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Environmental Conditions for Exhibiting Library and Archival Materials

Abstract: This standard establishes criteria to minimize the effect of environmental factors on deterioration of library and archival materials on exhibit. Specific parameters are recommended for exposure to light, relative humidity, temperature, gaseous and particulate contaminants, display techniques, and case and support material components. The standard is intended as a guide for librarians, archivists, exhibition designers, and others involved in preparing library and archival materials for exhibition.

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Foreword

(This foreword is not part of the American National Standard Environmental Conditions for Exhibiting Library and Archival Materials, ANSI/NISO Z39.79-2001. It is included for information only.)

This standard addresses environmental factors that should be considered in planning and mounting an exhibit of library and archival materials. The NISO Standards Committee that developed this standard has sought only to establish control parameters that minimize the potential for damage in an exhibition environment. In presenting these control parameters, the Committee has used phrasing established for NISO standards. Therefore, practices that the Committee agrees are mandatory are phrased as a "shall" statement. Practices that the Committee agrees are desirable but not mandatory are phrased as a "should" statement.

Sections 1 and 2 of the standard describe its scope and purpose, and define technical terms used in the standard. Sections 3 through 6 establish the environmental standards for light exposure, relative humidity, temperature, and pollutants. Sections 7, 8, and 9 establish standards for case and display materials and construction. Appendix A provides supplementary information as a foundation for the criteria presented in each of the preceding sections. Appendixes B and C list materials generally recognized to be safe and not safe in the construction of exhibit cases, and physical supports or restraints for exhibiting library and archival materials.

This standard was processed and approved for submittal to ANSI by the National Information Standards Organization. It was balloted by the NISO Voting Members November 23, 1998 - January 4, 1999. It will next be reviewed in 2006. Suggestions for improving this standard are welcome. They should be sent to the National Information Standards Organization, 4733 Bethesda Avenue, Suite 300, Bethesda, MD 20814. NISO approval of this standard does not imply that all Voting Members voted for its approval. At the time it approved this standard, NISO had the following Voting Members:

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Environmental Conditions for Exhibiting Library and Archival Materials

1. Scope and Purpose

This standard is designed so that the user is required to select specific limits for a particular exhibition situation. A number of options may be used to meet the standard. This choice will depend in part on (a) the types, characteristics and condition of material being exhibited, (b) local climatic conditions, (c) considerations of human comfort, (d) available technology for environmental control systems, (e) constraints of existing exhibition areas and exhibit cases, and (f) cost considerations. The limits chosen should fall within the range of limits recommended in the standard.

1.1 Scope

The standard establishes criteria for the environmental factors that contribute to the deterioration of library and archival materials that are on temporary exhibition, i.e., for a period of time lasting no longer than 12 months. Exhibitions of a longer duration or permanent exhibitions fall outside the scope of this standard, although many aspects of the standard may be applied to exhibitions of longer duration. Specifically, the standard recommends values or ranges for light, relative humidity, temperature, and pollutants. It also recommends acceptable components and techniques for the construction and use of exhibit cases and supports.

1.1.1 Library and Archival Materials Included

This standard relates to individual bound volumes in various binding styles and composed of various materials, printed ephemera, flat paper, and vellum items (manuscripts, art on paper, etc.), and photographs.

1.1.2 Library and Archival Materials Excluded

This standard does not relate to textiles, sculpture, decorative art objects, art on canvas, or other items not based on paper or vellum that may be found in libraries and archives.

1.1.3 Environmental and Physical Conditions Included

This standard addresses environmental conditions, including exposure to light, relative humidity, temperature, and pollutants, that directly affect exhibited items. These include the microenvironment (within the exhibit case or frame), the macroenvironment (outside the exhibit case but within a room), and the relationship between the macroenvironment and the environment within new or existing exhibit cases. In addition, the method of support of exhibited items is addressed.

1.1.4 Environmental and Physical Conditions Excluded

This standard does not address environmental or physical conditions for library and archival materials in transit, or physical supports that are to be used for long-term storage at the conclusion of an exhibition.

1.2 Purpose

This standard is intended to set parameters for environmental and physical exhibit conditions that minimize the potential for damage to library and archival materials on display. The standard is intended to serve as a guide for librarians, archivists, exhibition designers, exhibition preparators, and others involved in the design and preparation of exhibitions of library and archival materials.

2. Definitions

air contaminants. Any unwanted gaseous, liquid, or particulate matter in the atmosphere. The principal outdoor contaminants include particulate matter, sulfur dioxide, oxides of nitrogen, and ozone. Some contaminants from indoor sources may include nitrogen oxides, mineral acids, aldehydes, sulfides from proteinaceous materials and rubbers, and acetic and formic acids.

angle of display. The angle formed by a horizontal surface and the plane of the text block and spine of the volume.

angle of opening. The angle formed between the front and back cover of an open bound volume.

backing shoulder. The ridge formed as the back edges of the sewn sections are hammered over to create a right angle into which the boards are seated before covering.

bound volume. Any structure of gathered sheets of paper secured by stitching or tying, and protected by stiff (hardback) or flexible (paperback) boards on the exterior.

cradle. A framework constructed of plastic, paperboard , or other material that serves to support a bound volume.

cumulative light exposure. The total amount of light an object has been exposed to for a given period of time.

drift. A gradual change of value of temperature or relative humidity over a long period of time, usually following seasonal changes.

encapsulation. A protective housing that can be used to support an exhibited item. It consists of two or more pieces of polyethylene terephthalate (PET) film larger than the item. These are placed behind and in front of the item and are sealed in the margins projecting beyond the item to form a protective supporting envelope.

fluctuation. Rapid changes of value including measurements such as temperature or relative humidity which are generally cyclic in nature. Typical causes are infiltration of unconditioned air, cycling of HVAC equipment, and thermal heat load variations.

fly leaf (leaves). A leaf or leaves at the beginning and end of a bound volume, being the leaf or leaves not pasted to the boards, or covers, of the bound volume.

footcandle. See Photometric terms.

