



## Preservation and Conservation (PAC) Programme Frequently Asked Questions

### Document storage mode

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#### Physical-chemical and biological stabilization of library documents

**Q: Stabilization of documents - what is it? Stabilization of paper documents in relation to biological and physical-chemical factors.**

A: Under the storage mode is the creation and maintenance of optimal microclimatic storage conditions of documents. It is ensured by the observance of norms and basic storage parameters, the choice of means and the carrying out of measures to maintain factors favorable for ensuring the safety of documents.

The durability of documents depends on the quality of the environment. The mode of storage of documents ensures the maintenance of certain (normative) conditions of light, temperature, humidity and sanitary-hygienic regimes. The air quality in the document storage rooms is checked regularly. Concentration of harmful impurities in the air of the document storage room must comply with sanitary standards.

**Q: Biological damage to documents and measures to prevent them.**

A: Regulatory storage conditions such as temperature and humidity, light and sanitary and hygienic regimes affect the long-term preservation and protect documents from many damages. Failure to comply with regulatory conditions leads to the deterioration and aging of documents. In the book storage rooms, the air temperature is constantly maintained:  $(18 \pm 2)$  C and relative humidity:  $(55\% \pm 5\%)$ . For documents made entirely on parchment and leather, relative air humidity:  $60\% \pm 5\%$ . Recent standards allow for some change between the minimum and maximum of these settings, such as seasonal changes, granted this change occurs slowly.

Free air circulation should be carried out in the storage facility, eliminating the formation of stagnant zones.

The illumination rate on the surface of documents during storage is not more than 75 lx, when exposed at the time of inspection - not more than 150 lx. Light sources should provide optical radiation with a wavelength of at least 400 and not more than 760 nm. Documents stored in the dark or under ambient light. Do not illuminate documents in direct sunlight.

**Q: Microorganisms. Microscopic mushrooms. The manifestation of fungi on the documents, their viability in the composition of the old damage. Mycological examination of damaged documents.**

A: The effect of temperature, air humidity and light is significantly reflected in the safety and durability of documents. The material basis of most documents is harmful, both elevated and reduced values of these parameters. The higher the temperature, the faster the paper, glue, cardboard, fabrics, leather, film, etc., age. The processes of decay occur in them more intensively, the materials dry up, become brittle. Excessive humidity is no less harmful: the material basis of the document swells, its strength decreases, favorable conditions for mold and other microorganisms are created. Temperature and humidity drops are especially undesirable: they cause deformation of the material basis of the document, destroy its structure. In damp conditions, the harmful effects on documents of chemical impurities present in the air are more pronounced.

Light speeds up the process of natural aging of materials. Its exposure is manifested in yellowing, browning, decrease in strength and elasticity, the appearance of brittleness of materials; in extinction, i.e. the decrease in the richness of the color of texts up to their complete disappearance, in the fading ("burning out") of the binding materials. The effect of light is exacerbated by the presence on the surface of documents and inside the structure of materials by outsiders sensitive to light. These include not only the various contaminants that fell on the documents during storage and use, but also some bleaching and coloring substances incorporated into the composition of materials during their manufacture. These substances absorb light and act as catalysts. The speed of damage to materials under the action of light also depends on the spectral characteristics of the light flux. Sunlight contains waves in three areas: ultraviolet, visible, and infrared. The shorter the length of the light wave - the more damage it causes to library materials. Under the action of the long waves of the infrared light region, materials, when heated, lose moisture; the result is drying, shrinkage, deformation, loss of elasticity and strength. However, the effect of ultraviolet radiation is more dangerous, since it has high photochemical activity and has a much greater destructive effect on documents. The ultraviolet component should be 20-30 microwatts per lumen. The elimination of ultraviolet radiation reduces the rate of destruction of documents from 2 to 10 times. Unsafe effect on materials and the third component of sunlight - visible radiation. Illumination should normally be 75 lux.

