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Jozef Hanus,[*] Emília Hanusová[**]

SOME TECHNICAL PROBLEMS OF ARCHIVES AND LIBRARIES: PRESERVATION AND STORAGE OF DOCUMENTS

Abstract:

Current digital era has a great impact not only on every-day life and improvement of its quality in many ways, but also on archives services, creation of digitally born archives and digitization of archival documents originally created on "classical" information carriers (parchment, paper). In spite of the dominant tendency for their digitization, archives and libraries are obliged to preserve original documents; this is one of the principal tasks of their activities and mission. Anyway, a large majority of archives' and libraries' holdings are still on paper. Some views on storage conditions and their importance from the point of long-term preservation of documents are presented.

Key words:

archives, library, archival documents, storage conditions, degradation, preservation

Izvleček:

Nekaj tehničnih problemov arhivov in knjižnic: varovanje in hramba dokumentov

Digitalna doba ima velik vpliv ne samo na vsakodnevno življenje in izboljšanje njegove kvalitete, ampak tudi na arhivske storitve, ustvarjanje izvorno digitalnih dokumentov in digitalizacijo arhivskega gradiva, ki je bilo izvorno ustvarjeno na "tradicionalnih" nosilcih informacij (pergamentu, papirju). Ne glede na prevladujočo tendenco po njihovi digitalizaciji pa morajo arhivi in knjižnice hraniti originalne dokumente; to je ena od njihovih osnovnih nalog in del njihovega poslanstva. Velika večina arhivskega in knjižničnega gradiva je še vedno na papirju. Prispevek predstavlja nekaj pogledov na pogoje hrambe in njihovo pomembnost pri dolgoročni hrambi dokumentov.

Ključne besede:

arhivi, knjižnice, arhivsko gradivo, pogoji hrambe, degradacija, varovanje

INTRODUCTION

Archives and library collections and holdings represent a unique part of the cultural heritage of human society. These institutions all over the world contain rich and irreplaceable source of information. The preservation and management of those precious resources and accessibility to them by the public are principal responsibilities of all public archives and libraries. Preservation of cultural heritage is a summary of processes and proceedings ensuring stability and preservation against damage or destruction, treatments of damaged artifacts by conservation and

[*] *Jozef Hanus, dipl. ing., Ph. D., Department of Archives, Ministry of Interior of the Slovak Republic, Križkova 7, 811 04 Bratislava, Slovak Republic, email: jozef.hanus@mvsr.vs.sk.*

[**] *Emília Hanusová, dipl. ing., Department of Document Preservation, University Library Bratislava, Michalská 1, 814 17 Bratislava, Slovak Republic.*

restoration processes as well as treatments of all documents during processing, making accessible, using, exhibition, etc. The access to collections and holdings on one hand and their preservation on the other hand – are two main contradictory tasks and responsibilities of all these institutions.

Current digital era has a great impact not only on every-day life and improvement of its quality in many ways but also on archival services, creation of digitally born archives and digitization of archival documents originally created on "classical" information carriers (parchment, paper). In spite of the dominant tendency for their digitization, archives and libraries are obliged to preserve the original documents; this is one of the principal tasks of their activities and mission. Anyway, large majority of archives' and libraries' holdings are paper documents.