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fore edge. The edge of the bound volume opposite the spine, sometimes called the "front edge."

friable. Easily abraded, especially referring to layers of design media that are susceptible to being cracked or broken.

glazing. A protective transparent layer such as acrylic or glass (a) over the front of an object housed within a frame, or (b) covering the front, top, or sides of an exhibited item to protect it while allowing it to remain visible.

gouache. Pigment with a gum binder which is water soluble and generally applied in thick, opaque layers which can be vulnerable to cracking.

gutter. The adjoining inner margins of two facing pages, i.e., the margin at the sewn fold of a section of a bound volume.

hinge. Internal juncture of the pastedown and fly leaf of a bound volume.

impasto. Thick areas of paint applied to canvas or other support to form ridges, peaks, and other features that produce a raised surface texture.

incident light. Light that reaches the surface of the object.

infrared radiation (IR). Electromagnetic radiation lying in the wave-length interval from about 800 nanometers (nm) to an indefinite upper boundary sometimes set at 10,000 nm.

joint. The exterior juncture of the spine and covers of a bound volume.

leaf support. A sheet of archival paper or card stock that acts as a barrier between the displayed item and a suspect surface, or that adds support to or protects the edges of a bound page or unbound sheet of paper.

leather. A material made from animal skins by one of several procedures in which a tanning agent combines with the active sites in the protein (collagen) to form a material that is strong and durable, but not necessarily permanent. Used for centuries as a covering for bound volumes.

lux. See **Photometric terms**.

macroenvironment. (1) The general environment within a room or large area. Within such an area there are inevitable variations in temperature, relative humidity, dust concentrations, air flow, etc. (2) The space, or spaces, in an exhibition setting, not otherwise enclosed, such as an exhibit case or an item glazed and framed.

methyl cellulose. A cellulose ether made by the chemical alteration of cellulose fibers so that methyl groups are substituted for hydroxy groups on the cellulose molecule. This modification renders the material soluble in water. Methyl celluloses can have different physical properties (viscosity in solution, etc.), depending on how they are made.

microenvironment. (1) The environment in a confined, proximate area, such as that in a case or directly surrounding an object. The microenvironment within a properly designed case will have smaller variations and be more easily controlled than the macroenvironment in the room. One of the primary functions of a case is to moderate changes in the environ-

ment external to the case and to provide physical protection from external dust and pollutants. (2) A small, generally enclosed space within a macroenvironment; the space immediately surrounding an exhibited item, the object chamber, for example.

nonreactive. Chemically stable, i.e., should not release pollutants nor cause reactions with items being exhibited.

object chamber. Those materials, generally glazing and a bottom, and/or back, and/or side walls, that form the part of an exhibit case that immediately surrounds the item on display and its airspace. For a small simple case, the object chamber may be identical to the entire case. For a large case with structural components the object chamber consists of just the glazed display space, and the bottom, back, top, or side walls of that glazed space.

outgassing. The release of volatile components or degradation products, usually referring to undesirable or potentially harmful gasses such as formaldehyde, acetic acid, etc.

overmatting. The use of a window mat prepared with a window smaller than the overall dimensions of the displayed item so that the opaque matboard surround overlaps the edges of the displayed item.

paper. Felted sheets of fiber (usually vegetable, but sometimes mineral, animal, or synthetic) formed on a screen from a water suspension that may include fillers, sizing, and other chemical agents.

parchment and vellum. Materials made from the skins of sheep, goats, calves, and other animals by removing the hair and fat with lime, and then stretching, scraping, and rubbing with powdered chalk, pumice, gypsum, egg-white, etc. Vellum is a fine parchment usually made from the skins of calves, kids, or lambs, but there is no absolute distinction between parchment and vellum. Both have been used mainly as writing support material, but they also have been used to cover bookbindings. Tanning materials are not normally used in the manufacture of parchment.

passive pollutant monitor. A device that traps or detects pollutants by diffusion and which requires no energy to function.

pastedown. The half of the endpaper that lines the inside of a book cover.

photometric terms:

Candle (candela). The International System (SI) unit of luminous intensity. One candle is defined as the luminous intensity of one sixtieth of one sq. cm of projected area of a black body radiator operating at the temperature of freezing platinum, 1772°C.

Footcandle. The English system unit of illumination. One footcandle = 10.76 lux.

Lumen. The unit of luminous flux. It is equal to the flux through a unit solid angle (stearadian) from a uniform point source of one candle, or to the flux on a unit surface, all points of which are at unit distance from a uniform source of one candle.

Lux. The SI (metric system) unit of illumination. One lux = 0.0929 footcandle.

Microwatts per lumen. Microwatts of UV radiation per lumen of visible radiation. Microwatts per lumen is a measure of the proportion of UV emitted from a light source.

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pressure-sensitive tape. A laminate consisting of a carrier or backing and an adhesive layer which, when applied to a surface under light pressure, forms a bond.

relative humidity (RH). The ratio of the quantity of water vapor in the atmosphere to the quantity of water vapor which would saturate the atmosphere at the existing temperature. Also, the ratio of the pressure of water vapor present in the atmosphere to the pressure of water vapor required to saturate the air at the existing temperature.

retaining strap. Straps of flexible, nonreactive transparent materials that hold pages or covers of a bound volume to a desired opening.

scavenger. A chemically active substance with absorption or adsorption properties that act to make innocuous or remove an undesirable substance.

set point. The temperature or RH of a climate control system that the sensing system is adjusted to so that if measured conditions are different from the set point, the climate control mechanism switches on.

skylight. Light that radiates from the sky because of scattering of sunlight by air. The ultraviolet component of skylight is of the same order of magnitude as that of direct sunlight.

squares. The projection of the boards or covers of the book beyond the text block.

starch paste. An adhesive prepared by cooking pure starch in water until it reaches a gelatinous state.

text block. The body of a book, consisting of the leaves, or sections of leaves, comprising the unit to be bound, exclusive of the cover.

text block support. A custom cut strip of mat board or similar material designed to support the weight of the text block when the book is exhibited open at an angle or closed. It conforms in width and length to the shape of the text above it and in thickness to the height of the squares.

ultraviolet radiation (UV). Roughly that part of the electromagnetic spectrum from 200 to 400 nanometers. The spectrum of sunlight and skylight reaching the earth extends down to about 260 nm. Because window glass filters out radiation shorter than about 330 nm, monitors of exhibitions are interested in ultraviolet radiation only between 330 and 400 nm.

vellum. See Parchment.

visible light. The visible spectrum ranges from about 400 to 800 nm. Only that part of the visible spectrum from 400 to about 450 nm is considered damaging to paper, although some fugitive dyes are faded by longer wavelengths of visible light.

3. Light

3.1 Duration of Exhibition

A maximum exhibition length shall be chosen for each exhibited item, based on its light

sensitivity, anticipated light level, and its cumulative past and projected exhibition exposure. In common practice, the exhibition duration for light sensitive items exhibited repeatedly (no more than once every 2 years) is 12 weeks. Commensurably longer exhibit durations may be set for moderately sensitive items or for items rarely exhibited (once every 10 years). Exhibitions covered by this standard shall have a finite length, generally no more than 52 weeks.

3.2 Intensity

The intensity of visible light should be kept low to minimize damage but should still allow adequate viewing. Visible light levels are commonly set at no more than 50 lux (5 footcandles) for very sensitive materials and at no more than 100 lux (10 footcandles) for moderately sensitive materials. Items that combine media of varying stabilities or where the light sensitivity is not known should be assumed to fall in the category of very sensitive media. Visible light levels should be further reduced or eliminated when exhibition areas are not open to the public. A few library and archival materials are known to be moderately sensitive: e.g., carbon black inks (such as printers' inks and India ink) on high quality paper or modern black and white gelatin silver and non-resin coated photographs.

