

---

# Electronic Media and Preservation

---

by Fynnette Eaton<sup>1</sup>  
Chief, Technical Services  
Center for Electronic Records  
U.S. National Archives and Records  
Administration

The advent of the microcomputer has introduced great uncertainty to those persons responsible for ensuring the viability of information created on a computer. Yes, magnetic tape, round tape, has been recognized for years as a fragile medium. But at least there were recognized standards for this media. If someone orders a file from ICPSR and they sent a tape to the requestor's university, the information would be accessed easily by that university's mainframe.

But oh, what choices have appeared in the last five to ten years. I am willing to wager that each of you have come into contact with people who are using CD-ROM, WORM, Exabyte CD-recordable, diskette—I could go on. Since for most of us as archivists or librarians, the purchase or acceptance of files on these various media imply a commitment to ensure their accessibility to users for a certain period of time, the decision as to what media to use for storing information has a great impact on the computer operations of our institution.

Deciding what types of storage media to use involves determining the length of time your institution expects to have this information available, the computer resources currently available at your institution and your comfort level.

What I would like to discuss this morning are the general steps that should be considered by all institutions in seeking to preserve the information stored on electronic or optical media and then to briefly summarize the preservation requirements for the media currently in wide use. What do we mean when we say we are preserving information? How long will a product, a document or the information be preserved? I believe in many cases, there are underlying assumptions by the various groups that employ terms such as "archiving data" that are not necessarily shared by the larger community.

Permit me to use a personal story. When I began to work as an archivist with the Office of Presidential Libraries, I was responsible for preliminary preservation work for the color negatives from the Carter Administration. Since I had no previous experience in working with still photographs, I attended a workshop on preservation of photographic materials at the Eastman Kodak Institute. The information provided was timely and instructive. My

most vivid memory, however, was the demonstration of what happened to color film produced in the 1960's. We were viewing slides from the movie "West Side Story." As the lecturer explained the dye process used in manufacturing the film and showed a slide taken from one of the stills, the audience audibly gasped at what they saw: the projected image from the slide projector had only one color—magenta. One could almost feel the dismay as the audience realized that this famous cultural icon had deteriorated to the point that the only color on the film was red. Now, I will grant you that the basic information was still recorded, but for the millions of consumers who had been urged to buy this film to record all those wonderful family memories, would a film of children on vacation at the beach mean much to them if the entire photograph was red?

In many ways this is an unfair example, but it points to the fact that for many the concept of preservation is abstract and the question of longevity, unacknowledged.

It is the purpose of this paper to discuss how general preservation practices can and should be applied to electronic media and to suggest that for many institutions or organizations there is a need to carefully consider how long the information currently stored in an electronic format will be retained by that institution. That decision will influence the media used to store the information electronically.

First, let us discuss general preservation activities, as they relate to electronic records. When I began to research the basic preservation requirements for electronic records I was struck by how the requirements for textual materials seemed to mirror those for electronic records. I will be the first to admit that electronic records pose their own unusual problems, but, and it is a large but, the general maintenance and environmental requirements are very similar for textual and non-textual materials.

Many of the preservation policies that are constructed around attempts to prevent deterioration are just as relevant to electronic records as they are to paper based records. In their discussion of implementing an archival preservation program, Norvell Jones and Mary Lynn

Ritzenthaler detail the interrelated factors that cause archival records to deteriorate: the chemical and physical stability of specific materials, storage under adverse environmental conditions, and external causes such as excessive or careless handling, and loss or destruction brought about by human-induced or natural disasters. In every case the factors enunciated on this list are factors that must be considered in the preservation of electronic records as well.

An understanding of the physical properties of electronic records and the environmental conditions that they should be stored under are essential for ensuring that the information stored on these records are preserved.

The seven elements of a preservation program: environment, storage, handling and use; microreproduction and reformatting, exhibition, disaster planning and treatment must be considered by an institution charged with preserving electronic records. The only element that does not have real importance in electronic records is exhibition.