PRESERVATION OF PAPER AS THE PRINCIPAL INFORMATION CARRIER IN ARCHIVES AND LIBRARIES

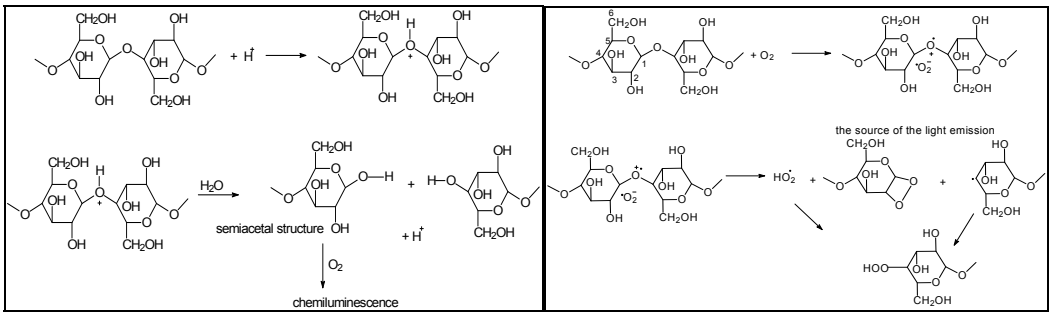
Paper has been an essential part of our civilization for the last two thousand years. Despite its ubiquity, paper is a complex material, a web of cellulosic fibers and sizing. Fillers, coatings, pigments may also be present. Fibers render the material its physical properties and they consist mainly of cellulose, although other constituents may also be present, depending on the origin and type of fabrication, such as lignin and hemicelluloses. Degradation of physical properties of paper, so important for the user, is predominantly a question of cellulose stability due to its important role. While the cause for paper degradation may be mechanical, biological or chemical, it is the latter that needs the most sophisticated conservation approach.

Chemically, cellulose is a macromolecule, synthesized by plants, some microorganisms and bacteria. It is a linear polymer consisting of glucose monomer units. As many organic materials, it is inherently instable, however, the mode of degradation depends very much on the macromolecule's chemical environment. This depends primarily on the technology of paper production, but also on subsequent application of inks and pigments. Degradation reactions of cellulose ultimately lead to bond scission. Fiber structure becomes more ordered, the average length of macromolecules decreases and so does the physical strength of fiber and consequently of paper *(Strlič, Papylum 2002)*.

The biggest problems in preservation of archives and libraries are caused – paradoxically – by modern papers produced from the 2nd half of the 19th up to the recent years. A new technology of paper-making introduced in 1850, involved paper formation in an acidic environment. This was a crucial milestone from the point of permanence and durability of paper, its degradation and preservation in archives and libraries. It is a self-degradative effect of acidic paper; "time bomb", as it is often called the limited lifetime of machine-made paper with acidic rosin sizing has been threatening the great part of the cultural paper heritage *(Hanus 1987)*.

In the course of production of certain papers (in use from 1807 until present time) acids were introduced in to paper during sizing. In acidic media (pH < 7), the glucosidal bond, linking two glucose monomers, is prone to acid-catalyzed hydrolysis. The direct cleavage of 1,4 ß-D-glycosidic bond takes place after its interaction with hydrogen ions and leads to semi-acetal chain-end groups. This reaction leads to extremely rapid loss of properties and is a problem of catastrophic proportions in many modern libraries and archives (*Strlič & Kolar 2005)*.

On the other hand, oxidation by oxygen is much more complex process occurring via oxidation of hydroxyl groups on glucopyranosyl structural units into carbonyl and carboxyl groups. The latter facilitate scission of the cellulose backbone as well. Both, production of chain-end semiacetal groups and oxidation of hydroxyl groups are accompanied by weak light emission (chemiluminescence) *(Havermans & Dufour 1997; Rychlý et all 2002)*.



Pictures 1, 2: Degradation of cellulose by acid hydrolysis and oxidation

The present state of knowledge confirms that paper degradation in the course of its ageing is the result of hydrolysis (acidic, alkaline) and oxidation of cellulose by internal agents presented in paper in close co-influence of contaminated atmosphere, humidity and light on one hand and cross-linking and fibers embrittlement on the other hand. Thermic, biological and mechanical destruction can occur as well. In most cases, however, a combination of all above mentioned effects causes degradation of cellulose macromolecule, hemicellulose and lignin which result in decrease of fibers strength, mechanical properties, creation of brittleness, fragility and color changes (yellowing, darkening) of paper.

These problems are well known to the experts from the field of preservation of archives and library paper materials. It seems that - because of large quantities of endangered materials – only mass treatment processes can help to solve these problems.

A large scale research into the field for many years has brought an extensive knowledge in paper degradation causes, mechanisms and also in different techniques and processes in order to improve its permanence, durability and life-span *(Williams 1981; Hendriks 1994; Strlič & Kollar 2005)*. Many deacidification processes have been introduced and several treatments are commercially used in a large scale *(Porck 1996; Hanus 2000; Bluher 2003; Lojewski 2010)*.