3.3 Monitoring

Light levels shall be measured as intensity of incident light falling on the object. Light levels shall be measured when the lighting for an exhibit is established and whenever a change in lighting conditions occurs, including replacing bulbs or lamps in an ongoing exhibit.

3.4 Light Sources

Artificial light sources shall be used to illuminate exhibitions. Direct sunlight shall not fall on exhibited items at any time. Skylight should be excluded.

3.5 Radiation

Nonvisible radiation should be excluded or prevented from falling on the exhibited object.

3.5.1 Ultraviolet light

Common practice is to limit ultraviolet light to no more than 75 microwatts per lumen at 10 to 100 lux.

3.5.2 Heat

Exhibited items should be protected from heat generated by light sources and associated electric systems.

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3.6 Recordkeeping

Records of the exhibit history of each item shall include each exhibition the item is included in, the length of time it is exhibited (which may be the duration of the exhibit, unless some special shorter exhibit time is implemented) and the light level of the display. For multipage documents or volumes, the individual pages displayed should be noted.

3.7 Inspection

Exhibited items shall be inspected regularly for evidence of light-induced change.

4. Relative Humidity

4.1 Choice of Level

The relative humidity (RH) shall be chosen based on the preservation needs of the objects, the objects' component materials, storage history, exhibit length, prevailing climate, and the capability of the building and its heating and cooling system.

4.2 Range

The relative humidity for the object's environment shall be set at a value (set point) between 35 and 50%, inclusive. The maximum acceptable total relative humidity variation or operating range shall be 5% on either side of the set point. The relative humidity therefore shall not go above 55% or below 30% RH.

4.3 Optimal Levels

Stricter relative humidity controls involving optimal RH levels and smaller variations than given in 4.2 and 4.4 should be maintained for items or materials for which dimensional or other responses to RH changes are unacceptable. Common practice is to maintain such materials in a microenvironment at a constant RH.

4.4 Seasonal Drift

The relative humidity set point may vary to accommodate annual seasonal variation and the shift from heating to cooling equipment operation. Set point change shall not exceed 5% per month.

4.5 Monitoring

The RH of the display environment shall be monitored at intervals frequent enough and at locations sufficiently representative to maintain the standard.

4.6 Recordkeeping

Records of RH levels shall be kept in such a manner that compliance with the standard can be demonstrated.

4.7 Inspection

Displayed items shall be inspected regularly for evidence of R- induced change.

5. Temperature

5.1 Set Point

The temperature of the object's environment shall be set at a value (set point) not to exceed 72ºF (21ºC). For preservation purposes, cooler temperatures are recommended.

5.2 Range

A temperature range of 5ºF (3ºC) on either side of the set point shall be the maximum acceptable total temperature variation. The temperature shall not go above 77ºF.

5.3 Monitoring

Temperature levels shall be monitored at intervals frequent enough and at locations sufficiently representative to maintain the standard.

5.4 Recordkeeping

Records of temperature levels shall be kept in such a manner that compliance with the standard can be demonstrated.

5.5 Inspection

Displayed items shall be inspected regularly for evidence of temperature-induced change.

6. Pollutants

6.1 Levels

Pollutant levels shall be minimized to prevent deterioration of materials on display.

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6.2 Sources

Sources of pollutants shall be eliminated or controlled.

6.3 Choice of Construction Materials

Materials used to construct both the object chamber and supports for displayed items within the object chamber shall be chemically stable and physically non-damaging to displayed items.

6.3.1 Design and Construction

Object exhibit cases or chambers shall be designed and constructed so as to reduce the infiltration of external gaseous and particulate pollutants. Existing cases should be retrofitted to counteract the effect of any reactive materials present in the case and to reduce infiltration of external gaseous and particulate pollutants.

6.3.2 Scavengers

Scavenger materials should be incorporated within exhibit case design, to reduce risk of pollutant damage when the presence of pollutants is suspected and/or when vulnerable items are exhibited.

6.4 Inspection

Displayed items and display surfaces shall be inspected regularly for evidence of change induced by pollutants and particulates (dust).

6.5 Monitoring

Exhibits should be monitored frequently after an exhibit is installed or altered. Frequency can be gradually reduced if no problems develop. Newly constructed or modified cases should be evaluated for problems such as odors (outgassing) prior to installation.

6.5.1 Passive Monitors

Passive pollutant monitors should be used, especially when the presence of pollutants is suspected or when vulnerable items are exhibited.

6.6 Presence of Pollutants

If displayed items show change or if monitors indicate the presence of pollutants, the display shall be examined in an attempt to determine the cause and to remove it. If particulates and dust accumulation are noted, the item and its case shall be examined to determine the points of entry and to block them.

7. Exhibit Case Materials, Design, and Construction

7.1 Choice of Materials

Materials listed in Appendix B-1 used in the construction of exhibition cases are generally recognized to be safe and can be assumed to meet the standard. Materials listed in Appendix B-2 are generally recognized not to be safe and can be assumed not to meet the standard. If wood is used in the construction of exhibit cases, it should not be part of the object chamber surrounding the displayed item.

7.1.1 Evaluation

Materials that do not appear in Appendix B should be evaluated for appropriate application before use. The evaluation should encompass outgassing or contact-transfer potential of harmful substances, water solubility or dry-transfer potential of dyes, the dry-texture (tackiness) of paints, pH, and abrasiveness.

7.2 Curing and Drying

Adequate time should be allowed for curing or drying of construction materials prior to installation. Materials should be dry and odor free.

7.3 Environment

Exhibition cases shall be constructed or modified and positioned to minimize air infiltration and to provide a physically secure environment that meets the levels for relative humidity, temperature, light, and pollutants established by this standard.

7.4 Dimensions

Exhibit cases shall be of adequate dimensions in order to accommodate the range of items to be displayed and shall be of adequate stability and structural strength to ensure object safety in the event of impact or external vibration (including earthquakes). The interior of the exhibit case should be easily and safely accessible for installation and maintenance by staff, yet secure from unauthorized access.

7.5 Object Chamber

The object chamber shall be constructed of component materials that meet the criteria established by this standard. The object chamber shall be isolated from mechanical systems and any materials not meeting this standard. The object chamber should be designed so that environmental control systems and monitoring devices can be introduced, if necessary, to achieve desired conditions.

7.6 Mechanical and Electrical Components

Mechanical and electrical components should be exterior to the object chamber/case. Case design should take into account risks associated with the possible failure of mechanical and electrical systems.

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7.7 Lighting

Where lighting is required for individual cases, the source of such lighting shall be located in a ventilated space isolated from the object chamber and shall be designed so that the lighting component of this standard can be achieved.

