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GUIDELINES ON DISASTER PREVENTION  
AND CONTROL IN ARCHIVES

COMMITTEE ON DISASTER PREVENTION

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11

## Guidelines on Disaster Prevention and Control in Archives

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## Introduction

### BACKGROUND

The Florence disaster of 1966 when the Arno flooded causing serious damage to the National Library's holdings was perhaps the point in time when the disaster risk was fully realised. There have since been a number of other disastrous incidents - mostly in libraries - which have caused the subject to be a major concern for archives and libraries. This has created an increased awareness of the need for disaster prevention and control planning in recent years.

One of the fundamental aims of the International Council on Archives (ICA) is to promote the preservation of the world's archival heritage. Aware of the widespread threats to this heritage, not least from armed conflicts in various parts of the world, and the role of disaster planning in meeting them, the XII General Assembly of ICA, meeting in Montreal in 1992, called for the preparation of plans and publications to assist in preventing damage to archives from natural and man-made disasters. As a result, the Committee on Disaster Prevention was established and held its first meeting in 1993.

As an introduction to the DP Committee's work in the field of disaster prevention and control planning an article, *Disaster Prevention: Facing up to Risks*, with a Bibliography as an appendix is published in *ARCHIVUM*, vol. 42, 1996.

### PURPOSE

The purpose of these Guidelines is to assist archives and archivists in need of guidance to implement a disaster management policy and strategy.

### SCOPE

The Guidelines are intended to have a world-wide scope to encourage and facilitate the implementation of disaster planning for archives wherever they may be. The Guidelines therefore have a general approach avoiding detail which may be necessary in local circumstances. The main risks are identified and followed by recommendations with regard to managing the risks, preparedness, reaction and recovery. To facilitate planning a select bibliography is added (Appendix 3).

One of the problems which arise when addressing a world-wide audience is one of diverse standards and differing prerequisites. What is a minimum in one country can be a maximum in others, and may be regarded as an optimum in another. The level of text therefore attempts to accommodate this problem. After much consideration the Committee decided to present the recommendations in steps, starting with the most fundamental. A lack of resources or advanced technical facilities should not discourage anyone from taking action. Any action, however small or incomplete, is generally much more beneficial than no action at all.

What goes for disaster planning in archives goes also to a great extent for libraries. Preventive measures are very similar but reaction and recovery techniques can differ. These Guidelines deal in the first place with planning and control measures with regard to archives.

In any of the following recommendations for preventing disasters, or responding to them, the safety of human life is considered paramount and it is assumed by the authors of the Guidelines that measures to ensure this are already in place.

It is strongly recommended that an archive institution forms a disaster policy and strategy, the details of which should be contained in a comprehensive document. This document should be disseminated as widely as is necessary within and outwith the institution to obtain the necessary support.

## DEFINITIONS

**Archives** These Guidelines deal primarily with archives in accordance with ICA definitions as follows:

- the *documents* created or received and accumulated by a person or organization in the course of the conduct of affairs, and preserved because of their continuing value;
- the building or part of a building in which *archives* are preserved and made available for consultation; also referred to as an archival repository;
- the agency or programme responsible for selecting, acquiring, preserving, and making available *archives*; also referred to as an archival agency, archival institution, or archival programme.

**Disaster** A disaster, whether it is natural or man-made, or caused by a combination of these, is "an event whose timing is unexpected and whose consequences are seriously destructive" (H. Bohem).

This document does not deal with what is often referred to as "slow disasters", such as insect and/or mould infestations.

**Emergency** An emergency is defined as an unexpected occurrence requiring immediate action.

## Chapter 1 – Types of disaster

### 1.1 CATEGORIES OF DISASTERS

Disasters can be classified as either natural or man-made. Natural disasters are those caused by natural phenomena, for example, earthquake, hurricane, cyclone, typhoon, volcanic eruption and drought. Man-made disasters result from the failings of the human race. Examples are, water leakage, fire (including arson), explosion and impact. Terrorist action, war and armed conflict may also be considered to be man-made disasters.

In general, a disaster situation is a temporary state resulting in a short term change in the environment with damaging consequences.

The nature of, and risks associated with, major disasters e.g. flood, fire and earthquake are as follows.

### 1.2 WATER INGRESS AND SEVERE WEATHER

Water ingress and severe weather are the most common types of disaster. The water damage threat may be divided into two types. One is climatic, e.g. flood resulting from heavy rain, or high tide caused by hurricanes, typhoons and cyclones, or overflowing rivers due to heavy rain or snow. The other is building related, e.g. weak building fabric and/or the failure of water carrying systems. In both types there is a risk of damage to archives from water entering a building, or building damage, or even collapse.

A strong example of damage to archives due to flood is the 1966 Florence flood which damaged more than 2 million manuscripts and became an epoch making disaster in modern society.

Cyclones, hurricanes and typhoons occur mainly in tropical zones. They cause damage such as:

- structural damage to buildings from strong winds and tornadoes;
- inundation, dislocation and washout of structures due to floods and high tides;
- structural damage and dislocation due to landslide;
- contamination.

Building damage results in damage to internal facilities and burst pipes can result in damage to documents. Flood and high tide can result in water ingress with resulting damage to documents. Landslides can produce mud flows which enter buildings damaging or destroying documents.

### 1.3 FIRE

Fire risk, from whatever cause, is potentially the most damaging risk carried by archival institutions.

Incendiary and accidental fires (due to electrical faults, cigarettes etc.) are common causes of fire. In 1986 the Los Angeles Central Library suffered two fires resulting in the loss of 400,000 volumes. Another 1,250,000 were damaged by smoke or water. The most serious library fire was suffered by the Academy of Sciences Library in St Petersburg which in 1988 lost 300,000 books with a further 3.6 million volumes damaged.