As with other media, perhaps the single most important factor in the preservation of electronic media is the environment. Electronic records, like other audiovisual records require temperatures between 62-68 degrees Fahrenheit, with an optimum of 65 degrees, which is probably within the range required for textual records. The humidity requirements, however, are different for magnetic tape than for paper. Lower humidity between 35 and 45 percent, with an optimum of 40 percent is the recommended level according to the National Institute of Standards and Technology (formerly the National Bureau of Standards), but this is less than the 50 percent recommended for paper records. According to George Cunha, the commonly accepted view currently held is if audiovisual materials (including magnetic tape) cannot be isolated in a mini-environment, then the overall humidity in the building should be kept between 40 percent and 50 percent.”

Successfully attaining the optimum environment recommended can be difficult. Most institutions have conflicting requirements for staff and various media. One must recognize the difficulty of creating the perfect environment with competing interests, and take to heart what one conservation authority has learned: “it is far more important to stabilize both temperature and humidity at points as near as possible to the optimum conditions than to strive for optimum conditions with heating and cooling machinery that is unequal to the task and likely to produce constantly fluctuating temperature and humidity levels.”

I would like to emphasize this point as well. Studies

indicate that one of the major contributions reducing the life expectancy of magnetic tapes is fluctuating temperature and humidity. Strive for the best conditions possible, but emphasize stability rather than occasional optimum conditions.

The proper storage and handling of archival materials is an essential element in a preservation program, particularly for paper records; but, again, this is also applicable to electronic records. Proper storage includes placing open reel tapes in plastic canisters and storing these tapes or cartridges vertically in shelving constructed specifically for open tape reels or tape cartridges. Unlike paper, which can be stored indefinitely if placed the proper containers, reels should be exercised periodically (there is discussion as to how often this should be done) and there should be a periodic inspection of a random sample of files, to test the readability of the media. An interesting theory proposed by Margaret Adams, who oversees the reference activities at the Center for Electronic Records is that, unlike paper records, reference activity actively promotes preservation in electronic records, because the staff uses the files, thereby determining the readability of that specific file and the media is cleaned and rewound after use, thus ensuring proper tensioning of the media.

Improper handling can have disastrous effects on magnetic tape. Dirt can create read errors. If the tapes are not tensioned properly, stretching can occur, which would create misalignment, leading to the inability of the computer to process the tape. Any distortion of the data due to improper tension or shrinking or expansion of the tape, or erasure of the tape can lead to the loss of the information stored on the tape. Improper handling of magnetic tapes or tape cartridges can cause edge damage as well. Thus procedures for ensuring the proper handling of electronic media must be an integral part of a preservation program for electronic records.

Reformatting, the next element in a preservation program is absolutely essential with electronic records. The requirement of moving electronic records to new formats is to keep up with the ever-changing technology. As the National Research Council pointed out in their study “Preservation of Historical Records” and the National Institute of Standards and Technology (NIST) has confirmed, the recording media in use may well outlast the hardware, thus making it necessary to recopy the electronic file every 10 to 20 years to ensure access to the information. This recopying process simply reformats the information to avoid obsolescence. The information is not changed in any way.

Disaster planning must be a part of any preservation program. Electronic records are susceptible to water and

fire damage. The best way to protect the information in electronic format is by making a second copy of any file and storing it offsite. The costs of a second copy are minimal compared to the expenses that would be incurred in trying to recreate the data. It is highly recommended that there be a second copy of any file stored in any electronic format, even ( and I would say particularly) diskettes.

Treatment, the last element discussed by Jones and Ritzenthaler, does not figure as prominently with electronic records, although the National Archives recently encountered problems with some of its older tapes and is working with the National Media Lab, in Minneapolis, Minnesota to find a way to salvage as much of the information from these tapes as possible. Generally, the best method of treatment is prevention, recopying electronic files before serious problems develop.

These then are the basic elements of a preservation program for archival materials. I have focused on their relevance to magnetic media. But what about the other media available on the market? Do CD-ROMS, optical disk systems and diskettes require the same type of program? Generally, I would say the answer is yes. Optical disks and CD-ROMs have been touted as being extremely durable. Perhaps yes, perhaps, no. There has been little empirical testing performed on these media. What you have heard are vendor claims and some horror stories. In certain cases, the seal on the CD-ROM was not perfect, so oxidation occurred and information was lost. There are indications that information stored on the outer layers of optical disks tend to have greater proportions of errors. Nothing is failsafe. Clean environments should be required for any media. Temperature and humidity should be controlled for best possible results. Disasters must always be planned for, so there should be a backup copy of any file that you are required to preserve. I must admit however, that there is no requirement for cleaning and rewinding of optical media.

