



The National Archives

**Digital Preservation
Guidance Note:**

2

**Selecting Storage Media for Long-Term
Preservation**

Document Control

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Document Reference: DPGN-02

Issue: 2

Issue Date: August 2008

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1 Introduction

This document is one of a series of guidance notes produced by The National Archives, giving general advice on issues relating to the preservation and management of electronic records. It is intended for use by anyone involved in the creation of electronic records that may need to be preserved over the long term, as well as by those responsible for preservation.

This guidance note provides information for the creators and managers of electronic records about the selection of physical storage media in the context of long-term preservation.







The scope of this guidance note is limited to removable storage media. Server-based hard disk storage offers a secure storage regime for electronic records, provided it is well managed and includes an effective back-up strategy. In many situations however, this may be neither possible nor appropriate. Removable media usually have some part to play in the life cycle of any electronic record. This guidance note sets out a range of criteria that aims to help data creators and archivists make informed choices about selecting removable storage media.

2 Selection issues

Any physical storage medium is, by definition, completely dependent upon very specific combinations of hardware and software for access. The accessibility of information stored on such media is highly vulnerable in today's rapidly evolving technological environment. This issue is not solely the concern of digital archivists, but of all those responsible for managing and sustaining access to electronic records over even relatively short timescales.

No computer storage medium can be considered archival, irrespective of its physical longevity: technological obsolescence is inevitable and all media have limited life spans. For the foreseeable future, the need to periodically refresh electronic records onto new media is therefore inescapable. Careful selection of storage media can maximise the periods between refreshment cycles and simplify the refreshment process, in addition to ensuring that data is as secure as possible.

The following criteria should be considered by data creators when selecting removable storage media:

-  Longevity
-  Capacity
-  Viability
-  Obsolescence
-  Cost
-  Susceptibility

These criteria are elaborated in the following sections:

2.1 Longevity

The media storage option chosen should have a proven life span of at least 10 years. Longevity greater than this, however, is not necessarily an advantage: over longer timescales, obsolescence of the drive technology used to read the medium will typically be a much more significant factor than physical deterioration of the storage medium itself.

2.2 Capacity

The media storage option chosen should provide a storage capacity appropriate for the quantity of data to be stored and the physical size of the storage facilities available. Minimising the number of actual media to be managed will generally be more efficient and cost effective.

2.3 Viability

The media and drives chosen should support robust error-detection methods for both reading and writing data. Provision for testing the integrity of media after writing is also a benefit. Proven data recovery techniques should also be available in case of data loss. Media should be write-once, or have a reliable write-protect mechanism to prevent accidental erasure and maintain the evidential integrity of the data.

2.4 Obsolescence

The media and its supporting hardware and software should preferably be based on mature, rather than leading-edge technology. The technology should be well established in the market place and widely available. Media technologies that are based upon open standards for both media and drives are generally preferable to those that are proprietary to a single manufacturer.

2.5 Cost

Two elements must be considered when assessing the relative costs of storage media – the cost of the media itself and the total cost of ownership. Valid comparisons of media costs must always be made on a price per Gigabyte (GB) basis. The total cost of ownership will include costs for purchasing and maintaining the necessary hardware and software, and of any storage equipment required. Support costs and the quoted Mean Time Before Failure of the relevant drive must also be taken into account.

2.6 Susceptibility

The media should have low susceptibility to physical damage and be tolerant of a wide range of environmental conditions without data loss. Magnetic media should have a high coercivity value (preferably in excess of 1000 Oersteds¹), in order to minimise the

¹ : Oersteds are the unit of measurement for magnetic field intensity.

chances of accidental erasure through exposure to magnetic fields. Any measures required to counter known susceptibilities (such as packaging or storage requirements) should be affordable and achievable.

3 The Media Selection Scorecard

The scorecard approach illustrated below uses a simple method for evaluating currently available media against the selection criteria². Each medium should be scored against the criteria on a scale of 1 (does not meet the criterion) to 3 (fully meets the criterion). As a general rule, no medium that scores less than 12 should be considered.

An example scorecard, comparing some common media types, is shown below:

Media	CD-R	DVD-R	Hard Disk	Flash Memory Stick and Card	Linear Tape Open (LTO)
Longevity	3	3	2	1	3
Capacity	1	3	3	2	3
Viability	2	2	2	1	3
Obsolescence	1	2	2	2	2
Cost	3	3	1	3	3
Susceptibility	1	1	3	1	3
Total	11	14	13	10	17

Figure 1: Media Selection Scorecard

The evaluation process should fully take into account variations within a media type. For example, a number of different dye and metal layer combinations are available for CD-Rs. In this example, CD-Rs with a gold reflective layer and phthalocyanine-based dyes have been assessed, since recent research suggests that these are the most stable, and have the greatest life span.

In situations where multiple copies of data are stored on separate media, it may be advantageous to use different media types for each copy, preferably using different base technologies (for example, magnetic and optical). This reduces the overall technology dependence of the stored data. Where the same type of media is used for multiple copies, different brands or batches should be used in each case in order to minimise the risks of data loss due to problems with specific manufacturers or batches.

² : This approach is based upon the concept of the media selection scorecard proposed by Bennett (1997, 18-19).

4 Conclusion

There are many issues to be considered when selecting physical storage media that extend beyond the immediate and obvious requirements of the situation. This guidance note should assist data creators to make informed decisions based on the ever-changing choices available.

The adoption of appropriate storage media for electronic records brings benefits to data creators, data managers and digital archivists. Selection decisions informed by the criteria described in this guidance note will greatly enhance the sustainability of the records created.

5 Bibliography

Bennett, J C, 1997, A framework of data types and formats, and issues affecting the long-term preservation of digital material. JISC/NPO studies on the preservation of electronic materials, *British Library Research and Innovation Report*, **50**