



the national archives

**Digital Preservation  
Guidance Note:**

**2**

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

## Document Control

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## 1 Introduction

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

This guidance note provides advice on general issues which should be considered by the creators and managers of electronic records when selecting physical storage media for long-term preservation. Guidance on storage media for transfer of electronic records to The National Archives is provided in separate Guidelines for Physical Transfer.

The scope of this guidance note is limited to removable storage media. Server-based hard disk storage is the most effective and secure storage regime for electronic records, provided it is well managed and includes an effective back-up strategy. However, in many situations this may not be possible or appropriate. Removable media usually have some part to play in the life cycle of any electronic record. This guidance note therefore describes a range of criteria which will help data creators and archivists to make informed choices about removable storage media issues.

## 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 therefore 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. The need to periodically refresh electronic records onto new media is inescapable for the foreseeable future. Nevertheless, careful selection of appropriate media can maximise the periods between refreshment cycles and simplify the refreshment process, in addition to providing the securest storage environment 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 should have a proven life span of at least 10 years. Greater longevity is not necessarily an advantage, since obsolescence of drive technology usually precedes physical deterioration of the storage medium.

## 2.2 Capacity

The media 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 usually create efficiencies and resource savings.

## 2.3 Viability

The media and drives 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, and should be well established in the market place and widely available. Media technologies which are based upon open standards for both media and drives should generally be preferred to those which 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 and the total cost of ownership. Valid comparisons of media costs must always be made on a price per MB/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 a 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<sup>1</sup> (preferably in excess of 1000 Oersteds<sup>2</sup>), to minimise the chances of accidental erasure. 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 described here provides a simple method for evaluating currently available media against the selection criteria<sup>3</sup>. 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 which scores less than 12 should be considered.

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

Media	CD-R	DVD-R	Zip Disk	3.5" Magnetic Disk	DLT	DAT
Longevity	3	3	1	1	2	1
Capacity	2	2	1	1	3	3
Viability	2	2	1	1	3	3
Obsolescence	3	2	2	3	2	2
Cost	3	2	1	1	3	3
Susceptibility	3	3	1	1	3	2
<b>Total</b>	<b>16</b>	<b>14</b>	<b>7</b>	<b>8</b>	<b>16</b>	<b>14</b>

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, to minimise the risks of data loss due to problems with specific manufacturers or batches.

<sup>1</sup> : Coercivity is a measure of the amount of magnetic field required to reduce magnetic induction to zero, i.e. erase the medium.

<sup>2</sup> : Oersteds are the unit of measurement for magnetic field intensity.

<sup>3</sup> : 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, which extend beyond the immediate and obvious requirements of the situation. This guidance note should assist data creators to make informed decisions from the ever-changing choices available.

The adoption of appropriate storage media 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**