However, despite all these achievements it seems that still some problems have to be solved. Among the most serious are ranked the following ones: which of the chemical processes offered is most effective; which collection materials should be subjected to such a mass treatment; which analytical methods should be used for evaluation of deacidification processes and life prediction after the treatment; which standards should be developed, which quality standards should be defined, etc. *(Banik 2005; Banik et all. 2005)*.

It must be realized that preservation of such enormous quantity of acidic papers – does not matter whether it is kept in archive or library – represents an enormous interdisciplinary problem in which role of paper chemists and their co-operation with experts from other fields of science and technology and conservators

and restorers can lead to solution of the problem. It has to bear in mind that preservation of such heritage requires also considerable financial costs.

One of the best examples of cooperation in this field is the mass deacidification in Switzerland *(Mass deacidification 2008)*. The "Papersave" technique, pioneered by the defunct company Battelle and now used by Nitrochemie Wimmis AG under license, has proved highly successful not merely as a means of conserving paper, but in terms of environmental sustainability as well. With government financial backing, Nitrochemie set up a paper deacidification plant in Wimmis in April 2000. Owned by the Swiss government, it is the largest, most advanced deacidification facility in the world: its two treatment chambers can process between 90 and 120 tons of books and archive material a year. Thus far, more than 650 tons of books and documents have been deacidified and preserved for future generations. The facility's two largest customers are the Swiss Federal Archives and the National Library of Switzerland, which together take up two-thirds of its total processing capacity. The remaining capacity is reserved for private customers.

SITUATION IN THE SLOVAK REPUBLIC

10 state archives and 37 their branches in the Slovak Republic keep altogether more then 29289 archival fonds and collections representing total scope of more than 190 800 running meters of archival documents *(Správa 2011)*.

It is estimated that about 80 – 85 % of total holdings are documents created on paper from the period 1850 – 1970, i.e. on acidic paper with very law ageing resistance and thus potentially liable to self-degradation processes *(Hanus et all 2002)*.

Situation in Slovak libraries can be illustrated by the example of the Slovak National Library in Martin. The total number of book volumes until year 1900 is 1,2 million, of which 684 000 are on acidic paper. Of 900 000 volumes produced on hand-made paper 470 000 ones are acidic – 117 500 volumes of them are in acute jeopardy. 300 000 volumes are produced on wooden paper; 214 000 volumes are on acidic paper – 107 000 volumes are in acute jeopardy. Much worse is situation concerning books after year 1900. The Slovak National Library keeps 2,4 millions of book titles of which 2 280 000 are made of acidic paper. 1 140 000 book volumes are in acute jeopardy *(Bukovský 2001)*.

In other Slovak libraries - scientific, public, special and academic - is kept about 43,6 millions of library units. On the basis of statistical data it can be stated that the situation in these libraries is even worse because most of their collections are books, journals, newspaper and other units produced after 1850 and 1900 on wooden and acidic paper *(Hanus 2003)*.

STORAGE CONDITIONS

Environmental factors such as temperature, relative humidity, light, and atmospheric and particulate pollutants can prolong or dramatically shorten the usable life of library material. Chemical reactions increase in organic materials when humidity and temperature rise. While moisture can catalyze chemical reactions, increases in temperature will accelerate the rate of these reactions.

It is useful to be able to predict whether an action will affect the rate at which a chemical reaction proceeds. In general, a factor that increases the number of collisions between particles will increase the reaction rate and a factor that decreases the number of collisions between particles will decrease the chemical reaction rate. There are several factors that can influence the rate of a chemical reaction: concentration of reactants, temperature, medium, presence of catalysts and competitors.

From the point of storage conditions we should be able to influence at least temperature, relative humidity and dust and air pollutants in order to ensure stabile environment and to minimize the rate of degradation reactions. In general, an increase in temperature is accompanied by an increase in the reaction rate. Temperature is a measure of the kinetic energy of a system, so higher temperature implies higher average kinetic energy of molecules and more collisions per unit time. A general rule of thumb for most (not all) chemical reactions is that the rate at which the reaction proceeds will approximately double for each 10°C increase in temperature.

