Guidelines for media management

Media usage

Removable media security policy

Establishing a removable media security policy will allow sound oversight and accountability of information transported or transferred between systems on removable media. In addition, a well-enforced removable media security policy can decrease the likelihood and consequence of accidental data spills and information theft or loss.

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Security Control: 1359; Revision: 2; Updated: Apr-19; Applicability: O, P, S, TS; Priority: Should
A removable media security policy is developed and implemented that includes:

- details of the removable media authority within the organisation
- types of media permitted within the organisation
- processes for media registration and auditing
- processes for media classification and labelling
- processes for the use of media for data transfers
- processes for the sanitisation/destuction and disposal of media.

Classifying media storing information

Media that is not correctly classified could be handled and stored inappropriately or accessed by personnel who do not have appropriate security clearances.

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Security Control: 0323; Revision: 5; Updated: Feb-19; Applicability: O, P, S, TS; Priority: Must
Media is classified to the highest sensitivity or classification of information stored on the media.

Classifying media connected to systems

There is no guarantee that information will not be copied to media while connected to a system unless read-only devices or read-only media are used.

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Security Control: 0325; Revision: 5; Updated: Mar-19; Applicability: O, P, S, TS; Priority: Must
Any media connected to a system is classified as the same sensitivity or classification as the system, unless the media is read-only, the media is inserted into a read-only device or the system has a mechanism through which read-only access can be ensured.
Reclassifying media

Media should always be protected according to the sensitivity or classification of the information it stores; however, if the sensitivity or classification of the information changes, so should the protection afforded to the media.

**Security Control: 0331; Revision: 5; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
Media is reclassified if information copied onto the media is of a higher sensitivity or classification than the information already on the media, or information stored on the media is subject to a classification upgrade.

**Security Control: 0330; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
If reclassifying media to a lower sensitivity or classification, the reclassification of all information on the media has been approved by the originator, or the media has been appropriately sanitised/destroyed and a formal administrative decision has been made to reclassify it.

Labelling media

Labelling media helps personnel to identify its sensitivity or classification and ensure that appropriate security controls are applied to its handling and usage.

While text-based protective markings are typically used for labelling media, there may be circumstances where colour-based protective markings or other marking schemes need to be used instead. In such cases, the marking scheme will need to be documented and personnel will need to be trained in its use.

**Security Control: 0332; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
Media, with the exception of internally mounted fixed media within ICT equipment, is labelled with protective markings reflecting its sensitivity or classification.

Connecting media to systems

Some operating systems provide functionality to automatically execute programs that reside on media. While this functionality was designed with a legitimate purpose in mind (e.g. such as automatically loading a graphical user interface for a user to browse the contents of media or to install software residing on the media) it can also be used for malicious purposes. For example, an adversary can create a file on media that the operating system believes it should automatically execute. When the operating system executes the file, it can have the same effect as when a user explicitly executes malicious code; however, in this case the user is taken out of the equation as the operating system executes the file without explicitly asking for permission.

Device access control software allows greater control over media that can be connected to systems and how it can be used. This assists in preventing unauthorised media being connected to systems and, if desired, preventing information from being written to it. Media can also be prevented from connecting to systems by disabling connection ports in software or by physical means such as using wafer seals or applying epoxy. If physical means are used to prevent media connecting to systems, procedures covering detection and reporting processes are needed in order to respond to attempts to bypass these security controls.

**Security Control: 0337; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
Media is not used with systems that are not authorised to process, store or communicate the sensitivity or classification of information on it.

**Security Control: 0341; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
Any automatic execution features for media are disabled in the operating system of systems.

**Security Control: 0342; Revision: 5; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
Unauthorised media is prevented from connecting to systems via the use of device access control software, disabling connection ports, or by physical means.
Security Control: 0343; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Should
Media is prevented from being written to via the use of device access control software if there is no business requirement for its use.

External interface connections that allow Direct Memory Access

It has been demonstrated that an adversary can connect media to a locked system via an external interface connection that allows Direct Memory Access (DMA) and subsequently gain access to encryption keys in memory. Furthermore, an adversary can read or write any content to memory that they desire. The best defence against this security vulnerability is to disable access to external interface connections that allow DMA using software controls or physical measures. External interface connections that allow DMA include Institute of Electrical and Electronics Engineers (IEEE) 1394 (FireWire), ExpressCard and Thunderbolt.

Security Control: 0345; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
External interface connections that allow DMA are disabled.

