then it can be kept in an airtight container and some silica gel placed in it.

For dehumidifying a room, it may be necessary to use a dehumidifier. It is a place of equipment which draws in the moist air in the specified space and strips it of its extra moisture and puts the dried air back into the space. The operation of a dehumidifier can be so adjusted that it achieves a steady condition of relative humidity in the controlled space. There are two types of dehumidifiers. One which relies upon refrigeration for removing water from the air and the other which uses a desiccant like silica gel or lithium fluride for drying the air. Both these types are continuous in their operation.

There are dehumidifiers available which are automatic so that when the relative humidity of the atmosphere exceeds a certain fixed point, the equipment goes into action until the relative humidity is back to the desired level.

Control of Acidity:

It has been shown that acidity is one of the common causes for damage in paper. It is essential to control the

acidity in the record component. Subbarao and Mehta made a study of the perishing of paper in Indian libraries and observed that degradation of acidic paper is difficult to arrest. Extensive investigations into causes of deterioration of paper of the 18th and 19th centuries carried out by W.J.Barrow, also confirmed that nearly all the deteriorated papers were highly acidic.

Acidity is indicated by pH. A low pH number means great acidity. A pH of 7 indicates that the paper is neutral neither alkalis nor acidic. Anything over 7 indicates alkalinity in paper. It is desirable that acidity in old archival material is reduced before steps are taken to strengthen it. This can be best done by treating the paper with alkaline solutions.

Barrows deacidification process :

W.J.Barrow had first devised a method of deacidification using saturated lime water and calcium bicarbonate (0.15%). The document to be acidified is to be immersed in lime water for twenty minutes and then transferred to the other bath and immersed likewise for twenty minutes. The immersion in calcium bicarbonate is for the purpose of removing the excess lime water. Calcium carbonate is formed in the process and deposited in the fibres of the paper.

Barrow himself later devised a one-bath deacidification process by using a solution of magnesium bicarbonate, prepared by passing carbon dioxide through a saturated solution of magnesium carbonate. This saves on the time of immersion of the document sheet in the aqueous medium. Magnesium bicarbonate solution may also be sprayed on the book or manuscript sheets.

Immersion of the affected documents, should be handled very carefully. Because it is having it's own offset.

It would affect the writing. The writings may be faded. So, in the National Museum at Delhi, deacidification is done exposing the acidic documents or archival materials to vapours of ammonia in an air tight chamber. This method avoids the necessity for immersion of sheets of the documents in aqueous solutions, and it is useful in cases were smudging of ink is feared.

Thymol Fumigation:

The first stage in the treatment of a document after dust removal would be invariably fumigation. It is a good precaution against the possibilities of the documents carrying spores and larvae which can result in mildew and insect growth which in course of time and spread to other documents. Hence it is a good policy to subject to fumigation all documents received for treatment to get ride of even future outbreak of mildew growths or insects.

The fumigant to be used depends on the type of infestation. If it is a question of attack by fungi then the fumigant to be used is thymol. Mr.Plenderleith suggests the use of one ounce (28.35gms) of thymol for every 16 cubic feet (0.44 cubic meters) of the cupboard capacity.

A suitable apparatus for thymol fumigation can be made by adapting an air-tight cupboard or box. It is like the refrigerator. The front door is paneled with glass and have a rubber lining. This apparatus is divided into three compartments in order to circulate the air conveniently. In the shelves there are two holes and a 40-60 watt electric bulb is fitted at the base of the cupboard over which thymol contained in a porcelaine dish is heated. The files or volumes are opened in an inverted 'V' form with the stitched or bound past forming the apex. On heating, thymol vaporizes and the closed space inside the air-tight cupboard

becomes saturated with thymol which destroy the mildew growth. Records infested with mildew should be first cleaned and then fumigated.

One precaution to be observed carefully is to see that the documents or books are spread out well and their position changed frequently so that the individual sheets may be well exposed to the vapours. The fumigation of each set of documents should be carried on for fourteen days. Thymol has been found to be quite harmless to archival materials in every way and so there is no fear of over dosage. The solution should be made and applied only in the evening. Because it would affect the visitors. To reduce this odorous Thymol smell and normalize the atmosphere created by Thymol Fumigation ammonia may be applied.

