

BULLETIN


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PROTECTING VALUABLE RECORDS



Photo courtesy Chubb Physical Security Equipment

- ❑ Most documents (paper records, books, ledgers) and documentary records (computer diskettes, computer tapes and audio tapes) are susceptible to damage from fire and moisture.
- ❑ The consequences of such damage to valuable records can be disastrous.
- ❑ Storage areas must be designed to provide protection to the items being stored, particularly from fire, moisture and earthquake.
- ❑ Environmental conditions within the storage space must be carefully controlled, within the limits defined, for the media being stored.



Providing safe storage for documents and documentary records within new and existing buildings is a problem faced by many building designers and owners/managers. This Bulletin sets out the common causes of damage and the specific storage criteria for commonly used documents and documentary records, as well as outlining methods to satisfy these criteria.

Background

Most documents (paper records, books, ledgers) and documentary records (computer diskettes, computer tapes and audio tapes) are susceptible to damage. Common causes are:

- fire
- excessive heat (high temperatures)
- UV exposure
- water damage (flooding, leaks)
- moisture damage (general dampness)
- dust
- magnetic fields
- chemical contamination
- earthquakes
- insects and rodents
- people
- wind damage
- static electricity.

Increasing reliance on computers to record and store valuable information means that consideration must be given to protecting that information from damage or ensuring that back-up information is readily available.

Two common scenarios are:

- a company has a relatively small fire in its accounts office. No specific provisions have been made for safe storage of records. The fire is contained within the office but documents suffer from water, fire and smoke damage. Documents destroyed included the debtors and creditors records and the company's insurance policy. Now it has no record of who it owes money to or what is owed to it. Nor can it check its insurance policy to determine the extent of its cover or prove any losses under that cover;
- the drawing files in an architect's office are stored in wooden plan drawers. A fire lit by a disgruntled client or former employee guts the office and destroys all records of past and current work, as well as the client database.

Physically damaged equipment and buildings can be repaired or replaced but damaged critical records can't readily be recovered unless copies are safely stored away from the area of damage, or stored in purpose-built facilities.

As a general observation:

- not enough attention is paid to ensuring valuable records are properly handled and securely and safely stored
- no disaster management plan has been prepared and put in place (such a plan should set out the means of limiting secondary losses and identify the way damaged records are to be stored and restored)
- the risk and impact of damage to or loss of valuable company (or personnel) records has not been adequately assessed and allowed for.

Vulnerability of Records

Office records are generally kept as hard paper copy (in bound volumes, files or as loose sheets), or on computer disks or tapes. Paper itself is a common fire hazard, particularly where its storage is uncontrolled or an office is untidy.

In many record storage systems:

- records are stored either centrally or in a number of different spaces, usually without the provision of specific document protection facilities
- off-site or remote back-up copies are not made and kept
- storage is often in a 'left over' space such as a basement that is likely to be damp and the first place to flood
- there are no suitable storage facilities for those items most readily damaged (diskettes or tapes).

Valuable historical business records are particularly vulnerable to damage if there is poor or improper provision for storage or careless attitudes by those using the records.

Large amounts of archived material are also stored in libraries, archives, art galleries and radio stations. Fire and flood are both credible risks, particularly where valuable records are on public display or available for public use. The consequence of such damage is likely to be disastrous. This material covers a wide range of media such as:

- microfiche
- drawings
- video tape
- film
- books
- magnetic tape
- compact disks
- parchment
- photographs and slides
- microfilm
- art works
- audio tape
- manuscripts
- maps
- newspapers
- CD ROMs.

All the above material is particularly susceptible to damage by excessive heat (sunshine, heating systems), accidental or deliberate fire, and moisture. Storage

in an environmentally controlled, secure environment will reduce the risk of damage or deterioration.

Temperature

Fire, whether deliberate or accidental, is a common cause of record damage or destruction. Damage can range from total incineration to charring followed by water damage because of fire-fighting activities or water damage. For some storage media, particularly diskettes, simply leaving the item in the sun (e.g. on a window sill) can prevent the information stored on them being retrieved.

The generally accepted surface temperatures above which damage to data storage media can occur are:

magnetic tapes	50°C	(1)
computer diskettes	52°C	(2)
other magnetic disk storage systems	66°C	(2)
photographic records	66°C	(2)
microfilm	93°C	(3)(4)
microfiche	93°C	(3)
paper	177°C	(2)
compact disks	no data	

Notes

- (1) Chubb Research Ltd data
- (2) data taken from the Underwriters Laboratories Standard UL 72 (also referred to as ANSI 72), the standard used in the US to test the fire resistance of document storage equipment
- (3) data from Chubb Safes brochure
- (4) microfilm is particularly susceptible to damage by steam. In the absence of steam, damage may not occur until temperatures of about 150°C are reached.