Handling media

As media can be easily misplaced or stolen, mechanisms should be put in place to protect information stored on it. Furthermore, applying encryption to media may reduce the requirements for storage and physical transfer. Any reduction in requirements needs to be based on the original sensitivity or classification of information residing on the media and the level of assurance in the encryption software being used to encrypt the media.

Security Control: 0831; Revision: 5; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
Media is handled in a manner suitable for its sensitivity or classification.

Security Control: 1059; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
Media is encrypted with at least an Australian Signals Directorate (ASD) Approved Cryptographic Algorithm (AACA).

Using media for data transfers

Organisations transferring data between systems belonging to different security domains are strongly encouraged to use write-once media. This will ensure that information from one of the systems cannot be accidently transferred onto the media then onto another system when the media is reused for the next transfer.

Security Control: 0347; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Should
When transferring data manually between two systems belonging to different security domains, write-once media is used.

Further information

Further information on accounting for and storing media can be found in the ICT equipment and media section of the Guidelines for physical security.

Further information on labelling ICT equipment can be found in the ICT equipment usage section of the Guidelines for ICT equipment management.

Further information on reducing storage and physical transfer requirements can be found in the Cryptographic fundamentals section of the Guidelines for using cryptography.

Further information on using media to transfer data between systems can be found in the Guidelines for data transfers and content filtering.

Further information on the use of protective markings can be found in the Attorney-General’s Department (AGD)’s Protective Security Policy Framework (PSPF), Sensitive and classified information policy, at https://www.protectivesecurity.gov.au/information/sensitive-classified-information/.
Further information on the storage and transfer of media can be found in AGD’s PSPF, *Physical security for entity resources* policy, at https://www.protectivesecurity.gov.au/physical/physical-security-entity-resources/.

**Media sanitisation**

**Media in ICT equipment**

ICT equipment will often contain devices that are quite small and may not be immediately recognisable as memory. Examples of these include M.2 or Mini-Serial Advanced Technology Attachment (mSATA) devices. When sanitising M.2 or mSATA devices, the sanitisation procedures for flash memory devices apply. Generally, if a device offers persistent storage of information, it is likely that the sanitisation procedures for flash memory will apply.

**Hybrid hard drives**

When sanitising hybrid hard drives, the sanitisation procedures for flash memory devices apply.

**Solid state drives**

When sanitising solid state drives (SSDs), the sanitisation procedures for flash memory devices apply.

**Media that cannot be sanitised**

When attempts to sanitise media are unsuccessful, the only way to provide assurance that all information has been erased is to destroy the media. Additionally, some types of media cannot be sanitised and therefore should be destroyed.

**Sanitisation procedures**

Sanitising media prior to reuse in a different environment ensures that information is not inadvertently accessed by unauthorised personnel or otherwise insufficiently protected.

Using approved sanitisation methods provides a level of assurance that no information will be left on media. The procedures described in this document are designed not only to prevent common information recovery practices but also to protect from those that could emerge in the future.

When sanitising media, it is necessary to read back the contents of the media to verify that the overwrite process was completed successfully.

*Security Control: 0348; Revision: 2; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must*

Procedures for the sanitisation of media are developed and implemented.

**Volatile media sanitisation**

When sanitising volatile media, the specified time to wait following removal of power is based on applying a safety factor to the time recommended in research into preventing the recovery of the contents of volatile media.

If read back cannot be achieved following the overwriting of media contents, or information persists on the media, destroying the media is the only way to provide complete assurance information no longer persists.

*Security Control: 0351; Revision: 5; Updated: Sep-18; Applicability: O, P; Priority: Must*

Volatile media is sanitised by removing power from the media for at least 10 minutes or by overwriting all locations on the media with a random pattern followed by a read back for verification.

*Security Control: 0352; Revision: 3; Updated: Sep-18; Applicability: S, TS; Priority: Must*

Volatile media is sanitised by overwriting the media at least once in its entirety with a random pattern, followed by a read back for verification, and then followed by removing power from the media for at least 10 minutes.
Treatment of volatile media following sanitisation

Published literature suggests that short-term remanence effects are likely in volatile media. Data retention times have been reported to be measured in minutes at normal room temperatures and up to hours in extreme cold. Furthermore, some volatile media can suffer from long-term remanence effects resulting from physical changes to the media due to continuous storage of static data for an extended period of time. It is for these reasons that under certain circumstances TOP SECRET volatile media retains its classification following sanitisation.