Natural light poses the greatest danger to documents: even scattered sunlight contains a large amount of ultraviolet radiation. If special glazing, filtering or diffusing sunlight, is not used for glazing, windows are covered with fabric shutters or blinds. Keepers must ensure that they are always closed. A similar effect has a long artificial light. Fluorescent lamps are especially dangerous because they create a high level of ultraviolet radiation (up to 30% of the light flux). The most harmless illumination is provided by incandescent lamps; they are convenient in operation, but they have low luminous efficiency and short service life. They also do pose a risk of a risk raising temperature.

Light exposure has a cumulative property: the same degree of damage can be the result of both intense, but short-term exposure, and less intense, but prolonged. If the document is irradiated with a light intensity of 150 lux daily for 9 hours, then it will collapse completely after 9 years, and if with a light intensity of 50 lux, it will be only after 65 years.

There are regulatory requirements not only for lamp types, but also for their installation. The distance from the luminaires to the nearest document should be at least 0.5 m. Lamps should be mounted in closed canopies, in order not only to ensure uniform diffused light, but also to ensure fire safety. Illumination in storages is measured using luxmeters. For safe lighting, use lamps with a filter that protects against ultraviolet radiation and absorb heat, or fiber-optic lighting systems.

**Q: Conditions leading to the growth of fungi. Preventive actions. Ensuring microbiological safety of documents.**

A: The air of modern cities is polluted with various gases, smoke and dust, which penetrate into the bookstores negatively affect the safety of documents. Pollutants are gaseous and aerosol. Gaseous pollutants (oxides of sulfur, nitrogen, ozone) catalyze dangerous chemical reactions that lead to the formation of acids in materials, especially in paper and leather. Sulfur oxide destroys paper, causes discoloration of some pigments, when combined with water forms sulfuric acid, which interacts with the moisture of the atmosphere and oxygen in the air, turns into sulfuric acid. Sulfuric acid in the air, settling on objects, affects the book fund, actively destroying it. Sulfur and ammonium compounds detrimental effect on many dyes, sulfur gases for cotton and linen papers are also very harmful. Aerosol contaminants, fine particulate matter suspended in the air, coming into contact with the surface of the books, form a layer of dirt that is sometimes impossible to remove, and also smears and abrades the surface of the books. The harmful effects of dust increase with the presence of soot and burned out particles. If dust accumulates even at normal humidity, spores of mold fungi and bacteria may develop.

At the present time (if the capacity of the libraries allows), measurements are being carried out to determine the harmful substances in the composition of the air of the vaults. And when they are detected, measures are taken to remove harmful pollutants, and the premises are cleaned. In order to ensure the safety of funds, free air circulation should be carried out in the vaults, excluding the formation of stagnant zones. Frequency of air exchange in 1 hour: inflow - 1.0; exhaust hood - 1.0. In rooms adapted for storage, but not equipped with air conditioning systems or forced-air ventilation, air parameters are normalized by rational ventilation and the use of technical means, guided by the indications of instrumentation. If possible, it is very beneficial to keep the storage rooms in superpressure.

**Q: Bio-resistance, protection from damage and disinfection of documents. Emergency measures in case of accidents.**

A: Sanitary and hygienic regime is carried out to maintain. It is a condition that excludes the possibility of mold, insects, rodents, dust. In the case of windows, it is not a problem to make sure that you can use it. It is necessary to carry out a systematic wet cleaning in the storage rooms. Dusting of shelving, cabinets, storage facilities carried out; floors, baseboards, windowsills, basements of racks are treated with water antiseptic solutions. Selection of the water and air condition of the heating season. Disinfecting stations and quarantine services. When cleaning or sanitizing water and antiseptic solutions should not fall on the documents.