Moisture or water damage

Moisture damage can result from:

- condensation
- generally high levels of dampness (rising damp, leaks)
- flooding from natural causes (storing records in containers can reduce or prevent damage from liquid water)
- accidental flooding (burst or leaking pipes, overflows, sprinklers, blocked drainage)
- water used in fire fighting.

With water damage, complications can include:

- flood water being contaminated by sewage or chemicals, which can pose a health risk to those doing the clean-up
- water used in fighting a fire within the storage space or an adjacent part of

the building being contaminated by acid or asbestos fibres.

Once water damage has occurred, the items must be removed and stabilised (usually by freezing) within 48 hours to prevent further damage. Obtaining expert help is essential to ensure damaged items are not damaged further by incorrect handling e.g. paper records must be supported during moving. Extreme care is necessary when removing items from contaminated water as they must be cleaned before freezing.

Modern conservation techniques can restore paper-based data. However, the processes are both time consuming and expensive and best done by experts. Where the damage is caused by the items being stored in damp conditions, such damage is insidious in that it occurs slowly and by the time it is noticed documents may be irreparably damaged.

Earthquakes

Another potential cause of damage to storage facilities is earthquake (crushing, toppling of cabinets, fire or exposure to moisture). Earthquake damage can be reduced by ensuring:

- cabinets are fixed to a solid wall to prevent them toppling over or moving
- shelving is constructed and braced to resist earthquakes with shelves designed to prevent items coming off them (e.g. by having an upstand along the front edge) during earthquake activity
- drawers or doors are latched or locked shut to prevent them coming open and spilling their contents.

STORAGE

Managing Storage

Organisations must have policies to ensure that critical records are correctly stored which include:

- a storage area(s) which is fire resistant and designed to prevent the internal temperature rising above the critical point for the stored items
- a fire detection and fire extinguishing system
- a disaster management plan
- a post-disaster management plan
- restricted access to storage and archive areas.

Businesses should also have:

- a system in place to ensure that critical business records are regularly placed in the storage facility (4 hourly or daily)

- a storage facility on another site or remotely located on the same site, with material being regularly placed in it to ensure it is kept current.

Record Storage Areas

General design principles which apply to all forms of records and archival storage are:

- make the area large enough to cope with future demands
- install a wet pipe sprinkler system
- keep the area within the room free of structural elements such as columns to make setting out shelving easier
- provide a waterproof threshold to doors
- provide smoke control doors to computer and storage spaces
- use non-combustible materials (steel, aluminium, gypsum plasterboard)
- have a means of controlling access to the storage space
- avoid areas that could readily be flooded e.g. basements - for multi-storey buildings the floor directly above the storage room should be waterproof
- provide a fire separation between storage space and adjacent spaces (see section on fire protection), designed to prevent the internal temperature rising above the critical point for paper records
- ensure storage spaces are designed to retain their fire integrity during an earthquake
- avoid locations above or below areas which could pose a threat to the storage room e.g. flammable storage or having a plant or tank room above
- maintain adjacent water services in good condition to reduce the risk of failure
- make the floor strong enough for current and future loads (documents are heavy and evenly distributed floor loadings of 11 kN/m² are normal)
- avoid areas prone to dampness
- allow sufficient width between aisles (775 mm minimum) and keep lengths of shelving runs under 10 m
- keep them rodent and insect proof
- provide boxes or containers to keep stored items in - such containers can prevent or reduce damage from fire, flooding and earthquake as well as from everyday wear and tear.

Computer Rooms

Special requirements for the design of centralised computer facilities are:

- have separate areas for computer record (magnetic tape) storage and functions which use paper
- do not use cellular plastics as these materials can give off toxic by-

products when burnt. Also, hydrogen chloride gas given off during combustion of polyvinylchloride (PVC) materials can damage electronic and electrical equipment. On contact with fire-fighting water the hydrogen chloride gas forms hydrochloric acid

- install a wet pipe sprinkler system with heads rated at 77°C. The system can incorporate a pre-action device that will initiate a programme to shut down the computer safely but rapidly if there is a fire. An alternative suppression system is one where the space is flooded with a non-toxic extinguishing gas. The damage caused by either an accidental sprinkler discharge or a discharge in response to a fire is significantly less than that caused by an uncontrolled fire. Where a sprinkler discharge does occur, restoration (cleaning up of any contamination, particularly from acids occurring when burnt chlorides and water combine) and drying out must begin immediately
- sizing the computer room so that it is not large enough for storing combustible materials.

