# ARCHIVAL QUALITY: WHAT'S IN A NAME?

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The words "archival quality" and "acid-free" are frequently used in relation to artifacts and their preservation. "Archival quality" is a non-specific term implying an inherent long-term preservation of materials, as in an archive. Descriptions calling commercial products "archival" should be accompanied by more specific information, including the item's acidity or alkalinity (pH level), and should refer to certain impurities which may or may not be present in the product.

"Acid-free" means that an item has a neutral pH level of 7. Since acids in paper cause 80% to 90% of all paper deterioration, it is important to understand acidity and what it means in preserving organic materials, including paper and textiles. Of concern are artifacts themselves, and the paper and plastic products used for their storage.

In one of a series of articles on conservation in Museum News, Roy Perkinson, coauthor of How to Care for Works of Art on Paper, offers a description of pH, what it means, and why it is an important factor in conservation. The amount of hydrogen ions in aqueous solutions (and by extension, in paper) determines its acidity or alkalinity. On a scale of 1 to 14, 7 is neutral, or acid-free. Acidic solutions have a lower pH number, alkaline solutions have a higher number. Perkinson points out that each unit on the scale is more concentrated by a factor of 10 - "an acid with a pH of 4 is 10 times more concentrated than if its pH were 5, and 100 times more concentrated than if it were 6." Paper with a pH of less than 5.5 must be treated to deacidify it, or there is danger that the paper will be lost. If the pH is much over 9, there may be a danger of the cellulose oxidizing. The pH level of a paper needs to be taken into consideration with other factors. Although a paper with a pH of 7 is acid-free, it may contain other impurities such as lignins, which hasten a paper's demise.

Acid in paper may be introduced in its manufacture or may be acquired from the environment. Many objects in museum collections and libraries are made of paper. Paper from the eighteenth and early nineteenth centuries is frequently in better condition today than those from the late nineteenth or twentieth centuries. One reason for this is that the earlier papers were made from cotton and linen rags. After the invention of the cotton gin in 1793, cotton became the principal raw material for paper. By 1840, however, the use of ground wood pulp was introduced. The period following the Civil War saw the mass production of quantities of paper in which wood pulp, widely available and inexpensive, replaced other sources of cellulose. Therefore, most papers created after 1870 are on a path of self-destruction. A survey of non-fiction books conducted by William J. Barrow in 1957 revealed that 90% of those printed in the first half of the twentieth century had a life expentancy of fifty years, and that only 1% would be around at the century's close.

The principal problem with the use of wood pulp is not from the cellulose fibers of wood, but rather from the impurities such as lignins, tannins, and resins. If these are removed, paper made of wood may be long-lasting and of quite good quality. There are three main types of wood pulp:

1. Mechanical pulp (groundwood). All components are left in and ground up, giving more bulk. It is inexpensive, but decreases the life span of the paper because of its impurities.

2. Semi-chemical pulp. Chemical treatment removes some lignin. This is a variable product, but more stable and long- lasting than groundwood.

3. Chemical pulp. Here the pulp is boiled under pressure using soda, sulfite, or sulfate (each creating a different final product). This process leaches out lignins and extractives, and can create a good quality paper. PERMALIFE paper, for instance, is composed of well-purified chemical wood fibers. The paper comes in neutral and in alkaline buffered pH levels. It is widely used in stationary, book text, ledgers, and library card stock, where permanence is a factor.

An all-rag paper is not necessarily of acid-free quality. Aluminum sulphate and rosin (alum-rosin), a sizing compound often added to papers (including rag papers) to keep inks from running, produces sulfuric acid which breaks down the cellulose fibers. Also, bleaching papers can leave harmful chloride residues. Other factors affecting the archival quality of paper are tear resistance, fold endurance, and the environment in which the paper is housed.

Paper is hygroscopic - it absorbs water from the atmosphere. Much of this moisture carries pollutants, especially in buildings without closed heat and air-conditioning systems. Sulfur dioxide in the atmosphere is affected by the presence of metallic impurities in the air and by elevations of temperature and humidity. Automobile exhaust, manufacturing processes, power plants, and heating systems add pollutants to the air, affecting organic materials in museum collections, especially paper, leather, and textiles. Sulfuric acid may also be present in iron gall inks (and other old inks). This can cause acid migration to interleaved sheets of paper, where the writing then appears in reverse.

Additional factors affecting the permanence of paper and other organic materials include light, dust, insect infestation, temperature, and humidity. Insects not only carry dirt, but leave tiny droppings that are highly acidic. Extremes of temperature and humidity seriously affect the lifespan of objects, and temperature elevations encourage acid migration. Especially harmful are rapid fluctuations in temperature and humidity. A constant temperature of 65 degrees (plus or minus 5 degrees) and a relative humidity of 55% (plus or minus 5%) are recommended for most museum objects.