Is the data permanent on these media? No. But the reason is not necessarily the medium. Some of these disks could well last 100 years. It is the technology that will fail. As I was preparing this paper I received a publication entitled *Government Imaging*, which claims the title of "The National Newspaper for Government Imaging Technology." In an article about standards for optical disk storage systems there is the clear acknowledgement that optical disks are not necessarily the best media for archival storage. In discussing the various standards used within document imaging systems, the author (Harvey Spencer) states the problem being "... that we are relying on these disks being available to us in twenty or maybe more years time and it is highly likely that the drives, and formats, that we are writing in will no

longer be supported. . ." He goes on to explain that the only standard that has survived from the 1960s is the 1/2" magnetic tape. The reason for its durability was the domination of the computer industry by a handful of suppliers that everyone used; the amount of information stored on these tapes is so great that manufacturers can not abandon this format. For optical disk systems, this situation does not exist.

CD-ROMS look more promising, because of the number of files being published on this media, and the acceptance by the library community as a means of information distribution. There have been questions for a number of years about the longevity of the polycarbonate CD media. An organization which is interested in promoting the use of CD-ROMs by government agencies, SIGCAT or Special Interest Group on CD-ROM Applications and Technology, is trying to collect information on this issue. One member, Ron Kushnier, a storage specialist with the Naval Air Warfare Center in Warminster, Pa reported to SIGCAT members last spring about his extensive environmental tests of CD media from about 100 manufacturers. What he found was that "All CD-ROMS are not created equal." Some disks came out of high-humidity, high temperature chambers in as good shape as they went in; others failed miserably. SIGCAT is continuing its efforts to determine longevity for this medium. Yet there is again the issue of standard, or I should say, the lack thereof.

Charles Dollar, a member of the Archival Research and Evaluation Staff at the National Archives has argued that disk longevity takes second place to "a much more important and pervasive issue—how to deal with technology-dependent records," Dollar used as an example relevant for CD's—data compression. Although there is an international standard for data compression, many vendors use proprietary compression techniques "that in essence become an encryption tool that only one vendor's software can open or close."

The point that I am trying to make with this discussion of the limitations of various media, is that you and your institution should consciously decide how long you intend to preserve information in an electronic format and base the decision of the which format on the length of time you will need access to the media. If it falls within ten to twenty years, then optical disk or CD-ROM is a valid choice, although you must monitor changes in technology in the marketplace and the condition of the equipment you use to access this information. If the requirement is for longer-term preservation, you can still use CD-ROMs and optical disks, but you must plan to reformat the information onto a technology that can be accessed in the future. There is no panacea for electronic media. It is a very small cost of migrating files to newer

format, to preserve previously unimaginable amounts of information and making this available to a world community.

1. Paper presented at IASSIST 93 in Edinburgh.

### Sources

Norvell M.M. Jones and Mary Lynn Ritzenthaler, "Implementing an Archival Preservation Program," in Managing Archives and Archival Institutions, ed. James Gregory Bradsher (Chicago: The University of Chicago Press, 1988), 188.

George Martin Cunha, "Current Trends in Preservation Research and Development," The American Archivist, vol. 53, no.2, Spring 1990, 195. Sidney B. Geller, Care and Handling of Computer Magnetic Storage Media, National Bureau of Standards Special Publication 200-101, (Washington, D.C.: National Bureau of Standards, 1983), 86.

Cunha, p. 195.

Jones and Ritzenthaler, 191-2.

Bruce I. Ambacher, "Managing Machine-Readable Archives," Managing Archives and Archival Institutions, ed. James Gregory Bradsher (Chicago: University of Chicago Press, 1988), 124-5.

National Research Council, Preservation of Historical Records, (Washington, D.C.: National Academy Press, 1986), 61-2.

Harvey Spencer, "Standards for Optical Disk Storage Systems," Government Imaging, vol. 2 no. 3, May - June 1993, 15.

Florence Olsen, "Experts debate longevity of polycarbonate CD media," Government Computer News, June 8, 1992.

Ibid.