Computer Record Storage

Space where computer records are stored should:

- be solely dedicated to the storage of computer data. It is recommended that activities which use paper be located in a separate space as paper gives off a fine dust
- have the air pressure inside the room higher than that outside, to prevent dust being transmitted into the room
- be clean - free of dust, lint, minute food particles (on people's hands) etc.
- be temperature and relative humidity controlled (see Table 1)
- be cleaned with specialised liquid cleaners that leave no residue. Vacuum cleaner exhausts must be vented outside the room and floors should not be waxed
- be free of magnetic fields such as those from electric motors or generating equipment
- be constructed to prevent internal temperatures (in the event of a fire outside the room) rising above the critical temperatures for the storage media used. If not, provision must be made for their storage in specially-built proprietary (certified or tested) data protection cabinets. Always keep cabinets closed when not being used.

Where computer records are kept on individual PC's and there is no centralised backing up of data, the back-up data can

be protected by:

- using data storage cabinets. Locating the cabinets within a fire-resisting storage space will improve the level of protection provided. Ultimate protection is provided by having the cabinets (with back-up information) in a remote location
- locating data storage cabinets so that the cabinet is unlikely to be buried if there is serious damage to the building. After a cabinet has been in a fire open it carefully - there are tales of documents which have survived a fire subsequently being damaged by inappropriate cabinet opening methods, such as a gas torch!

Paper Storage

Above all else the environment within paper storage or archive rooms must be dry - that is, with a relatively constant temperature and relative humidity (see Table 1).

Installing a wet pipe sprinkler system is recommended as wet paper is relatively easy to salvage - burnt paper ash is gone forever.

Keeping paper stored in tightly closed containers can reduce the damage that occurs should a fire or flood happen (paper records stored in containers are not usually damaged by sprinklers).

If computer data is stored within a paper storage area specialised storage facilities must be provided so that they are not exposed to temperatures which will damage them (a room that will protect paper from ignition will not provide sufficient protection for floppy disks).

Specialised Storage

A number of media require very specific storage facilities to ensure they remain in good condition. British Standards 1153, 4783 and 5687 provide additional detail for specific storage requirements. Preventing temperature change is particularly important for media formats that are composites of materials such as photographic negatives or magnetic tapes.

CALCULATING THE LEVEL OF FIRE PROTECTION REQUIRED

BS 6266 suggests that, for electronic data processing areas, the minimum level of protection provided by the enclosing elements should be:

- 60 minutes where the remainder of the building has a low fire load

- 120 minutes where the remainder of the building has a medium fire load, such as most factories
- 240 minutes where the remainder of the building has a high fire load, such as furniture warehouses or chemical plants.

The insulation criteria of BS 476 Part 20 seem to be the most applicable criteria for establishing the level of fire protection provided by the walls, floor and roof of a fire-resistant storage facility. To pass the insulation criteria the mean unexposed face temperature must not rise to more than 140°C above its initial value. Also the maximum temperature at any one point measured on the unexposed face must not exceed 180°C. The point in time when the temperatures exceed these limits gives the insulation criteria. Therefore, for a wall with a fire resistance rating of:

120:120:15 - whilst the structure will retain its stability and integrity for 120 minutes, documents will only be protected for 15 minutes as the insulation limit was exceeded after 15 minutes (i.e. the unexposed face temperature rose above 140° after 15 minutes)

120:120:60 - the structure will retain its stability and integrity for 120 minutes and satisfy the insulation criteria for 60 minutes, therefore it should provide a safe environment for paper records for 60 minutes (recommended minimum level of protection)

120:120:120 - the structure will retain its stability and integrity for 120 minutes and satisfy the insulation criteria for 120 minutes therefore it should provide a safe environment for paper records for 120 minutes.

Fire-resistant storage rooms are also available as proprietary, modular, lightweight vault systems that are prefabricated and constructed on site. They can also be built from conventional drywall framing or from in-situ masonry construction.