7.8. Flammability

Fire resistant or nonflammable materials shall be used in the construction of exhibit cases. Display materials in direct contact or close proximity to exhibited items should not be treated with fire retardant chemicals that are potentially corrosive.

7.9 Water Damage

Exhibits and cases should be designed to prevent or minimize water damage from sources such as sprinklers or leaks.

8. Display Considerations and Structures for Bound and Unbound Materials

8.1 Evaluation for Display

The condition and structure of the book, document, or other item must be examined in advance to determine what support is needed during exhibition to prevent damage from gravity, physical impact, chemical changes, vibration, and environmental factors.

8.2 Choice of Materials

Materials used in the construction of physical supports for exhibiting library and archival materials should be chemically and physically nondamaging. Materials listed in Appendix C-1 used in the construction of physical supports are generally recognized to be safe and can be assumed to meet the standard. Materials listed in Appendix C-2 are generally recognized not to be safe and can be assumed not to meet the standard.

8.2.1 Evaluation

Materials that do not appear in Appendix C should be evaluated for appropriate application before use. The evaluation should encompass outgassing or contact-transfer potential of harmful substances, water solubility or potential transfer of dyes through dry contact, as well as extreme values of pH and abrasiveness.

8.2.2 Metal Fasteners

Pins, screws, thumbtacks and other metal fasteners shall not pierce or come in direct contact with items on display. Nonreactive cushioning or isolating layers should be placed around mounting pins used as edge supports.

8.3 Placement

Physical supports used in exhibiting library and archival materials shall be constructed and attached to items in ways that minimize potential damage and prevent slipping, sagging, and distortion. Physical supports shall be of appropriate strength and size to support the item for which they are designed.

8.3.1 Safe Contact

The object being exhibited should not be placed directly on the floor or wall of the object chamber unless the floor or wall is constructed completely of materials known to be safe for contact with items.

8.3.2 Stacking

Items of different sizes shall not be stacked or otherwise overlapped while on display. If items of identical size are stacked, they should be stacked evenly to avoid differential light exposure and to prevent physical distortion.

8.3.3 Exhibit Labels

Exhibit labels shall not be laid on top of or overlap items on display.

8.3.4 Tapes

Pressure-sensitive tapes shall not come in direct contact with an item.

8.3.5 Angle of Display

The object should not be displayed at an angle that results in the distortion of the object.

8.4 Bound Materials

8.4.1 Angle of Opening

Bound volumes should be opened only as far as the binding allows without force. The angle of opening should not cause strain to the binding, the paper, or the sewing. Common practice is to open bound volumes no greater than 135 degrees. The angle of opening should not cause paper to fold sharply.

8.4.2 Supports

Bound volumes that open flat without causing stress to the spine or text block may be displayed open on leaf support cards without the support of a cradle. Fold-outs should be supported with card stock that is shaped to conform to the overall shape of the unfolded paper.

8.4.3 Blocks or Wedges

Some open volumes can be supported with a block or wedge to elevate a book cover to reduce strain at the book hinge. The height of the block or wedge must be sufficient to bear the weight of the cover without strain.

8.4.4 Angle of Display

Common practice is to limit the angle of display to no more than 30 to 45 degrees from horizontal.

8.4.5 Cradles

A cradle should be used to support bound volumes that are to be displayed open if they do not open flat without stress to the binding structure. Materials used to construct

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cradles should be chemically and physically nonreactive. The cradle should be constructed so that it continuously supports the covers of the bound volume and relieves or minimizes any mechanical (physical) stresses to the text block, sewing structure, joints, or binding caused by display. When a bound volume is to be displayed with the spine at an angle to the case floor, the cradle should have a bottom ledge of adequate depth to support the volume.

8.4.6 Text Block Supports

Text block supports should be used when a bound volume's text block is greater than 1/2 inch thick, sags visibly, or is displayed on a cradle at an angle greater than 30 degrees (between the spine of the volume and a horizontal plane). The text block support can be an integral part of the book support structure, such as a bottom edge of a cradle.

8.4.7 Large and Heavy Volumes

The condition and structure of lectern, folio and other large or heavy bound volumes should be carefully examined to determine whether the book should be displayed closed and flat on the case floor. If such items are to be displayed open, a cradle should be used for support. The angle of display for large or heavy books should not be greater than 20 degrees from the horizontal. For heavy or large volumes, a text block support should be provided even at low angles.

8.4.8 Straps

If bound volumes displayed open need to have the leaves at the opening secured, straps of flexible, nonreactive transparent material should be laid across the outer margins parallel to the fore edge and secured around the volume boards or the cradle. Retaining straps should be attached with minimal tension. Adhesives used to attach the retaining strap to itself or to the support shall not come in contact with the bound volume. Retaining straps used to fasten extremely fragile or valuable paper should be shaped and attached in such a way that the strap does not cut into or deform the paper at the upper and lower edge of the sheet. Leaf supports should be placed behind bound vellum leaves when retaining straps are used to secure the leaves. Leaf supports should also be used when retaining straps are used to secure the leaves of an untrimmed or fragile paper text block to the front and back boards of bound volumes. Transparent strapping used to secure the text block of an open, bound volume to the cradle should not cause stiff paper or embrittled paper to fold sharply. Opaque objects shall not be used to hold open bound volumes.

8.4.9 Duration

Common practice is that bound volumes should not be displayed at the same opening for a period longer than 3 months. Maintain records of openings that have been displayed.

8.5 Unbound Materials

8.5.1 Matting

Matting of an item shall provide rigid support to an item and prevent an item from coming into contact with the glazing. Overmatting may be used to restrain the edges of a single sheet item which tends to curl, bend, or torque. When overmatting an item, the amount of overlap shall be sufficient to prevent the item from being pulled out or slipping out from under the edge of the mat. Overmatting should not extend over or otherwise come in contact with friable media. The surface of a matted item should be protected by glazing or by placement in an exhibit case. Hinges, tabs, straps, corners or encapsulations should be used to support, attach, or secure items into mats. They shall be constructed of inert materials that will not cut into or otherwise damage the object.

The number and location of hinges or other supports shall be sufficient to bear the weight of the item and to prevent the item from dropping, shifting, or moving. For some items, it may be preferable to avoid the use of adhesive attachment. Adhesive used to attach supports to items shall be inert and of a nature that is easily removable without causing damage to the item.

8.5.2 Encapsulation

Encapsulation may be used to support a variety of library and archival materials, including single sheet items which have a tendency to curl, bend or torque when subjected to changes in temperature and relative humidity; items for which hinging is not desirable or acceptable; or items that cannot be given adequate support by hinging. Encapsulation shall not be used for items with flaking, friable, powdery, or three-dimensional media such as pastel, soft graphite pencil, cracked gouache, and thick or soft impasto, or for items with extensive unmended tears.