This is the reason that in many standards and guidelines at least the values of temperature and relative humidity are strictly recommended to follow.

Rooms where library material is stored and shelves on which library material is kept should be properly ventilated. Air movement removes off-gassing of organic materials and prevents a build up of pockets of high relative humidity which can lead to outbreaks of mould.

It is not only essential to have adequate ventilation but the air entering and circulating in storage areas should be free from air pollutants. Air pollutants vary greatly in nature, from gases to particulates.

Pollutants such as sulphur dioxide, hydrogen sulphide, and nitrogen dioxide combine with moisture in the air to form acids that attack and damage library material.

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

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

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

Particulate pollutants, such as soot, dirt, and dust abrade, soil, and disfigure materials. Dust and dirt that have absorbed gaseous pollutants from the air become sites for harmful chemical reactions when they settle on library material. Particulate

pollutants can also aid mould growth. Modern library material, such as magnetic and optical media, are very sensitive to dust and dirt *(University of Oxford 2005)*.

The Slovak archival legislation covers these requirements as follows *(Vyhláška 628, 2002)*:

Article 24

Protection against degradation factors

(1) Degradation factors are distinguished as external and internal ones. External degradation factors are physical – especially heat, humidity, optical radiation, dustiness; chemical - especially oxides of sulphur, oxides of nitrogen and ozone from air pollution, or biological ones – especially microbiological contamination and biological agents as moulds, insects and rodents. Internal degradation factors result from material nature of archival documents and the way of their formation or preparation and production of information carriers.

(2) In order to exclude or minimize detrimental effect of degradation factors, the values of temperature and relative humidity are continuously or at least twice a week, recorded and evaluated. The allowed temperature is 16°C ± 2°C and relative humidity of air 50 % ± 5 %.

(3) Illumination in storage areas is limited to the time which is inevitable to take out and to store archival documents. If direct light or other source of illumination contains a part of ultraviolet radiation exceeding value of 75 μW/lm (microwatt per lumen), ultraviolet filters eliminating radiation of the wave length below 400 nm must be used.

For illumination of archives and exhibition areas light sources of the following intensity are used

a) up to 300 lx in the search room,

b) up to 200 lx in storage areas,

c) up to 50 lx in exhibition areas.

(4) Dustiness in storage areas is decreased by mechanical and technical means. Number of dust particles on air in storage areas must not exceed the value of 50 $\mu g/m^3$.

ISO 11799: (2003)

These requirements are reflected also in *(ISO 11799: 2003)* which specifies the characteristics of general-purpose repositories used for the long-term storage of archive and library materials. It covers the sitting and construction of the building and the installation and equipment to be used. It applies to all archive and library materials held in general-purpose repositories, where mixed media may be stored together.

In Annex A of the standard (informative) the following maximum **limits for air pollution** are set up:

	Parts per billion (volume)
Sulphur dioxide (SO_2) Nitrogen oxides (NO_x) Ozone (O_3)	5 – 10 5 – 10 5 – 10
	µg / m^3
Dust particles	50

Severe fluctuations or "cycling" of temperature and relative humidity will cause more damage than constantly high readings and so must be avoided. In Annex B of the standard (informative) the following conditions are recommended for different types of materials:

	Temperature [°C]			**Relative humidity [%]**		
	min	max	changes	min	max	changes
Paper, optimal storage	2	18	± 1	30	50	± 5
Parchment, leather	2	18	1°/h	50	60	3%/h
Photographic film b&w, ester of cellulose Photographic film b&w, polyester		< 21 < 21	± 2 ± 2	15 30	50 50	No changes
Microfilm colour, ester of cellulose Photographic microfilm colour, polyester		< 2 < 2	± 2 ± 2	15 25	30 30	No changes
Photographic sheets b&w Photographic sheets colour		< 20 < 2	± 2 ± 2	20 20	50 50	No changes
Photographic paper b&w Photographic paper colour	2	20 < 2	4/day	30 30	50 50	No changes
Microfilm b&w, ester of cellulose Photographic microfilm b&w, polyester		< 21 < 21	± 2 ± 2	15 30	40 40	No changes
Vinyl plates		< 21			50	
Magnetic media (audio, video)	17	20		20	30	No changes