**Q: Insects, especially habitats in book storages. Species composition. Protection of library collections from insects.**

A: Sanitary norms of concentrations of harmful impurities in the air of the document storage rooms are as follows:

	Max. single, mg / m <sup>3</sup>	Daily average, mg / m <sup>3</sup>
Sulfur oxide SO <sub>2</sub>	0.500	0.05
Nitric oxide NO <sub>2</sub>	0.085	0.04
Chlorine	0.100	0.03
Dust	0,500	0,15
Soot	0.150	0.05
Suspended solids	0.500	0.05

**Q: Preventive measures. Surveys of book storages. Disinfection. Damage to rodents.**

A: The effect of dust on the safety of documents is enormous. Dust is one of the most aggressive factors. It enters the storehouse from the outside and is accumulated in the room due to the abrasion of various materials. Dust is suspended in the air or solid particles deposited on the surface. More than 80% of particles with a long fiber form (paper fibers, cotton, wool, silk, etc.) are stored in library vaults. The duration of their stay in the air depends on the shape and size of the dust particles.

Many types of dust are hygroscopic and, being on the surface of materials, increase their moisture content. Large amounts of spores of fungi and other microorganisms settle on specks of dust (a direct relationship has been established between the dustiness of documents and their contamination with microorganisms). With local high moisture content of materials, microorganisms begin to develop, and some types of dust can serve as a nutrient substrate for them. The hygroscopicity of dust also increases the corrosive properties of salts (for example, sodium chloride, which is found in human epithelium), accelerates the hydrolysis reaction and the release of acids.

Mineral dust, especially soot, whitewash, is dangerous because of its abrasive effect, since, penetrating between the fibers of the paper, solids cut through its fibers. With a long stay on the surface of the documents, the dust condenses (caking); removing it is very difficult. Paper and lightweight binding materials get a gray tint that spoils the appearance of documents.

**Q: Stabilisation of documents by blocking metal ions with complexing compounds.**

A: Sanitary and hygienic regime includes hygienic processing, entomological and mycological supervision of the state of book monuments. Mycological supervision (control) - measures to identify mold fungi on documents and in storage rooms in order to prevent the destruction of documents. One of the ways to ensure the preservation of documents is the prevention of biological damage on the books. The most common destructors of paper are microscopic fungi. Their appearance is always associated with a violation of the microclimate in the storage: an increase in humidity and a decrease in air temperature. Already with a short-term increase in the relative humidity of the air over 70-80% or with an abrupt change in air temperature, when condensation forms on the surface of documents, the sprouting of microscopic fungi spores and their further development is possible when normal storage is restored. Microscopic fungi have a mobile metabolic system. Moisture in the material basis of the document they need to germinate a dispute, and they are able to provide all the conditions for further development on their own.

Currently, there are more than 200 species of fungi found in book storages, of which about 40 species are permanent inhabitants. They are the most dangerous for documents, since they produce enzymes that destroy cellulose and cause severe damage to the paper. Such mushrooms can destroy up to 50% of cellulose in paper in two months. It is not only paper that is affected by mushrooms, but also cardboard, leather, glue, threads, fabric. The main way to prevent damage to documents by mold fungi is to maintain an optimal microclimate, which eliminates the emergence of spores, but preserves favorable conditions for storing paper. Such conditions are created at a temperature of 16-20 ° C and a humidity of 40-60%.

**Q: Determination of pH and neutralization of acidity weakly alkaline compositions.**

A: The main requirement for temperature and humidity storage of documents is to maintain its consistency. Deviation of temperature and relative humidity is unacceptable even for a short period of time, unless the changes occur slowly.

It is necessary to ensure that the storage mode is the same in the entire volume of the room. Sometimes, in poorly ventilated book storages, zones of stagnant air are formed, especially in the corners of the room, near the outer walls. The climate of these areas is characterized by increased air humidity and, accordingly, increased moisture content in the materials. Microbiological monitoring of air in library rooms should be carried out twice a year, and more often if necessary. Indicators of the state of air in this case are the quantitative and species composition of microorganisms. It is known that microorganisms in the air are on particles of dust, in droplets of water, carried by air currents during ventilation, getting from outside on clothes, shoes and things of visitors. Air contamination depends on various factors: weather and climatic conditions, time of year and many others. It is proved that the largest number of microorganisms in the air flow is observed in the spring-summer period, decreasing in winter. Warm and humid weather leads to an increase in the relative humidity of the air, which contributes to the settling of the spores and an increase in the concentration of viable microorganisms.