Typical circumstances preventing the reclassification of TOP SECRET volatile media include a static cryptographic key being stored in the same memory location during every boot of a device and a static image being displayed on a device and stored in volatile media for a period of months.

Security Control: 0835; Revision: 3; Updated: Sep-18; Applicability: TS; Priority: Must
Following sanitisation, highly classified volatile media retains its classification if it stored static data for an extended period of time, or had data repeatedly stored on or written to the same memory location for an extended period of time.

Non-volatile magnetic media sanitisation

Both the host-protected area and device configuration overlay table of non-volatile magnetic media are normally not visible to an operating system or a computer’s basic input/output system. Therefore, any sanitisation of the readable sectors of media will not overwrite these hidden sectors leaving any data contained in these locations untouched. Some sanitisation programs include the ability to reset media to their default state removing any host-protected areas or device configuration overlays. This allows the sanitisation program to see the entire contents of media during the subsequent sanitisation process.

Modern non-volatile magnetic media automatically reallocates space for bad sectors at a hardware level. These bad sectors are maintained in what is known as the growth defects table or ‘g-list’. If data was stored in a sector that was subsequently added to the g-list, sanitising the media will not overwrite these non-addressable bad sectors. While these sectors may be considered bad by the media, quite often this is due to the sectors no longer meeting expected performance norms and not due to an inability to read/write to them. The Advanced Technology Attachment (ATA) secure erase command was built into the firmware of post-2001 media and is able to access sectors that have been added to the g-list.

Modern non-volatile magnetic media also contain a primary defects table or ‘p-list’. The p-list contains a list of bad sectors found during post-production processes. No data is ever stored in sectors on the p-list as they are inaccessible before the media is used for the first time.

Security Control: 1065; Revision: 2; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Should
The host-protected area and device configuration overlay table of non-volatile magnetic media is reset prior to sanitisation.

Security Control: 0354; Revision: 5; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
Non-volatile magnetic media is sanitised by booting from separate media to the media being sanitised and then overwriting the media at least once (or three times if pre-2001 or under 15 Gigabytes) in its entirety with a random pattern followed by a read back for verification.

Security Control: 1067; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Should
The ATA secure erase command is used where available, in addition to using block overwriting software, to ensure the growth defects table (g-list) is overwritten.

Treatment of non-volatile magnetic media following sanitisation

Due to concerns with the sanitisation of the host-protected area, device configuration overlay table and growth defects table, highly classified non-volatile magnetic media retains its classification following sanitisation.
Following sanitisation, highly classified non-volatile magnetic media retains its classification.

Non-volatile erasable programmable read-only memory media sanitisation

When sanitising non-volatile erasable programmable read-only memory (EPROM), the manufacturer’s specification for ultraviolet erasure time should be multiplied by a factor of three to provide an additional level of certainty in the process.

Non-volatile EPROM media is sanitised by erasing the media in accordance with the manufacturer’s specification, increasing the specified ultraviolet erasure time by a factor of three, then overwriting the media at least once in its entirety with a random pattern followed by a read back for verification.

Non-volatile electrically erasable programmable read-only memory media sanitisation

A single overwrite with a random pattern is considered best practice for sanitising non-volatile electrically erasable programmable read-only memory (EEPROM) media.

Non-volatile EEPROM media is sanitised by overwriting the media at least once in its entirety with a random pattern followed by a read back for verification.

Treatment of non-volatile erasable and electrically erasable programmable read-only memory media following sanitisation

As little research has been conducted into the ability to recover information from non-volatile EPROM and EEPROM media following sanitisation, highly classified EPROM and EEPROM media retains its classification following sanitisation.

Non-volatile flash memory media sanitisation

In flash memory media, a technique known as wear levelling ensures that writes are distributed evenly across each memory block. This feature necessitates flash memory being overwritten with a random pattern twice as this helps ensure that all memory blocks are overwritten.

Non-volatile flash memory media is sanitised by overwriting the media at least twice in its entirety with a random pattern followed by a read back for verification.

Treatment of non-volatile flash memory media following sanitisation

Due to the use of wear levelling in flash memory, it is possible that not all memory locations were written to when attempting to overwrite the media. For this reason, highly classified flash memory media retains its classification following sanitisation.

Sanitising media prior to reuse

Sanitising media prior to reuse assists with enforcing the need-to-know principle.
Security Control: 0947; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Should
All media is sanitised prior to reuse.