BS 5454 AND PD 5454:2012

In this connection we would like to refer at least to several other useful standards in this field. The first one is *(British Standard 5454: 2000)* which provided relevant information for storage facilities. BS 5454 was a British Standard for the preservation of archival material. Among other things, it specified temperature and humidity ranges for document storage, shelving schemes, and materials for document containers. It has been in existence in one form or other since the late 1970's. Throughout this period, it has been a fairly succint document (last revision contained just 25 pages) and has been primarily used to give guidance on archival conditions for

long-term preservation, for example, museum conditions. In this respect, it has often been misquoted as a general standard for the design and operation of business archives.

The British Standards Institute has now withdrawn this standard, together with the associated guide PD 0024:2001, and have instead made available a Published Document *(PD 5454:2012)* Guide for the Storage and Exhibition of Archival Materials, published in March 2012. This new document is a more substantial publication, being 76 pages, and really brings the previous standard up-to-date. Although it still has an emphasis on preservation of valuable documents – such as manuscripts - and the exhibition of such documents, it is now much more applicable in a business archive scenario. It also addresses storage of digital media.

The document begins with detailed guidance on the nature of documents and best practice for their storage and use. This includes topics such as environmental controls for different media, protection against mould, infestation and pollution, environmental monitoring, environmental control, packaging and security. The guide then goes on to describe the repository building and measures that can be taken in the design and build of an archive facility. This section includes hazard avoidance, security, construction, environmental stability, fire and water protection, load distribution, shelving and lighting, to name but a few.

PD 5454:2012 gives recommendations for the storage and exhibition of documents, including books and other library materials. These recommendations apply to permanent and temporary storage of documents, and equally apply to material which is subject to restricted access or is on display.

The recommendations in PD 5454:2012 have been designed to help create and maintain appropriate conditions for document storage and use, and to enable a repository for archives to be built or converted to a high standard. They can be used where an archive is located in a mixed use development and can also be used as guidance for custodians of collections in historic buildings, defining best practice for archival materials while recognizing that best practice for the conservation of a building might require a compromise, based on a risk assessment. They have been developed to cover the United Kingdom's common geological and atmospheric conditions.

PD 5454:2012 is for use by archivists, librarians, conservators, museum curators, architects, facility managers, contractors, engineers and those concerned with the planning, construction, equipment, maintenance and working of storage repositories and their associated searchrooms, reading rooms and display areas.

The recommendations in PD 5454:2012 apply to archives of all traditional archival materials and formats, such as paper and parchment documents, books, maps and plans, and also cover guidance on photographic media common to archives and on more modern machine-readable media.

However, care should be taken to avoid treating the content as a standard, expecting absolute compliance. Indeed, the cover warns "This publication is not to be considered a British Standard".

PAS 198: (2012)

British Standard Institution published this year PAS 198:2012 (Publicly Available Specification) which specifies requirements for managing the setting of environmental conditions for collection items held in cultural collections in the UK, whether in storage, on display or in transit. It is applicable to all types and sizes of cultural collections held by individual collectors and all types of collecting organizations such as archives, historic houses, libraries and museums, whether public or private. It sets out a framework within which environmental conditions can be specified and methods of achieving them can be determined. It also provides guidance in the form of notes and informative annexes to support collecting organizations in complying with the requirements of PAS 198:2012.

PAS 198:2012 has been developed to help collecting organizations meet their responsibility to establish and maintain environmental conditions that preserve the cultural collections in their care for future use and enjoyment. It is a specification for managing environmental conditions for collections and covers temperature, relative humidity, light and pollution. The starting point for users of this PAS is to develop an understanding of the sensitivity of collection items to these agents of deterioration.

PAS 198:2012 aims to help users make their own judgements about specifying beneficial environmental conditions appropriate to local circumstances. The emphasis is on providing conditions for the materials and structures of collection items that will help prevent rapid deterioration or irreversible damage. Although deterioration cannot be arrested altogether, it can be significantly slowed down. Good management of environmental conditions can extend the lifetime of even sensitive materials.