8.5.3 Framing

Items in frames shall be separated from wood or other harmful materials through the use of mats, glazing, and barrier layers. Glazing for a framed item shall not come in direct contact with the item. Glass should be used as glazing for friable or powdery media to eliminate the possibility of static attraction disturbing the media.

8.5.4 Support Cards

Single or stacked loose bound or unbound items displayed in cases should be laid on support cards or attached to the support card with corners, straps or a sheet of stable plastic film.

9. Other Considerations

9.1 Food and Drink

Food preparation areas should not be located within exhibition areas. Food and drink should not be allowed in exhibition areas. If food and drink are introduced into an exhibition area, the area should be cleaned thoroughly immediately after the event.

9.2 Pests and Insects

Exhibition areas should be monitored for the presence of pests and insects. Keep dated records of sightings and locations.

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APPENDIX A

Factors in Planning and Maintaining Library and Archival Exhibits

(This Appendix is not part of the American National Standard Environmental Conditions for Exhibiting Library and Archival Materials, ANSI/NISO Z39.79-2001. It is included for information only.)

Assumptions underlying this standard are that exhibitions are inherently damaging to materials and that the exhibition is a temporary one, generally lasting from 3 to 12 months. Any item to be exhibited for longer than 12 months should be viewed by a conservator for advice. While the standard is applicable to all in-scope library and archive materials, it seems reasonable to assume that more consideration and resources will be devoted to creating a safe exhibition environment for irreplaceable materials. In consequence, the standard is biased towards the rare and unique. Because damage caused by exposure to light and pollutants, improper values of temperature and relative humidity, and even the most considered display techniques cannot, for the most part, be prevented in absolute terms, Standards Committee MM has sought to establish control parameters that minimize the potential for damage in an exhibition environment.

Experience and research have shown that maintaining a stable and appropriate storage environment will significantly enhance the long-term preservation of materials in libraries and archives. Exhibitions of library and archival materials should be viewed as a type of storage environment that poses significant preservation challenges above and beyond those of stack storage. Typically, exhibition environments expose materials to higher light intensities, often for long periods of time. Temperature and relative humidity fluctuations are generally more difficult to control in an exhibition space. Exhibition case materials may contribute to a high concentration of pollutants. Material supports and display techniques may cause distortion or damage to exhibited items. Because it is difficult to make general statements about the environmental sensitivities of the wide variety of component materials that make up objects commonly exhibited in libraries and archives, the suitability of materials for exhibition needs to be assessed on an item by item basis. Exhibits need to be monitored for changes over time.

A-1. Environmental Standards

A-1.1 Light

Section 3 establishes environmental standards for the intensity and duration of light exposure. The underlying premises for this section are that exposing an object to light causes damage and that light damage is cumulative over the lifetime of the object. The objectives are to keep visible light levels as low as possible while still allowing enough light for adequate viewing of the exhibited items and to minimize their exposure to radiation outside the visible range, i.e. ultraviolet and infrared.

Because light damage is cumulative, section 3.3 of the standard emphasizes the importance of measuring and recording the light levels to which each exhibited item is exposed. The reciprocity equation states that light exposure equals light intensity

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multiplied by duration. At the commonly specified range of light intensities of 50 to 100 lux, cumulative light exposures are approximately 3,500 to 7,000 lux-hours per week or 42,000 and 84,000 lux-hours over a 12-week period, assuming 10 hours of illumination each day in an exhibition environment. Cumulative damage from light exposure becomes perceptible at approximately one megaluxhour exposure for sensitive media and 10 megaluxhours for intermediate sensitive media. These megaluxhour figures are the basis for the maximum exposure limits per year recommended in section 3.2. British Blue Wool Standards may be used to monitor the effect of light over time.

Radiation outside the visible range does not help a viewer see exhibited items but does contribute to photochemical and thermal degradation of exhibited items. Because natural light (both sunlight and skylight) contains significant proportions of ultraviolet radiation which is damaging to organic materials, and because it can be too bright and is inherently variable, its presence in an exhibition setting is undesirable and is limited under sections 3.4 and 3.5. Ultraviolet filters and/or absorbers may be inserted at the light source or in the glazing of frames or cases.

A-1.2 Relative Humidity

Section 4 establishes environmental standards for relative humidity. An item's susceptibility to relative humidity-induced changes is influenced by the storage conditions from which it comes and the microenvironment into which it is being moved for exhibition. The microenvironment's relative humidity will be subject to and strongly influenced by the macroenvironment unless special measures are taken to control the microenvironment. If no such measures are taken, it can usually be assumed that approximately similar conditions exist in the microenvironment as exist in the macroenvironment. If the macroenvironment meets the standard, then the microenvironment is likely to be acceptable. In common practice, the macroenvironment is monitored in an exhibition space overall. Each exhibit case may be monitored individually when greater care is thought to be necessary. Knowledge of the facility and its vulnerability, as well as the objects' characteristics will suggest the need and frequency for monitoring. Monitoring equipment may include recording hygrothermographs, case meters, or data loggers.

A-1.3 Temperature

Section 5 establishes environmental standards for temperature. Temperature and relative humidity are interdependent. Large, fast changes in temperature, especially abrupt cooling, are often accompanied by significant changes in relative humidity. Changes in temperature, like changes in relative humidity, can cause dimensional and other damaging changes in materials. Elevated temperatures hasten degradation reaction rates and may soften or deform heat sensitive materials.

Lower temperature settings generally contribute to the preservation of materials by slowing down the rate of degradation reactions. A lower temperature, down to 50ºF, should be considered safe for a majority of materials. Temperatures much below 50ºF involve considerations not addressed in this standard.

A-1.4 Pollutants

Section 6 establishes approaches to reduce and minimize problems caused by the presence of pollutants in an exhibition setting. Pollutants that may be generated from the materials used in the construction of cases and buildings include formaldehyde, acetic acid, formic acid, and hydrogen sulfide. Sources for these pollutants may include wood and wood products, paints, caulks, adhesives, carpet, and fabrics. Pollutants that typically may be present outdoors and enter buildings include nitrogen oxides, ozone, and sulfur dioxide. Almost all components of library and archival materials are sensitive to pollution. Cellulose, leather, inks, and dyes are organic and undergo degradation reactions which are numerous and varied, poorly defined or not extensively studied. In addition, seemingly similar materials may be chemically quite different. It is therefore harder to single out specific materials that are more susceptible to damage by pollution than others. For many categories of items, the sensitivity of component materials to pollutants can lead to visible alterations, such as discoloration and yellowing of surfaces, silver tarnishing, and corrosion. Other items may be weakened or damaged by pollutants without immediate visible change. Table 1 lists material types likely to be exhibited in libraries and archives which are known to be especially vulnerable to pollutants. Other materials may be added as experience reveals their vulnerability.