ENVIRONMENTAL DESIGN

A UNESCO study report on archiving oral history records says that standard archival storage conditions (a temperature of 18°C and a relative humidity of 45%) are suitable for audio and magnetic tape. Rapid fluctuations in the environmental conditions, even within the recommended temperature and humidity ranges, increases the rate of

deterioration of the stored material, particularly with composite materials.

Air within archive storage rooms must be clean. BS 5454 recommends using specially activated carbon filters to remove at least 80% of impurities. Ventilation rates of 6 air changes per hour are suggested, with 10% of the air being replaced on each change. Storage racks must allow for the free circulation of air.

Natural and artificial lighting of archive rooms must be filtered to cut off light with a wavelength of less than 400 micrometres, as this light hastens paper deterioration. A light level of 100 lux at floor level is recommended.

Audio tape storage must be free of magnetic fields such as those from electric motors or generating equipment.

Table 1. Guidelines for Storage Space Environmental Conditions

Medium stored	Type of storage facility	Temperature range °C	Relative humidity range %RH	Maximum wet bulb temperature °C
silver image photo plates	a	15 - 25 (1)	20 - 50 (2)	na
silver gelatine microfilm	a	15 - 25 (1)	20 - 40	na
	c	25 max	60 max	na
3½ inch computer diskettes	o	18 - 24	40 - 60	na
	a	18 - 22	35 - 45	30
flexible disk cartridges (5¼ inch discs)	o	10 - 51.5	20 - 80	26
	a	18 - 22	35 - 45	na
18 track magnetic data cartridges	o	18 - 24	45 - 55	25
	a	18 - 22	35 - 45	na
magnetic data tape on spools	o	18 - 24	40 - 60	na
	a	18 - 22	35 - 45	30
optical disk cartridges	o	10 - 50	10 - 80	29
	a	18 - 22	35 - 45	29
CD ROM	o	10 - 50 (3)	10 - 80	29
	a	18 - 22	35 - 45	29
parchment	a	13 - 18	55 - 60	na
bound volumes	a		40	na
paper, generally	a	13 - 16	50 - 60	na
gramophone records	a	10 - 21	40 - 55	na
tape cartridges and cassettes	o	10 - 45	20 - 80	25
	a	18 - 22	35 - 45	na
magnetic audio tape	a	4 - 16	40 - 60	na
magnetic audio tape (polyester)	a	4 - 16	30 - 40	
Abbreviations		Notes		
c	commercial access to stored data	1	storage preferably below 20°C	
o	operational or during use storage	2	storage preferably below 40% RH	
a	archived storage only	3	avoid rapid temperature changes	

STANDARDS

British Standards Institution. London

BS 476 Part 20: 1987. Method for determination of the fire resistance of elements of construction (general principles)

BS 1153: 1992. Recommendations for processing and storage of silver-gelatine-type microfilm

BS 4783 Storage, transportation and maintenance of media for use in data processing and information storage

Part 1: 1988. Recommendations for disk packs, storage modules and disk cartridges

Part 2: 1988. Recommendations for magnetic tape on open spools

Part 3: 1988. Recommendations for flexible disk cartridges

Part 4: 1988. Recommendations for magnetic tape cartridges and cassettes

Part 5: 1991. Recommendations for 12.7 mm magnetic tape cartridges for data interchange, recording at 1491 data bytes per millimetre on 18 tracks

Part 6: 1993. Recommendations for optical disk cartridges (ODC)

Part 7: 1993. Recommendations for optical data disks (CD ROM)

Part 8: 1994. Recommendations for 4 mm and 8 mm helical scan tape cartridges

BS 5454: 1989. Recommendations for storage and exhibition of archival documents

BS 5687: 1979. Recommendations for storage conditions for silver image photographic plates for record purposes

BS 6266: 1992. Code of practice for fire protection for electronic data processing installations.



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HEAD OFFICE AND RESEARCH STATION

Moonshine Road, Judgeford
Postal Address - Private Bag 50908, Porirua
Telephone - (04) 235-7600, FAX - (04) 235-6070

REGIONAL OFFICES

AUCKLAND

Telephone - (09) 524-7018
FAX - (09) 524-7069
118 Carlton Gore Road
PO Box 99186
Newmarket

WELLINGTON

Telephone - (04) 235-7600
FAX - (04) 235-6070
Moonshine Road, Judgeford

CHRISTCHURCH

Telephone - (03) 366-3435
FAX - (03) 366-8552
GRE Building
79-83 Hereford Street
PO Box 496

CI/SfB

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