Besides fumigation with thymol as a preventive measure, thymolised paper can be used for interleaving books and documents. This paper reduces the susceptibility of fungus growth. Thymolised paper can be prepared by immersing blotting paper in a 10% solution of thymol in alcohol, which is dried subsequently.

Another fumigant that may be used only for paper and not for parchment and vellum is formaldehyde. A 40% solution is used, and the papers are exposed to the vapours in an air-tight box for about 12 hours. After the treatment, the papers are to be aired well for several hours.

In the case of insect attack, the fumigant to be used is paradichlorobenzene. A quantity of 1b for 10c. ft. of space of the chamber is required for effective fumigation. The thymol fumigation chamber may be used for this also.

Another fumigant recommended is a mixture of carbon tetrachloride and ethylene dichloride in the concentration of 14lbs per 1000c.ft. This fumigant is to be

kept on the top of the shelf of the fumigation almirah as it's fumes flow downwards. This fumigation must be done for a period of seven to eight days.

Fumigation with Lindane is effective against many enemies of books and manuscripts; silver fish, booklice, woodworm, moths, cockroaches, book worms and dermestes. It is harmless to the materials of books and manuscripts. It is obtainable in powder or pollet form and acts by sublimation; its vapours settle down on books and other surfaces as a thin film, and the adult insect trying to get out through the film, is killed by it.

In hot climates, the film retains its efficiency for about eight days. Repeated fumigations should be carried out in one room within a few days of one another so that successive generations of insects coming out during the season may be annihilated thus giving the insects no chance to survive and breed.

Mr. Block has suggested the following solution to be given as a protective coating to book binding against attack by cockroaches.

Ethyle cellulose	-	10.5 ozs
Saliculanilide	-	0.5 ozs
Butyl alcohol	-	6.0 ozs
xyeene	-	3.0 quarts

A heavy coating of 1.0025 gms per sq.cm has been recommended.

II. PROTECTIVE MEASURES

Protection is needed only to the affected records. It is nothing but the restrengthening of old records. In involves something like giving strength to the records. Private

Cleaning and Stain Removal:

Besides general discolouration which may occur in paper, there is always the possibility of extraneous material depositing itself on it and other document material and causing disfiguring is stains. So it is better to remove the stains. The removal of stains is needed many reagents and medicines.

Commonly adopted cleaning processes are:

1) Use of mechanical devices such as use of erasures, brushing air cleaning, soft rubber powders, kneaded or synthetic erasing mediums, etc.
2) Use of soaps, detergents with enzyme.
3) Use of inert organic solvents like acetone carbontetra-chloride petroleum other, penzene, etc.
4) Use of bleaching agents like calcium hypochlorite (bleaching powder) sodium sulphate, potassium permangenate, oxalic acid, chlorine dioxide, hydrogen peroxide etc.

Adoption of stain removing technique depends on the type of the stain, its intensity and fixation. Each process may answer a specific use.

When adopting mechanical methods the document has to be dry, firm enough to withstand the treatment. While adopting liquid cleaning methods it is necessary to adopt only a solvent that does not bleed the ink. Bleaching operation is a drastic method and needs caution, experience and skill and is to be adopted when it is absolutely essential.

In case where only casual stains are present immersion of the document in the medium is not necessary. The stain can be removed by dab and transfer process. A thick blotter of absorbent pad is kept underneath the stained portion of the document. The solvent is applied starting from the edge

of the stain to the inner part of the stain. The position of the blooter pad is shifted after each dabbing so that the transfer stain does not spoil the other parts of the document. In case where soap or other detergents are used the document should be washed and dried after the operation.

A few specific stain solvents are:

1) Stain made of oil; Pyridine is good to remove stains from oil.
2) Stain due to fat or tar: Pyridine and Petrol.
3) Wax and candle grease stain: Petrol.
4) Fly stains: Hydrogen Peroxide.
5) Paint: Mixture of ethyl alcohol and benezens, turpentine, amyl acetate, puridine.
6) Tea and Coffee stains: Potacium perborate 2% solution.
7) Ink stains and iron stains: Sodium formaldehyde sulphoxylate.
8) Adhesive tape (Cellotape): Mixture of hexane and toluene.
9) Rust: Oxalic acid, mixture of tartaric and citric acid, salt and fresh lemon juice.