The mass of spores or particles of mycelium due to swelling increases, and precipitation occurs faster. Fungal and bacterial communities can develop on books similarly to the community of destructors in natural conditions. Colonization and biodegradation of books implies the mandatory participation of cellulolytic organisms, since only these species can use cellulose as a nutrient substrate and translate it into low molecular weight and inorganic forms available for other microorganisms. It is known from the literature that various microscopic fungi play a key role in the biodegradation of cellulose. Therefore, special attention should be given to this group of microorganisms when analyzing the air of book storages. If after 1 h of exposure by the sedimentation method, the number of grown colonies of fungi on a Petri dish does not exceed 10, the storage microbiological state is considered satisfactory. In addition, it is considered satisfactory condition of the room, in which the number of microorganisms in the air is not more than 300-500 CFU / m<sup>3</sup>, the excess indicates the need for processing and taking preventive measures.

**Q: Stabilization of documents in relation to fungi infections by the method of treatment with anti-fungi compounds.**

A: Damage to library documents can be caused by insects. The main pests are: kozheed beetle (it feeds on skin, wool, animal glue), bread grinder (animal and flour glue), silver fish (starch), in addition, cockroaches, skin louse, moth. Insects affect not only books, but also wooden racks, parts of buildings. Bird nests are often the sites of insect infestations. It is not the insects themselves that do the direct harm, but their larvae that are difficult to detect during the inspection. Indicators of insect infestation are the presence of dead insects, larvae skins, cocoons and cobwebs, the presence of holes in the roots, heaps of brown "flour" on the shelves.

Preventing insect contamination of the book depository: 1. Fully exclude food from entering the book depository. Places of public catering should be placed in rooms isolated from the book depository. Do not deposit or eat food in storage. 2. The windows of the book depository opened for airing should be with protective nets. 3. It is prohibited to keep flowers in and near the book depository. 4. Do not allow nesting of birds on library buildings and feeding them in the yard. 5. Regularly carefully clean the book depository, clean the books from dust, do not store books in packs, stacks, do not block the aisles with foreign objects. 6. All used books in the library should be disinfected. 7. If there are no permanent jobs in book storage, then insect repellents are used.

From ancient times, manuscripts and books were defended by smearing papyrus with cedar oil, putting leaves and flowers of smelling plants between sheets of books, sprinkling bookshelves with mustard, black pepper, alum. When pests are found in book storage, the damaged specimens are first of all removed and the pest control is disinfected. Disinsection is carried out mechanically (clean the premises with a vacuum cleaner, brush) and chemically (the floor and walls are treated with insecticides recommended for domestic purposes). On the documents they should not fall. Disinsection of significant document arrays is performed with paradichlorobenzene vapor in the chamber. Other countries may use a non-pollutant technique, such as an anoxic treatment system.

From the larvae inside the books get rid of by introducing into the holes with a pipette or syringe of any insecticide. The mass destruction of insects in the book depository is carried out by the sanitary-disinfection services of the city. Rodent Control (Rodent Control) The harm caused by rodents to the book fund is irreparable. A distinct sign of the presence of rodents is corroded edges or paper surface. The most effective way to fight is the extermination of rodents in the entire library building by the sanitary epidemiological station, sealing cracks and passages. Entomological control is carried out by examining the funds twice a year, more often if necessary, by carefully inspecting the premises of the vaults and selectively or continuously viewing documents.

**Q: Stabilisation of documents on the skin and parchment in relation to physical-chemical and biological factors.**

A: The placement and storage of documents are based on the maximum utilization of the storage cubic capacity and should be combined with the possibilities of differentiated storage of the fund depending on the value, usage characteristics and type of stored material.