Table 1. Materials especially vulnerable to pollutants

Types of Material	Materials within type
Carbonate compounds	Minerals Mother of pearl Shell
Metals and alloys	Lead Copper Silver Brass
Photographic images on metal	Daguerreotypes
Silver-image photographic papers, especially printing-out papers (POP) and non-emulsion papers	Salt prints Albumen prints Gelatin POP prints Silver image resin coated (RC) photo papers
Color photographs	
Lignin-containing paper	Newsprint Paper of low-quality manufacture
Colorants	
Pigments	Chalk Lead white
Plastics / rubber-based	

At present, accurate, standardized, cost-effective methods or procedures for monitoring gaseous pollutants are lacking. Depending upon the resources available, monitoring pollutants can be approached in different ways by measuring, by using passive collection devices or passive indicator systems (such as silver, copper, lead and zinc metal coupons or indicator strips), or by inspecting for evidence of change in the displayed materials, but each of the methods has drawbacks. Measuring pollutant levels accurately is difficult, expensive, and requires resources not normally available in a library or archive. Passive collection devices need to be processed in a lab to obtain data. Some

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training in interpreting the indicators in passive indicator systems is required. And visible inspection methods are not preferred because pollutant-induced changes to displayed materials become visible only after damage has begun to occur.

A-2. Exhibit Case Materials

Section 7 establishes standards for component materials, design, and construction of exhibit cases. Exhibit cases can be constructed from almost every imaginable material, ranging from traditional materials such as wood to the newest synthetic polymers. A case's component materials can become a significant source of pollutants affecting items displayed within it. Design, security, conservation, and audience demands on exhibit case functionality result in requirements that limit the choice of materials for constructing exhibit cases. The safest and least complicated method for choosing suitable materials is to restrict the choice of materials to those that have been shown to be safe through use and long-term testing.

Appendix B presents lists of materials generally considered to be safe or not safe when used to construct exhibition cases. These lists must be considered only as guidelines, because the way a material is used must also be considered. For instance, some polymers are stable under recommended environmental conditions, but can be damaged by exposure to ultraviolet light. The form of the materials must also be considered. Acrylics in solid form are considered to be suitable for archival use, and solutions of pure acrylics dissolved in good quality solvents can be used as varnishes and coatings. Acrylic emulsions (as dispersions) contain additives which may affect the suitability of the adhesive. Polyvinyl acetate emulsions or dispersions also contain additives and have been observed to release acidic gasses for at least several days after drying. This tendency to offgas may affect the suitability of the adhesive for use in closed environments. Nonwoven polyester fabrics which are heat-welded together are generally acceptable, but if such fabrics are held together by glue, some of the glues used may not be acceptable.

Some general tendencies are evident in the lists. Most of the polymers in the "safe" category are ones that generally do not require additives to modify their properties or to stabilize or preserve them. On the other hand, many of the "unsafe" polymers are those that are inherently unstable and require the use of antioxidants, UV absorbers, or stabilizers, or whose properties can only be modified by additives, many of which are volatile.

Many materials are not included on either the "safe" or "unsafe" list. These may or may not be suitable. For instance, the term "epoxy" refers to a chemically diverse class of materials with widely varying stabilities. The chemical stability of many additives used in commercial formulations varies widely as well. In general, if the composition of a material is already known, then it should be possible to place it in one of three categories: safe, unsafe, or unknown or variable and requiring testing before use.

For materials of initially unknown composition, the manufacturer may be able to provide enough information to evaluate the material. Ask for general product literature, as well as a Materials Safety Data Sheet (MSDS) if available, as either or both may give information on the chemical nature of the materials present and the MSDS may give information on volatiles that offgas in fabrication or application which could be harmful to humans as well as displayed items. If not enough information is available to identify the material, an analysis can be conducted, but this process can be time-consuming and costly and still may not

provide enough information to preclude testing. In general, the simple analysis of materials of unknown composition is not sufficient to classify them as safe. And materials of unknown composition or which are not known to be safe require testing. Such tests are generally of two types. The material may be tested empirically in some form of accelerated aging test or an analysis for a specific harmful chemical or property may be conducted.

Most empirical tests are some variant of a test first proposed by Oddy (see Bamberger in the Bibliography). The material to be tested is bottled up with polished metal coupons and the results compared with those for a control experiment. The control is identical except for the absence of the material being tested. The release of acids or oxidizers by the material being tested will result in more corrosion or tarnish than in the control experiment. Such tests simply seek to identify absolute damage which may be caused by the material being tested. It is not necessary to determine the mechanism of damage to rule out an unsafe material. The conditions used for these tests are not meant to reproduce natural aging exactly, but are chosen to speed up reactions and exaggerate any problems that might occur. Many modifications to empirical tests are possible. The conditions for the tests can include high humidity, increased temperatures, and/or exposure to intense visible or ultraviolet light or to pollutants. Detectors other than metal coupons, such as pH or other indicator strips, can be used to detect acid gases. Carbon dioxide can be added to exaggerate the effect of acetic acid on lead. The detector can be separated from the tested material to check for volatile corrosives only, or the two can be placed in direct contact. Such empirical tests necessarily must be long term (weeks or months) to predict accurately whether materials can be used safely over a period of years. This is especially true for modern materials which have added antioxidants or UV absorbers that may disguise any problems until the additive is used up.

Analytical tests to check for specific problems or to identify materials are available. Spot tests for the analysis of polymers (such as a Beilstein test for chlorinated organics that may release hydrochloric acid during aging) are often used when analytical instrumentation is not available. Other tests may be used to look for a specific type of reactivity. These quick tests can be used to determine whether a material presents a specific problem or whether it belongs to one of the safe or unsafe categories of materials. Specific analytical tests cannot substitute for long-term testing in the evaluation of new or previously untested materials.

In areas where the ambient humidity of exhibition rooms is not stable or in areas that receive substantial air-borne pollutants, cases should have designed into them spaces in which humidity buffering and/or pollutant absorbing material can be installed. The size of such spaces should be kept to a minimum and should be placed nearest the object chamber. The design of the case should allow easy access to the material.

The question of whether or not to seal a case tightly depends on the approach being used to control the environment of the objects displayed in a case. First, it must be stated that there is almost always some interchange between room air and the air inside the case, since extraordinary measures must be taken to seal a case hermetically. There is about one air exchange a day in typical "sealed" cases. If the air around the case is conditioned and clean, then the role of the case in controlling the object environment is less critical, and the case serves primarily as a security barrier and protection against failure of the external environmental controls. Such cases may be relatively "open," and in fact hidden openings may be added to direct air exchanges through filters or pollutants. If the external environment around the case is problematic, then a reasonably "sealed" case is preferable. A sealed case minimizes the amount of unconditioned or unclean air to which internal buffers and pollutant absorbers in the

case are exposed. Though safe materials should always be used in the object environment, it is especially important in sealed cases to avoid the use of materials that may emit damaging vapors. The use of pollutant absorbers such as activated charcoal in sealed cases is advisable, since pollutants that do end up in the case (for example by emission from materials incorporated in objects) otherwise may remain in the case long enough to cause damage.