Fungi and moulds, besides weakening the paper fibres, also leave behind very discolouring stains. Madame Flieder, after very systematic work on 14 types of fungi secreting colouring substances, has arrived at the following conclusions; bleaching powder, sodium chlorite and sodium hypochlorite are most efficient in removing these stains.

Re-sizing:

In all these processes of treatment-deacidification and bleaching-it is very likely that the size in the paper is lost and it becomes very limp and weak. Resizing is the way to give back

the paper its crispness and strength back. For this first we have to prepare a gelatine solution (i.e. 31gms of gelatine in one litre of water). The sheets to be preserved are immersed in this solution one by one and then the excess size is squeezed out in a press and the sheets are spread out on a large sheet of paper or a clothesline for drying. After this the sheets may be again pressed to flatten them out well.

Flattening and Minor repairs:

A document may suffer physical damage such as tears, wrinkling and scattered holes and gross deterioration such as fragility due to loss of size, abnormally large number of holes and tunnels caused by insects attacking books. All cases of minor damage require local attention as quickly as possibly so that the damage may be contained.

The edges and corners of papers in a file when it comes to the records room may be folded and slightly damaged due to improper tagging of the papers in the file cover. File covers themselves are at times torn and damaged, and need replacement. Therefore, before a file is restored for storage on the shelf, all such minor damages, as would subsequently result in major ones should be attended to. However, before the files are unstitched, for flattening and minor repairs of the individual sheets, it is necessary that they are paginated, so that the order of the file is kept undisturbed when the sheets after flattening and repairs are restricted into files.

The edges of paper which might show crampling tendency should be flattened. Use of moderately not electric iron is satisfactory for the purpose. The portion to be flattened should be made dap with a wet sponge covering with blotting paper and ironed. If there are creases in the paper these should be removed by ironing. If there are minor

tears they should be repaired by pasting strips of good quality hand-made paper at the back of the torn portion.

If the portion where the tear exists is written on both sides it could be mended by pasting strips of thin tissue paper on both sides of the tear. Torn and damaged covers could also be mended likewise, or replaced with new covers. In most of the papers the damage is usually confined to the edges of sheets. Such damaged portions may also be re-inforced by pasting slips of all rag hand-made paper, care being taken that if there is writing on the back, the same is not covered in the mending process.

While selecting adhesives for repair work use of gum or glue should always be avoided. Both these materials are unsuitable as they shrink on drying. Binder's paste made of starch, dextrine or maida is still the best for this purpose. If tissue paper is used for repaid dextrine, thin starch paste or C.M.C. paste should be used for maintaining legibility of the writing.

Full pasting:

If a document is brittle and written on one side, full pasting may be given. For this purpose hand made paper may be used. It must larger than the document paper. It should be held an inch larger in every side. While pasting we have to be very careful, because it would affect the writing.

Tissue Repair:

Documents, writings on which have not faded and which show only slight deterioration can be re-inforced with fine quality of tissue paper. Only unsized imitation Japanese tissue paper, free from oily and waxy constituents, should be used. The sheet to be reinforced is spread on a waxed or

oiled paper and dextrin paste is applied to it in thin layer. Tissue paper larger than the document in size is placed on one side of the document and spread lightly from edge of the document to the other, the tissue which comes in contact with the document being simultaneously pressed with a wet cloth or cotton swab. The other side of the document is similarly treated. If dextrine paste is not available, thin starch or maida paste can also be used for chiffon or tissue repair.

Chiffon Repair:

Chiffon or fine flexible, transparent silk gauze is used for repairing extremely fragile, ink corroded or insect damaged documents. Before undertaking repair with chiffon all the slips and patches pasted on the document should be removed. After the removal of the patches of the document which is ready on a waxed or oiled paper is covered with a chiffon or silk piece slightly larger than the document, and dextrin paste is applied to the chiffon piece with a brush starting from the centre and spreading outwards. When the entire document has been so covered and treated with the paste, the assembly is turned over on another waxed or oiled paper. The first oiled or waxed paper which will be now on the top is carefully removed so that the document remains intact on the second oiled or waxed paper.