**Encrypted media**

When applied appropriately, the use of encryption can provide additional assurance during media sanitisation, reuse and disposal. However, unless otherwise stated in consumer guides for evaluated encryption software, the use of encryption does not reduce the post-sanitisation classification of media.

Security Control: 1464; Revision: 1; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
Where a consumer guide for evaluated encryption software exists, the sanitisation and post-sanitisation requirements stated in the consumer guide are followed.

**Further information**

Further information on sanitising ICT equipment can be found in the *ICT equipment sanitisation and disposal* section of the *Guidelines for ICT equipment management*.

Further information on recoverability of information from volatile media can be found in the paper *Data Remanence in Semiconductor Devices* at [https://www.usenix.org/legacy/events/sec01/full_papers/gutmann/gutmann.pdf](https://www.usenix.org/legacy/events/sec01/full_papers/gutmann/gutmann.pdf).

The random-access memory (RAM) testing tool MemTest86 can be obtained from [https://www.memtest86.com/](https://www.memtest86.com/).

The graphics card RAM testing tool MemtestG80 and MemtestCL can be obtained from [https://www.simtk.org/home/memtest](https://www.simtk.org/home/memtest).

HDDerase is a freeware tool developed by the Center for Memory and Recording Research at the University of California San Diego. It is capable of calling the ATA secure erase command for non-volatile magnetic media. It is also capable of resetting the host-protected area and the device configuration overlay table information on the media. The tool is available for download from [https://cmrr.ucsd.edu/resources/secure-erase.html](https://cmrr.ucsd.edu/resources/secure-erase.html).

Information on reliably erasing information from SSDs can be found in the paper *Reliably Erasing Data From Flash-Based Solid State Drives* at [https://www.usenix.org/legacy/event/fast11/tech/full_papers/Wei.pdf](https://www.usenix.org/legacy/event/fast11/tech/full_papers/Wei.pdf).

**Media destruction**

**Destruction procedures**

Documenting procedures for media destruction will ensure that organisations carry out media destruction in an appropriate and consistent manner.

Security Control: 0363; Revision: 1; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
Procedures for the destruction of media are developed and implemented.

**Media that cannot be sanitised**

It is not possible to sanitise some types of media while maintaining a level of assurance that no information can be recovered.

Security Control: 0350; Revision: 4; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
The following media types are destroyed prior to disposal as they cannot be sanitised:

- microfiche and microfilm
- optical discs
- programmable read-only memory
- read-only memory
- other types of media that cannot be sanitised
- faulty media that cannot be successfully sanitised.

Media destruction equipment

When physically destroying media, using approved equipment can provide a level of assurance that that information residing on the media is actually destroyed.

Approved equipment includes destruction equipment listed in the Security Construction and Equipment Committee (SCEC)’s **Security Equipment Evaluated Products List**, the Australian Security Intelligence Organisation (ASIO)’s Security Equipment Guide (SEG)-009, **Optical Media Shredders**, and ASIO’s SEG-018, **Destructors**. ASIO’s SEG-009 and SEG-018 are available from the Protective Security Policy gowdex community or ASIO by email.

If using degaussers to destroy media, the United States’ National Security Agency maintains a list of evaluated degaussers while the United Kingdom’s National Cyber Security Centre maintains a list of certified degaussers.

**Security Control: 1361; Revision: 1; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Should**
SCEC or ASIO approved equipment is used when destroying media.

**Security Control: 1160; Revision: 1; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
If using degaussers to destroy media, degaussers evaluated by the United States’ National Security Agency or certified by the United Kingdom’s National Cyber Security Centre are used.

Media destruction methods

The destruction methods given below are designed to ensure that recovery of information is impossible or impractical.

**Security Control: 1517; Revision: 0; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
Equipment that is capable of reducing microfiche to a fine powder, with resultant particles not showing more than five consecutive characters per particle upon microscopic inspection, is used to destroy microfiche and microfilm.

**Security Control: 0366; Revision: 2; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must**
One of the methods in the following table is used to destroy media.

<table>
<thead>
<tr>
<th>Item</th>
<th>Destruction Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Furnace/Incinerator</td>
</tr>
<tr>
<td>Electrostatic memory devices</td>
<td>Yes</td>
</tr>
<tr>
<td>Magnetic floppy disks</td>
<td>Yes</td>
</tr>
<tr>
<td>Magnetic hard disks</td>
<td>Yes</td>
</tr>
<tr>
<td>Magnetic tapes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Optical disks
Yes Yes Yes Yes Yes No
Semiconductor memory
Yes Yes Yes No No No

Treatment of media waste particles

Following destruction, normal accounting and auditing procedures for media do not apply. However, depending on the destruction method used and the resulting particle size, it may still need to be stored and handled as classified waste.