A-3. Display Considerations

Section 8 establishes standards for the components, construction, and application of physical supports used to display items. In this section, more than in any other in the standard, librarians and archivists can bring common sense to bear.

Materials in direct contact with a displayed item, i.e., its physical support, shall be chemically stable (see Appendix C). Support cards can be used as a barrier to direct contact between the item and the exhibition case floor or wall. Additionally, leaf support cards can provide physical support (alone or in addition to encapsulations) for thin or fragile single-leaf items, or foldouts in bound volumes.

Cradles made of acrylic, card, or other chemically stable material also serve a support function, primarily for bound volumes that do not open flat without causing damage to the spine or text block. Custom-made or adjustable cradles can conform precisely to the unique shape and size of each opened bound volume. Commercial cradles can often be adapted to safely support a variety of differently shaped bound volumes.

Vulnerable areas of open, bound volumes include the gutter margin of the pages as they arch over the backing shoulder and the joints. When a volume is exhibited at an angle greater than 20 degrees the downward weight of the text block can exceed the friction between the pages, causing them to slide, and the text block begins to deform. The pages drop and more stress is placed at the top edge of the spine. Other structural factors are either capable of absorbing these stresses without further visible result or the top of the spine area begins to fall forward and the bottom begins to compress. These strains can be avoided or minimized by displaying the bound volume horizontally (i.e., flat on the floor of the exhibition case) or by using text block supports. Older materials might not have the strength to resist these strains over the course of the exhibit period. Even when no deflection is immediately visible, text block supports should be used as a preventive measure. Ideally, lectern, folio, and other large or heavy volumes should not be displayed with their spine raised at an angle from the floor of the exhibition case. Because display case design sometimes requires that a volume's spine be angled relative to the case floor, measures need to be taken to support the weight of the text and to relieve the strain on the spine. Where high angles of display (higher than 30 degrees from the case floor) are desired, extraordinary measures should be taken to fully support the weight of the text block.

Bound volumes displayed at the same opening for long periods run a risk of becoming irreversibly deformed and they may not close completely any longer. Items generally should not be displayed open to the same page for more than three months. If longer exhibit periods are required, changing the opening substantially can be useful in preventing damage.

Encapsulation is a technique most often used when paper is too thin or deteriorated to be hinged safely or when it is not acceptable or desirable to adhere hinges to an item.

Encapsulation is also a useful support technique for oversized or oddly-shaped single-leaf items (such as posters, panoramic photographic prints or newspaper clippings) which are often impractical to mat and frame. Encapsulation can also be used to hold UV filtering polyester film in place if an item requires extraordinary protection from exposure to ultraviolet light. And it is a useful technique for preparing items that can be safely mounted on the walls of exhibition cases. Nonadhesive techniques are preferred methods for sealing encapsulations. If pressure sensitive adhesive tape is used for encapsulation, care should be taken to prevent items from shifting and coming into contact with the adhesive. Adhesive tape encapsulation should not be used on items to be displayed vertically that are too bulky or heavy to be supported by static cling, for example, pamphlets or items on cardboard mounts or supports, because there is a risk of the adhesive bond failing. Whenever possible a sheet of paper with an alkaline reserve should be included inside the encapsulation to reduce the effects of acid degradation.

Matting, glazing and framing are recommended for items that are to be displayed outside exhibit cases on the walls of exhibition areas.

Any extremely rare, valuable, or vulnerable items to be exhibited on a temporary basis should be viewed by a conservator for advice on display technique. Pins and thumb-tacks should not be used to mount items on exhibit case walls. Overlapping exhibition items or placing exhibit labels or opaque book weights on exhibition items promotes differential damage from light exposure and is not a recommended display technique. While exhibitions as defined in this standard are short term (no longer than 52 weeks), materials used for encapsulating, matting, or framing items for exhibit sometimes are retained when the items are returned to storage. If this is the practice, such housings should comply with commonly accepted long-term storage practices.

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APPENDIX B

Materials Used in Construction of Exhibit Cases

(This Appendix is not part of the American National Standard Environmental Conditions for Exhibiting Library and Archival Materials, ANSI/NISO Z39.79-2001. It is included for information only.)

B-1. Generally Recognized as Safe to Use

Adhesives and Tapes

Certain acrylics (e.g., Acryloid F-10, B-72, and B82; Rhoplex AC-33 and AC 234)
Transparent acrylic adhesive on polyester tape carrier (e.g., Scotch Brand Tape #415)
Acrylic contact cements
Certain two-part epoxies (e.g., Epo Tek 301-2; Hxtal NYL-1)
Certain polyvinyl acetate (PVA) emulsions (e.g., Jade No. 403)
Certain ethylene/vinyl acetate copolymers (EVA) (e.g., Beva 371)
Certain hot melt glues
Animal glues (may stain)
Starch paste (rice; wheat)

Foams

Polyethylene (PE) (e.g., Ethafoam; Polyplank; Polyfoam)
Cross-linked polyethylene (e.g., Plastazote; Volara)
White, extruded plank (not expanded bead) polystyrene (e.g., Styrofoam)
Ethylene/vinyl acetate copolymers (EVA foam) (e.g., Evazote; Volara)
Polypropylene (e.g., Microfoam)
Silicone

Miscellaneous

Glass
Ceramics
Neutral silicone sealant
Rubber sealants without sulfur vulcanizing agents (noncontact) (use after 1 month)
Metals (avoid galvanic corrosion)
Pen with acid-free indelible ink (e.g., Pigma Pens)

Paints, Varnishes, and Stains

Low volatiles, medium barrier:
- Acrylic emulsion (exterior or interior)
- Vapour barrier paint composed of butadiene-styrene
- Acrylic urethane (fully reacted urethane type)
- Vinyl acrylic or modified acrylic
- Epoxies or urethanes (two component systems)

Few volatiles:
- Powder coating (for metals and alloys only)

Poorer barrier:
- Shellac (but not bleached shellac)
- Alcohol or water-soluble stain

Plastic or Foam Boards

Corrugated plastic boards (e.g., Coroplast; Cor-X; Hi-Core; PolyFlute; Kortek)
Paper-faced, laminated panel board (e.g., ArtCor; Fome-Cor)

Styrene plastic-faced laminated panel board (e.g., ArtCor)
Aluminum sheet laminated to panel board

Plastic Products

Polyethylene (PE)
Polypropylene (PP)
Polyester (polyethylene terephthalate) (PET)
Polystyrene (PS) and modified PS such as:
- Acrylonitrile/butadiene/styrene (ABS)
- High impact polystyrene (HIPS)

Acrylic
Polycarbonate
Polytetrafluoroethylene (PTFE)

Polymers (Recommended)