The process of pasting of chiffon piece is not repeated on the top side. After the chiffon has been fixed on both sides of the document, care is being taken to, avoid creasing of the fabric, the sandwiched document is allowed to dry. The semi-dried repaired document enclosed in between two waxed or oiled papers should be kept pressed in a hand press or between two hand boards with weights over them. After the documents have been pressed, these should be removed

from oiled or waxed paper, edges of protruding chiffon trimmed and the documents stitched and docketed as described earlier.

In case the ink of the document is soluble in water they should preferably be repaired by hand lamination process. If such documents are to be repaired with chiffon the process adopted should be as follows; A piece of chiffon, larger than the document, is spread on the waxed or oiled paper and dextrine paste applied to it with a brush. The document then spread gently over the chiffon and pressed under a waxed paper. Another piece of chiffon of the same size as the first one is again spread on a waxed or oiled paper and dextrine paste applied to it as in the first case. The document to which chiffon has been applied on one side is taken off from the waxed paper and the untreated side of it placed on the paste-treated chiffon, and pressed under a waxed paper. The waxed paper on the top is removed without disturbing the sandwich is then allowed to dry. The document may than be treated for subsequent processes as described earlier.

Lamination:

The National Archives and Records service, Washington, U.S.A. developed the process of sealing the documents between two sheets of cellulose acetate foil by application of heat and pressure and for this purpose installed a prototype flat bed hydraulic press. In a similar machine installed in the National Archives of India there are six plattens (61 x 81cm.) hollow from inside, and providing five openings each 7.5 cms. wide. Five plattens move with the help of a piston under hydraulic pressure. Steam for heating the plattens is produced by an oil-fired boiler and fed at 7-8 kg/cm pressure. Both the temperature and pressure in the plattens are suitably indicated in the

control panel fixed to the press. Cooling of the plattens is effected by circulation of water.

Tissue paper is incorporated during lamination to give added strength. To prepare an envelope for lamination, a sheet of tissue paper is placed on a table, and a piece of cellulose acetate foil of the same size is spread on it. The sheets to be laminated are placed over the cellulose acetate foil in a manner that enough margin is left on the binding side of the documents for having a guard flap, while there is an equal margin on the other edges for trimming.

In case of books and volumes the sheets are arranged in such a manner as to provide ready sections for binding after lamination. The relative position of the sheets is secured by a little application of acetone on the four corners of each sheet.

Cellulose acetate foil and then tissue paper are again placed over the document. The corners of the formation are again touched with acetone so that sandwich may not get disturbed during its transmission to the press. The envelopes are placed in between two sheets of Teflon cloth (tetra flourethyleance coated glass fabric) and two such envelopes are placed between two metallic sheets (chromium plated stainless steel cauls plates, thickness of cauls plates being 1mm.).

Similar compositions are placed on all the platens and the pressing operated, i.e., the plattens are subjected to hydraulic pressure and heated. Temperature required to melt cellulose acetate is 145°C-155°C and is achieved by steam under pressure 7-8 kg/sq.mm. or more.

The pressure needed for satisfactory lamination depends upon the nature of the documents. Normally pressure in the range of 50-50 kg/cm^2 is adequate and the entire cycle takes ten to fifteen minutes. After the plattens

are cooled by circulation of cold water, the pressure is released. The caul plates are removed and the repaired sheets taken out and trimmed, leaving a margin of approximately three mm. all round.

Since the documents are cooled under pressure no curling taken place on removal from the press. In order to have satisfactory adhesion all along, documents in one envelope should have the same thickness. Slight variation of thickness is taken care of by Teflon cloth and to further ensure uniformity of pressure all over the documents while in the press, two sheets of thick blotting paper are placed on either side of the Teflon sandwich before placing at between the caul plates.

A rotary laminator developed by W.J.Barrow consists essentially of two electrically heated thermostatically controlled metal plates for preheating the material to be laminated, and two revolving calendar rolls with a pressure range from 20-20 kg/sq.cm to supply the necessary compression. The process of lamination consists on placing the documents between two sheets of cellulose acetate foil having two pieces of tissue paper on the two extremities and laid in a moulding form made of thin cardboard lined with tracing cloth which acts as a conveyor during the process of lamination.