Security Control: 0368; Revision: 6; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
The resulting waste for all destruction methods, except for furnace/incinerator and degausser, is stored and handled as per the following table.

<table>
<thead>
<tr>
<th>Initial Media Handling</th>
<th>Screen Aperture Size Particles Can Pass Through</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less Than or Equal to 3 mm</td>
</tr>
<tr>
<td>TOP SECRET</td>
<td>OFFICIAL</td>
</tr>
<tr>
<td>SECRET</td>
<td>OFFICIAL</td>
</tr>
<tr>
<td>PROTECTED</td>
<td>OFFICIAL</td>
</tr>
<tr>
<td>OFFICIAL: Sensitive</td>
<td>OFFICIAL</td>
</tr>
<tr>
<td>OFFICIAL</td>
<td>OFFICIAL</td>
</tr>
</tbody>
</table>

Degaussing magnetic media

Degaussing magnetic media changes the alignment of magnetic domains resulting in information being permanently corrupted.

Coercivity (the resistance of magnetic material to change) varies between magnetic media types and between brands and models of the same type of media. Care is needed when degaussing magnetic media since a degausser of insufficient strength will not be effective. The United States’ National Security Agency provides information on the common types of magnetic media and their associated coercivity ratings with their list of evaluated degaussers.

Since 2006, perpendicular magnetic media has been available. As some degaussers are only capable of sanitising longitudinal magnetic media, care needs to be taken to ensure that a suitable degausser is used.

Finally, to ensure that degaussers are being used in the correct manner to achieve an effective destruction outcome, product-specific directions provided by degausser manufacturers should be followed.

Security Control: 0361; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
A degausser of sufficient field strength for the coercivity of the magnetic media is used, with the field strength being checked at regular intervals.

Security Control: 0838; Revision: 2; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must
A degausser capable of the magnetic orientation (longitudinal or perpendicular) of the magnetic media is used.
Supervision of destruction

To verify that media is appropriately destroyed, the process needs to be supervised by at least one person cleared to the sensitivity or classification of the media being destroyed.

Supervision of accountable material destruction

Accountable material is more important than standard media. As such, its destruction should be supervised by at least two personnel who sign a destruction certificate afterwards.

Outsourcing media destruction

ASIO has approved National Association for Information Destruction AAA certified destruction services with endorsements, as specified in ASIO’s Protective Security Circular (PSC)-167, *External destruction of security classified information*, for the outsourced destruction of media. ASIO’s PSC-167 is available from the Protective Security Policy govdex community or ASIO by email.

Transporting media for external destruction

To prevent the unauthorised disclosure of official or classified information on media, it should be sanitised, if possible, before being transported to an off-site location for destruction.

Further information

Further information on the destruction of ICT equipment can be found in the *ICT equipment sanitisation and disposal* section of the *Guidelines for ICT equipment management*. 

The United Kingdom’s National Cyber Security Centre maintains a list of certified degaussers at https://www.ncsc.gov.uk/index/certified-product.


**Media disposal**

**Disposal of media**

Before media, or its waste, can be released into the public domain it needs to be sanitised, destroyed or declassified. As the compromise of official information still presents a security risk, albeit minor, an appropriate authority needs to formally authorise its release into the public domain.

In addition, removing labels and markings indicating the classification, codewords, caveats, owner, system or network details as part of the disposal process will ensure media does not display indications of its prior use and draw undue attention.

*Security Control: 0374; Revision: 1; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must*

Procedures for the disposal of media are developed and implemented.

*Security Control: 0375; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must*

Following sanitisation, destruction or declassification, a formal administrative decision is made to handle media, or its waste, as ‘publicly releasable’ before it is released into the public domain.

*Security Control: 0378; Revision: 3; Updated: Sep-18; Applicability: O, P, S, TS; Priority: Must*

Labels and markings indicating the classification, codewords, caveats, owner, system, network, or any other marking that can associate media with its original use, are removed prior to disposal.

**Further information**

Further information on the disposal of ICT equipment can be found in the ICT equipment sanitisation and disposal section of the Guidelines for ICT equipment management.