Acrylonitrile butadiene styrene (ABS)
Nonsoluble polyamide (Nylon™)
Polycarbonate
Polyethylene
Polyethylene terephthalate
Methyl polymethacrylate (acrylic)
Polypropylene
Polystyrene
Polytetrafluoroethylene (Teflon™)
Polymers that may be used with caution:
- Cellulose acetate (some may contain phthalates and may release acetic acid)
- Polyvinylidene chloride (PVDC) (stable polymer containing chloride and providing an extremely impermeable film
- Ester-type polyurethane (the more stable of the two types of polyurethane but can stain artifacts by direct contact)
- Silicone (Silicone used as a sealant is not compatible in direct contact. Select a sealant that is neutral or, at the very least, alkaline)

Sheet plastics

Best barrier:
- Aluminum foil barrier sheeting (e.g., Marvelseal; Marvelguard)

Good barriers:
- Polyethylene terephthalate (e.g., Mylar)
- Polyethylene (PE)
- Acrylics (e.g., Acrylite SDP; Plexiglas)
- Polycarbonate (e.g., Cryolon SDP; Lexan; Tuffak)
- Air-bubble sheeting (e.g., Aircap; Astro-bubble; Bubble pack; polyCap)
- Polytetrafluoroethylene (e.g., Teflon)
- Silicone

Textiles

Unbleached cotton and linen
Polyester: woven, spunbonded
Nylon: woven and spunbonded
Acrylic
Hook and loop fasteners (Velcro)

Wires and Tubes

Nylon monofilament (fishing line)
Polyester monofilament (fishing line)

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Polyethylene plastic-coated wire
Polyethylene or silicone tubing
Polytetrafluoroethylene (e.g., Teflon)
Glass tubing

Wood
Antique wood (not just old or seasoned)

B-2. Generally Recognized as Unsafe to Use

Adhesives and Tapes
Most epoxies
Polysulphides
Most polyvinyl acetate (PVA) emulsions and solids
Cellulose nitrate
Natural and synthetic rubber cements (most contact cements)

Miscellaneous
Cellulose nitrate
Sand, soil, and pebble (contact with salts)
Acidic silicone adhesive and sealant

Paints, Varnishes, and Stains
High volatiles:
- Oil-based paints
- Alkyd paints
- Oil-modified polyurethane varnish
- Epoxies and urethanes (one component)
- Chlorinated rubber paints

Polyvinyl chloride (PVC) (for metals and alloys)

Plastic or Foam Boards
Urea formaldehyde impregnated paper laminated panel board (Gatorfoam)
Polyurethane foam board
Polyvinyl chloride foam boards (e.g., Sintra)
Plastic products
Chlorine-containing compounds
Chlorinated rubbers
Rubbers containing sulfur vulcanizing agents

Polymers
Vulcanized rubber (contains sulfur)
Cellulose nitrate
Polyvinyl acetate (PVAC)
Polychloroprene (Neoprene)
Polyvinyl chloride
Ether-type polyurethane
Urea formaldehyde

Sheet plastics
Polyvinyl chloride
Rubber with sulfur vulcanizing agents

Chlorinated rubber
Cellulose nitrate
Cellulose acetate

Textiles

Wool (tarnishes silver)
Fire retardant treatments (disodium phosphate, etc.)
Durable press finishes (urea formaldehyde)
Carpets (generally accumulate dust and can house insects)
Carpets with rubber-based backings

Wires and Tubes

Polyvinyl chloride tubing (e.g., some Tygon)
Rubber tubing with sulfur vulcanizing agents
Chloroprene rubber (e.g., Neoprene)

Wood

Green
Unconditioned
With knots
Certain, more acidic species (e.g., red cedar, oak, Douglas fir)

Wood panel products

Interior plywood
Interior particleboard
Waferboard
Chipboard
Untempered hardboard (e.g., Masonite)
Oil-tempered hardboard (e.g., tempered Masonite)
Fiberboards

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APPENDIX C

Materials Used for Physical Supports or Restraints

(This Appendix is not part of the American National Standard Environmental Conditions for Exhibiting Library and Archival Materials, ANSI/NISO Z39.79-2001. It is included for information only.)

C-1. Generally Recognized as Safe To Use

Adhesives and Tapes
Starch paste (rice; wheat)
Methyl cellulose

Foams
Polyethylene (PE) (e.g., Ethafoam; Polyplank; Polyfoam)
Cross-linked polyethylene (e.g., Plastazote; Volara)
White, extruded plank (not expanded bead) polystyrene (e.g., Styrofoam)
Ethylene/vinyl acetate copolymers (EVA foam) (e.g., Evazote; Volara)
Polypropylene (e.g., Microfoam)
Silicone

Miscellaneous
Glass

Papers and Cardboards
Acid-free tissue paper
Archival quality papers (e.g., Permalife paper)
Acid-free mat board
Acid-free corrugated paper board
Acid-free folder stock (e.g., Perma/Dur)
Acid-free honeycomb paper panel

Plastic or Foam Boards
Corrugated plastic boards (e.g., Coroplast; Cor-X; Hi-Core; PolyFlute; Kortek)
Paper-faced, laminated panel board (e.g., ArtCor; Fome-Cor)
Styrene plastic faced laminated panel board (e.g., ArtCor)

Sheet plastics
Polyethylene terephthalate (PET) (e.g., Mylar)
Polyethylene
Acrylics (e.g., Acrylite SDP; Plexiglas)

Textiles
Unbleached cotton and linen
Polyester: woven, spunbonded
Nylon: woven and spunbonded
Acrylic
Hook and loop fasteners (Velcro)

Wires and Tubes
Nylon monofilament (fishing line)
Polyester monofilament (fishing line)
Polyethylene plastic-coated wire
Polyethylene or silicone tubing
Polytetrafluoroethylene (PTFE) (e.g., Teflon)

C-2. Generally Recognized as Unsafe To Use

Adhesives and Tapes
Most epoxies
Polysulphides
Most polyvinyl acetate (PVA) emulsions and solids
Cellulose nitrate
Natural and synthetic rubber cements (most contact cements)

Miscellaneous
Cellulose nitrate
Sand, soil, and pebble (contact with salts)
Acidic silicone adhesive and sealant

Papers and Cardboards
Newsprint
Kraft paper
Cardboard
Glassine
Wrapping paper

Plastic or Foam Boards
Urea formaldehyde impregnated paper laminated panel board (Gatorfoam)
Polyurethane foam board
Polyvinyl chloride (PVC) foam boards (e.g., Sintra)

Restraints
Rubber bands

Textiles
Wool (tarnishes silver)
Fire retardant treatments (disodium phosphate, etc.)
Durable press finishes (urea formaldehyde)

Wires and Tubes
Polyvinyl chloride (PVC) tubing (e.g., some Tygon)
Rubber tubing with sulfur vulcanizing agents
Chloroprene rubber (e.g., Neoprene)

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