US National Archives and Records Administration adopted a new regulation in this filed in 2002. This transmits a new policy directive establishing the internal NARA structural, environmental control, fire safety, preservation, and security standards for appropriate archival storage conditions in NARA archival facilities *(National Archives and Records Administration 2000)*.

LOW-OXYGEN LEVEL ATMOSPHERE STORAGE FACILITIES

Archives and libraries are the same institutions from the point of their needs for quality storage conditions for keeping and long-term preservation of valuable archival and library fonds and collections. Remarkable approach and an extraordinary solution using low-oxygen level atmosphere in new storage facilities of the British Library provides not only fire protection precautions but can considerably reduce the rate of degradation of materials – e.g. paper - by oxidation.

The British Library's £26m Additional Storage Building (ASB) at Boston Spa in West Yorkshire was officially opened on 3 December 2009 by Rosie Winterton, MP Minister for Yorkshire and The Humber (Start/Completion 2003-2009). It provides the British Library with additional storage capacity for seven million items from the UK national collection. The fully-automated facility comprises 262 linear km of extra shelf space for the collection which is currently expanding at a rate of 12.5 km of linear shelf space per year. The project is also the first of its kind in the world to incorporate automated storage and retrieval systems, optimum environmental controls, and pioneering low-oxygen fire prevention technology in a single building.

Although sprinklers are (usually) the preferred solution for libraries (wet books can be freeze dried), the British Library has adopted a low-oxygen system of fire prevention which sees oxygen levels kept to just 14.8 % (fires can only break out if oxygen levels are at 17 % and above). To support this, the building is also one of the most air-tight in the UK - the leakage rate specification is not more than 0.5 cubic meter of air per square meter of wall area per hour (0.5 $m^3/m^2/hr$). The ASB building will house low-use material including patent specifications, books, serials and newspapers in 144 000 storage containers. The air conditioning system maintains a controlled, microbe-free climate at a constant temperature of 16°C (± 1 %) and constant humidity of 52 % (± 5 %). The storage repository itself features insulated vertical walls with a four hour fire resistance rating and a double-sealed, thermally efficient roof. These collection items form a substantial part of the memory of the nation and since now will be stored in environmental conditions that will ensure their long-term survival *(World's leading library storage facility opens 2009)*.

Picture 3: The British Library's Additional Storage Building (ASB) at Boston Spa, West Yorkshire

PRACTICAL MEASURES TO IMPROVE THE ENVIRONMENT *(UNIVERSITY OF OXFORD 2005)*

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

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

- Use draft excluders and weatherstripping to make the building weathertight.
- Ensure windows and doors fit securely.
- Ensure good air circulation by appropriate use of fans and windows.
- Use dehumidifiers and humidifiers to reduce or increase relative humidity.
- Use insulation methods to reduce heat gain or loss.
- Use UV-filters on windows and fluorescent lighting.
- Use screens, blinds, shutters (preferably outside the windows, as this reduces solar heat gain), and heavy curtains to keep out direct sunlight.

- Ensure storage facilities are dark.
- Ensure buildings are properly maintained to keep out dampness during rainy periods.
- Use close-fitting enclosures (boxes and envelopes) wherever possible to protect important and valuable library material. These can create a microclimate around the object, which delays the effects of changes in temperature and relative humidity. They also shield the item from light, and can act as a buVer against atmospheric pollutants and prevent particulate deposits.
- Be aware that while trees and vegetation near buildings can reduce heat gain, they can also encourage insect and pest activity.
- Locate plumbing and heating pipes outside storage areas.
- Locate sanitary premises and sinks outside storage areas.

CONCLUSION

In spite of the dominant tendency of digitization, archives and libraries are obliged to preserve the original documents; this is one of the principal tasks of their activities and mission. Anyway, large majority of archives and libraries holdings are still on paper.

In order to be able to protect archival collections against harmful and detrimental effects of environment, first of all it is necessary to know these effects and to understand the nature of the deteriorative and destructive factors.