Shelves are placed perpendicular to the window-carrying walls, the aisles between the shelves are 0.75 m, the main aisles are 1.2 m, and the walkways around the walls are 0.45 m wide if the wall has a heat source of 0.6 m. Documents on the shelves are stored vertically on lower section,

but when the storage is full, it is possible to place books on the shelves on the side cut upwards, except for books with a large number of pages or printed on paper with a large mass of square meter (such as coated), the gap between the upper edge of the book and the next rack should not be more than 2 cm. On a shelf documents should be so that you can freely borrow a book for the lateral panels of binding, but in any case, not at the root. Horizontally stored only large format publications (more than 41 cm). Newspapers are stored in a horizontal position no more than 6-7 roots in a pile. Documents in paper covers, without binding, such as leaflets are also stored horizontally in folders or boxes.

Batch processing materials, scrolls, sheet material, as well as damaged documents are stored in containers of appropriate shape and size. Ideally, wrapping paper and containers should be made of acid-free materials and bandaged with soft tape. Any container for placing library documents must be well dried beforehand. Stored material and the container must be kept in the same conditions for 3-4 weeks to establish a balance of humidity. Folders serve as a good mechanical protection when handling sheet materials. To protect the extreme sheets from damage, it is advisable to wrap the contents of the folder with thick paper. Folders and boxes cannot be overfilled, cannot be placed in one box materials that differ significantly in size. Sheets cannot be folded into a tube, fold. If in the process of cleaning or handling a document, part of it is torn off, then it is placed in a separate envelope, on which the cipher and the name of the document are marked. Documents of large sizes (maps, drawings, prints, etc.) should be stored in special furniture with shallow drawers. Illustrated materials with a rich colorful coating is better to store shifting sheets of waxed paper. Dust jackets often not only protect the binding, but also are of artistic value, or contain information that complements the book, so they can be mounted into a book. It is necessary to exclude the placement of books on windowsills, on the floor and other places not intended for storage. Do not store books in stacks. Documents on durable paper from cotton and linen fibers, from sulphate pulp should not be combined with those made on paper containing wood pulp (degradation products initiate the destruction of documents on durable paper). To accommodate film and photo documents, closed metal thermostatic cabinets are used in standard plastic (excluding PVC) or metal containers.

Improper transportation of books can cause great damage. When moving documents inside the library, they use trolleys, conveyors, lifts, while it is necessary to ensure that the documents do not get inside the mechanism, do not hang from the edges. When moving documents outside the library, proper packaging and packaging is necessary. Best of all are special canvas bags, trunks, and suitcases. They transport books in packs of no more than 5 kg, wrapped in thick paper (kraft paper), with padded strips of cardboard in the places where the strings pass. When being transported in a car, it is necessary to cover the packs with a tarpaulin, there should be a protective flooring on the floor, the machine should not be used to transport products (especially flour and meat).

**Q: Physical and chemical cleaning of paper documents.**

A: Particular attention should be paid to exhibitions and showcases when exposing genuine materials. When preparing exhibitions during exposure, materials may be damaged due to improper installation, fixing of inscriptions on exhibits, deformation due to other conditions of temperature and humidity, and enhanced lighting. The inscriptions are made on paper and pressed against strips of organic or silicate glass. Do not use office clips to fasten the inscriptions.

It should not be installed near windows, lamps, heat sources, exhibition should be protected with cloth or filters of green or orange-yellow tones. Particularly carefully, the conditions of the light regime must be observed when storing and displaying rare and valuable editions. If possible, it is advisable to store these documents in acid-free cardboard containers. Avoid frequent and prolonged exposure of these materials. Frequent photo, micro, and photocopying leads to irreversible changes: drying out of the paper, yellowing and fading. The norm of illumination on the surface of documents during exposure at the time of inspection, it is desirable not to exceed 150 lux.