The complete lamination cycle require only thirty-five seconds. After the document has been sealed, it is pressed between cardboard and kept overnight under pressure to eliminate any tendency to curl. The pressure by rollers eliminates any possibility or entrapping air between document and the foil which occasionally occurs with flat bed machines. The machine also has advantage of operating only on electricity and no additional equipment for supply of steam under pressure is necessary.

Lamination offers a number of advantages over other repair processes. The process can easily be applied to documents written with water soluble ink or colours without fear of their spreading. In this regard a word of caution against use of roller type machines where foils with adhesives are applied to documents is called for. Even if the foil used is cellulose acetate, the adhesive may have deleterious effect on record materials.

Hand Lamination:

A modified technique of laminaion which does not require elaborate and expensive equipment was developed by O.P.Goel in the Research Laboratory of the National Archives of India in 1952. This process does not make use of heat and pressure but cellulose acetate is turned semi-plastic by acetone and on drying this forms a bond between tissue paper and document. The document that requires reinforcement is placed on a polished glass plate, and a sheet of cellulose acetate foil is placed over the document and a sheet of tissue paper is spread gently over the cellulose acetate foil covering the document.

The size of cellulose acetate foil and tissue paper should be slightly larger than the size of the document. A cotton swab dipped in acetone is gently rubbed over the tissue paper. Small quantities of acetone from the cotton swab penetrate the tissue paper and reach cellulose acetate foil which becomes semi-plastic and on drying binds the tissue with the document. Care, however, is taken that the cotton swab is only lightly pressed, otherwise excessive quantity of acetone will be released and dissolved the acetate foil completely at places which will subsequently show as patches on tissue paper. The reverse side of the document is likewise treated and the document dried under pressure. Instead of tissue paper, chiffon may also be used.

The hand lamination or the solvent lamination not only offers decided advantage for institutions where expensive equipment cannot be installed but also provides the only means of laminating documents with seals which would be obliterated under pressure or those written in inks which are liable to decomposition under heat.

Docketing:

After the individual sheets have been attended to for minor repairs these should be properly put in a thick docket cover and sewn. The size of the cover should be slightly larger than the size of the document. If there is not enough margin on the document for sewing purpose (the writing may be extending upto the margin), a flap of 2.5-4cm. breedth may be pasted along the margin.

The process of flipping is technically known as guarding. The length of the guard should preferably be equal to that of the document. Use of all rag hand - made paper or good quality writing paper is preferable for making guards or flaps. One advantage in guarding is that the individual sheets can be made into pairs or sections and sewn to the cover through the folds of the guard. After the subject matter of the file and its numbers are recorded on the cover, it is ready for storage.

Guarding :

The outline of the guard strip is marked in the centre of work table in pencil, and then the outline of the sheets to be guarded is marked on both sides, after allowing approximately 5mm. overlap on either side of the guard paper. The eight leaves of the first gather, i.e., pages 1, 3, 5, 7, 9, 11, 13 and15 and a waste sheet are placed one over another in a step ladder formation, providing a margin of nearly 5mm. between the respective sheets of tipping. Binder's paste is then evenly applied with a brush over the

marginal step formation, thus giving a streak of paste 5 mm width on all the sheets. The blank sheet then is removed. Pages 15, 12, 11 and 9 are removed in the formation without disturbing the rest, and kept aside. The guard strips are then fixed over the edges of pages 1,3,5 and 7 respectively.

After the guards have been pasted these sheets are turned over and placed the other side of the outline of the guard ensuring proper alignment of sheets. Page 15 is then placed on the outline, keeping its edges well aligned. The protruding edge of the guard from page 2 is pasted on the margin of page 15 which already has paste. Page 13 is then placed over page 15 with its fore-edge drawn in approximately 2.5mm. from the fore-edge of page 15 and their heads properly aligned. Protruding guard from page 4 is then pasted over it. Likewise, pages 11 and 9 are pasted to guards on pages 6 and 8 respectively. After the paste has dried the protruding and unattached portions of the guard strips from pages 9, 11 and 13 are torn off with the help of a straight edge. The sheets are then folded individually and the folded sheets kept inside one another to form running text pages from 1-16.