Archival documents from the 20th century represent the major part of archival holdings nearly in all archives. However, very often it can be said – the bigger quantity the lower quality. The biggest problems in preservation of archives and libraries are caused – paradoxically – by modern papers produced from the 2nd half of the 19th up to the recent years. The new technology of paper-making introduced in 1850, involved paper formation in an acidic environment and brought wood as the raw material. This was a crucial milestone from the point of permanence and durability of paper, its degradation and preservation in archives and libraries. The self-degradative effect of acidic papers causes the limited lifetime of machine-made paper from wood pulp with acidic rosin sizing with addition of alum. It seems that - because of large quantities of these materials - only mass treatment processes can help to solve these problems.

Therefore the main accent and emphasis of archivist's activities is being put on preventive complex measures to minimize the rate of deterioration of documents. From this point of view the proper storage conditions are basic and crucial requirements for long-term keeping of archives and library documents and their lifetime. Information on relevant publications, standards and some latest examples of archival buildings providing such facilities are provided.

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POVZETEK

NEKAJ TEHNIČNIH PROBLEMOV ARHIVOV IN KNJIŽNIC: VAROVANJE IN HRAMBA DOKUMENTOV

Ne glede na prevladujočo tendenco po digitalizaciji morajo arhivi in knjižnice hraniti originalne dokumente, kar je ena izmed njihovih primarnih dejavnosti in nalog. Velika večina arhivskega in knjižničnega gradiva je namreč še vedno na papirju. Da bi lahko te zbirke zaščitili pred škodljivi elementi okolja, je najprej potrebno poznati njihove učinke in razumeti naravo škodljivih in uničujočih dejavnikov.

Večji del arhivskega in knjižničnega gradiva je iz organskih surovin, večinoma iz rastlinskih vlaken in živalske kože. Zaradi tega prej razpade in je zelo ranljivo ter občutljivo na okoljske pogoje, v katerih ga hranimo. Tako so okoljski pogoji - zunanji dejavniki - zelo pomembni v procesu staranja vseh arhivskih in knjižničnih dokumentov.

Po drugi strani pa obstajajo tudi notranji dejavniki, ki jih določa narava materiala, iz katerega so dokumenti narejeni, ali pa jih določa proizvodnja teh materialov; v primeru papirja npr. so ti dejavniki vrsta in kvaliteta vlaken, velikost, prevleka, prisotnost kislih in kovinskih primesi ter ostalih komponent listov.

Trditi moremo, da lahko propadanje in uničenje arhivskih dokumentov povzročajo notranji ali okoljski (zunanji) dejavniki fizične, kemične, biološke in mehanične narave. Delujejo lahko skupaj ali posamično, redno ali občasno.

Arhivski dokumenti iz 20. stoletja predstavljajo v skoraj vseh arhivih večji del arhivskega gradiva. Lahko pa bi rekli, kot ponavadi - večja količina, manjša kvaliteta. Največje težave pri zaščiti arhivskega in knjižničnega gradiva povzroča - paradoksalno - moderni papir, proizveden od druge polovice 19. stoletja do danes. Nova tehnologija proizvodnje papirja, uvedena leta 1850, je vključevala izdelovanje papirja v kislem okolju in uvedla kot surovino les. To je bil s stališča trajnosti in obstojnosti papirja, njegovega staranja in varovanja v arhivih in knjižnicah bistven mejnik. Samouničujoč učinek kislih papirjev povzroča omejeno življenjsko dobo industrijsko proizvedenega papirja iz lesne kaše, s kislinsko smolo ter dodatkom

galunovca. Zdi se, da lahko - zaradi velikih količin tovrstnih materialov – s tem povezane probleme rešijo samo masovni obnovitveni procesi.

Tako je glavni poudarek arhivskih in knjižničnih dejavnosti na preventivnih, kompleksnih ukrepih za minimiziranje stopnje uničenja dokumentov. S tega stališča so primerni pogoji hrambe osnovni in osnovni temelji za dolgoročno hrambo arhivskih in knjižničnih dokumentov. Prispevek podaja še informacijo o relevantnih publikacijah in standardih.