What can be done to protect paper artifacts and textiles? If the object itself is

acidic, as is the case for many paper artifacts, several things may be done. The artifact should be placed in an environment which does not permit further acid migration and other conditions which accelerate deterioration. Temperature and humidity must be controlled. In the absence of closed central systems, heating or air conditioning units can be supplemented by humidifiers or dehumidifiers and by the use of products such as silica gel which can remove dampness in small closed spaces.

If the object is valuable and its pH is 5.5 or lower, deacidification is another possibility. This may be done by using special aqueous solutions or by deaqueous sprays. The object must first be tested to determine that the inks or dyes are stable and will not run. Whether or not they are themselves acidic, museum objects need to be kept in an acid-free environment to protect them from pollution. Contact with other highly acidic objects such as rubber bands, metal paper clips, staples, or pins (unless stainless steel) should be avoided.

Acid-free file folders, paper for interleaving, tissue paper, and storage boxes all offer protection for artifacts. One should be cautious about materials used as adhesives in folds, flaps, or seams of containers. They may be acidic or may place pressure on the enclosed object.

Plastic products for archival storage should be made of polyester, polypropylene, triacetate, or polyethylene. Dupont's Mylar D, a popular archival-quality plastic, is a polyester. Plastics are not porous, so should not be sealed because of the danger of moisture buildup. Plastic enclosures made from polyvinyl chloride (PVC) are *not* stable and are unacceptable for archival storage. Such products include plastic dry-cleaning bags, trash bags, and bags for food products.

For some artifacts, the adjacent material should not only be acid-free, but should contain an alkaline buffer to create a barrier to acid migration from the atmosphere. These paper enclosures usually have a pH of 8.5 to 10.0, with a 3% calcium carbonate buffering. They should also be lignin-free. An alkaline buffering is appropriate for paper artifacts and for cotton and linen textiles.

Some artifacts should be kept in an acid-free environment *without* touching an alkaline buffer. These include photographic materials, and silk and wool fabrics. Without the alkaline buffer, however, the neutral pH materials used to protect these artifacts will be subject to acid migration from the atmosphere over time. Further protection for these artifacts may be obtained by interleaving a group of them with neutral pH materials in a larger container with alkaline buffering, by changing the neutral pH materials after an extended period of time, or by using specially constructed containers that have a neutral interior layer and alkaline buffered exterior layers. The latter kinds of boxes are expensive, but offer the most permanent protection for most types of valuable artifacts. An easy rule of thumb for using buffered or nonbuffered products is to remember to buffer plant (vegetable) products, but not protein (animal) products.

Although it doesn't protect the document itself, photocopying documents onto acid-free paper can extend the life and preserve the appearance of the writing or printing and the information contained in them. This may be appropriate in some cases. Permanent museum records should also be maintained on acid-free bond paper. National standards for the permanence of uncoated papers have been developed. NISO, the National Information Standards Organization (Z39), is accredited by the American National Standards Institute (ANSI) as a standards developer. A standard has been developed by the NISO for the permanence of uncoated paper. Such paper may be used for archival purposes or in publications where archival quality is a consideration. Paper meeting the requirements for pH (minimum 7.5), alkaline reserve (minimum 2% calcium carbonate), and paper stock free of groundwood or unbleached pulp should last at least several hundred years without significant deterioration under normal library use and storage conditions. The standard also has requirements for folding endurance and tear resistance. All publications printed on paper that meets this standard should carry a statement of compliance and may use in addition the mathematical symbol denoting infinity set inside a circle. Information on whether papers meet NISO standards can be obtained from paper suppliers.

Archival supplies are expensive, and learning about their proper use is time consuming. Ultimately, however, museums should strive to put each artifact in the best possible environment for its preservation. Once a museum accepts artifacts into its collection it is responsible for their protection. No charge is more important than this stewardship.

**Glossary**

*Alkali:* an hydroxide or carbonate made of an alkaline metal; any of a group of soft white, low-melting, highly reactive metallic elements, including lithium, sodium potassium, rubidium, cesium, and francium.

*Alkaline:* containing an alkali

*Extractives:* capable of being extracted.
Inert: exhibiting no chemical activity.

*Leaching*: dissolving and washing out by a percolating liquid.

*Lignin:* a polymer present in wood which functions as a natural binder and support of cellulose fibers. Lignins generate destructive peroxides.

*pH:* liiterally, the p(otential) of H(ydrogen). A measure of acidity or alkalinity of a solution numerically equal to 7 for neutral solutions, increasing with alkalinity, decreasing with acidity.

**Archival-quality plastics (chemically stable, with neutral pH)**

*Polyester (mylar)*: most inert and rigid; generates static electricity, which may damage some products such as photos.

*Polypropylene:* can be rigid and strong or soft and pliable; used for ring binder storage pages.

*Triacetate:* stronger than polyethylene, but not as strong as polyester; softer than polyester, more easily scratched.

*Polyethylene*: softest and most easily scratched; very pliable; envelopes need additional support; appropriate for storage of stiff objects such as post cards and stereo cards.

**Bibliography**

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These volumes may be borrowed from the IHA lending library. Additional materials on this topic, some of which are also consulted for this technical insert are contained in the IHA vertical files.