Leather Book Bindings:

For binding the documents there are some stipulated methods to be followed. Stretched binding is advisable. There should not be more than 100 documents in a single binding. Because it may be bulky and will not give sufficient protection. Hundred sheets are conclusive for binding. It is easy for handling also. Only trained individuals may be posted for binding.

When leather decays, it becomes hard and brittle. In the case of leather book bindings, the decay starts at the hinges of the book and can be noticed from the top inside

and takes the form of cracking. With time and neglet, the cracks spread and the leather itself begins to disintegrate. So the process of treatment of leather is as follows:

It is fully dusted with a brush to remove all dust and other superficial deposits. If there are still caked deposits of dust, the leather may be cleaned by sponging with solution of Castile soap in water. It is then allowed to dry in the air for a day. Then the 7% potassium lactate solution is applied. The binding may be polished two days latter.

Another method is also dopted. Madame Flieder of the National Museum of Paris has devised a protective wax called "wax 212", for application to leather. It is quickly applied and effective and imparts polish as well to the leather.

Restoring faded inks:

There is possibility of fading the writing during the course of time. Iron gall ink fade in adverse conditions because the tannin in the ink decomposes and disappears. How to bring darkness to the writing? There are three methods to bring darkness to the writing.

Firstly, a dilute solution of potassium ferrocyanide slightly acidified with hydrochloric acid may be used. If we touch this solution with a soft brush and brush it gently on the faded writings, immediately the writing will be darkened. Visible writing will be restored.

Secondly, the paper containing the faded writing may be treated for a few seconds with a dilute solution of ammonium hydro sulphide until the writing darkens. But the effect of this is not permanent.

Thirdly, the faded writing may also be treated with a 2 to 3% solution of tannic acid or a saturated solution (about 1.25%) of gallic acid so as to darken the iron oxide and bring back the writing. We have to be very careful in dealing with these methods. Before doing this process we have to take photographic record of the writting. Because there is the possibility of damage to the faded letters when we apply medicines.

Repair of Maps and Charts:

Maps and charts more than double foolscap in size are reinforced by mounting them on muslin or long cloth. The mounting cloth is moistened in water and stretched on the table and fixed to it with thumb tacks. The map or chart to be mounted is cleaned and flattened. It is placed face down on a waxed or oiled paper and paste is applied to its back. It is then transferred from the oiled paper to the stretched cloth and pressed. The piece of cloth used for mounting should always be a few centimetres larger than the size of the map or chart to be reinforced. The mounted map is allowed to dry in taut condition. When dry, the surplus portion of the backing cloth is trimmed, keeping a margin of 4-5mm. all round which is then turned back and pasted. This protects the edges of the map.

Charts and maps that are to be stored or in rolls are mounted in one piece while those that must be folded are cut before mounting along the fold lines. This is known as "sectioning". The individual pieces are mounted in proper positions on a single piece of musline or long cloth, leaving spaces of 1.5-2mm. between the individual pieces, depending on the thickness of the paper and the number of folds.

Maps and charts can be laminated in the press, using muslin for support at the back in place of tissue paper. Tissue paper is also not used on the face of the map, but two or more sheets of acetate foil may be added instead. Over size maps can be laminated in sections to size of plattens and sections joined together by using muslin and cellulose acetate strips at the joints using acetone as in hand lamination.

Conclusion:

Preservation of Archives is the most important and inevitable duty of the archivist. If we follow the above preservation methods the records will be last long. If the archivists are trained in this field properly the valuable archival record materials may be surely saved from the fatal deteriorating factors. As preservation is highly a technical matter, the archivist must be thorough with the technique of preservation and repairing.

It is the bounden responsibility of the archival authorities to be vigilant in tracing the causes and areas of deterioration and finding out the remedy for them. Preservation is not the oneway process or a one man's responsibility. The users of archival materials also should recognise and realize their responsibilities to keep the material intact. The government should allocate sufficient founds and dedicated servants for the maintanance of the archives, which are the symbols of national prestige and the holders of national heritage. Thus preservation of archival materials is the important duty in a civilized society.