City fires where large areas of a city burn as in San Francisco in the 1906 earthquake, Tokyo and Yokohama in the 1923 Great Kanto earthquake, and more recently the Kobe city fires caused by the Hanshin earthquake in 1995 are examples of more widespread fires.

Resulting damage

- heat and/or fire damage;
- smoke damage;
- water damage.

#### 1.4 EARTHQUAKES

Earthquakes are caused by movement in the earth's crust. The spatial distribution of earthquakes varies from place to place.

Examples of archives damaged due to earthquakes include the National Archives of Mexico in Mexico City which was damaged by the Mexico earthquake of 1985, the San Francisco City Archives in the U.S.A. damaged by the Loma Prieta Earthquake in 1989 and several archives institutions in the Hanshin Region of Japan in 1995.

Earthquakes result in ground tremors, land liquefaction, landslides or tsunami (tidal waves), and cause damage to buildings, flood and fire.

Building damage includes

- collapse/tilt of buildings;
- collapse/tilt of shelving systems;
- movement of documents from storage systems;
- computer damage and lost data;
- water damage due to pipe fracture.

Tsunami damage includes

- movement or collapse of buildings;
- flood and water damage.

Fire damage includes

- loss of buildings;
- loss of documents;
- water damage from fire extinguishing systems.

In an earthquake, many fires may occur simultaneously and there may be fire spread from adjoining properties.

#### 1.5 OTHER HIGH RISK AREAS

Archives located in other high risk areas or regions should be aware of any associated disaster risk. Such areas include:

- close proximity to dangerous industrial, military or strategically important sites;
- location under an aircraft flight path;
- at the side of a road carrying traffic with hazardous loads;
- an area suffering from political or civil unrest;
- an area at risk from landslides;
- volcanic activity.

Possible resulting damage

- fire from explosion;
- building and archives damage or loss;
- fire from arson;
- explosion or fire from impacting road vehicle or aircraft;
- hazardous pollution from chemical sites;
- electro-magnetic radiation (some modern media).

#### 1.6 ARMED CONFLICT

In situations of war and armed conflict archives may be exposed to severe risks. In such situations there is a difficulty in anticipating the future, being caught in the line of fire, and breaks in communication lines and power supplies. In such situations, archives have been deliberately attacked



for the purpose of destroying ethnic records. There is also the possibility of theft, vandalism, sabotage, panic and psychosis.

Possible resulting damage

- building & archives damage or loss, directly or indirectly;
- fire damage;
- water damage.

#### 1.7 NUCLEAR ACCIDENT

In the event of an accident in a nuclear facility archives may be affected by radiation. With the very limited experience to date contamination by radioactive fall-out appears to be the greatest risk. The best course of action therefore seems to be to protect archive storage areas against an ingress of radioactive dust.

#### 1.8 DISASTERS AND DAMAGE

A summary of the types of disasters in the above groups and possible consequential damage is contained in Appendix 1.

## Chapter 2 – Financial planning

### 2.1 FINANCE

Funding is always an important issue and one which is fundamental to the administration of archives as in other institutions. It is also a crucial element of disaster control planning which must be taken into account when planning to counter disaster, both in action to prevent an event happening, and to reduce the effect of an incident suffered. It is often forgotten, or perhaps ignored because of difficulties with funding bodies, that buildings related expenditure is necessary if the disaster threat is to be met. Funding is necessary to take action to reduce the threat, and it is required that people in charge are authorised to allocate and spend necessary resources if there is to be a reaction to an incident suffered.

Funding to control disasters can be split into two areas of expenditure, that associated with providing protection through preventive measures and that associated with reacting to an incident. Both are extremely important if plans are to be effective and the provision of funding should be dealt with at an early stage when developing a strategy.

### 2.2 BUILDING FINANCE

Perhaps the most expensive of the two areas of expenditure is that intended to reduce the risk associated with the features of a building.

An archives building is a protective envelope intended primarily to protect the archives from the elements and other external hazards. It should provide a secure and safe environment both for the storage of records and for them to be consulted, yet in many cases the building itself presents a threat through a high risk factor associated with the building structure and/or its services. All too often the need for protection from risks inherent in the building are realised too late, perhaps when the destructive power of fire is experienced.

When a new archives building is planned there is a rare opportunity to lower the risk through incorporating disaster prevention design features. This may require a convincing argument for higher funding.

Managing the risk associated with an existing building can also require substantial funding to be made available and an equally convincing case to be presented to the funding body. This funding can often be more difficult to obtain as the perceived risk may not be recognised by others. The destructive power and consequences of risks carried, such as fire, should be used in the argument to win funding and the cost of taking no action cited.

### 2.3 CONTINGENCY FUNDING

Contingency funds to enable a reaction to an incident to be made need to be established. Expenditure on emergency equipment and supplies held are small in comparison to the possible cost of hiring on a large scale, freezing facilities, freeze-drying plant, extra containers, transport and perhaps expertise if it is not already present in the institution. When disaster strikes there is no time to consult finance committees or funding bodies for permission to spend money. The best laid plans will grind to an early halt without the power of expenditure.

### 2.4 INSURANCE

For those who carry it, insurance can be the means of providing emergency spending power but only if this is part of the arranged cover. The insurance world mostly has concern for loss but, with the unique nature of archives material, there needs to be concern for the cost of a reaction and recovery.

Funding arrangements for preventing, and for recovering from, disaster incidents is an important issue and fundamental to success.

## Chapter 3 – Risk assessment

### 3.1 INTRODUCTION

Disaster prevention measures are an essential and most important requirement in any planning exercise designed to counter the disaster threat. Although risk can never be completely removed, many disasters that happen can be prevented or their effect considerably reduced, even to the extent of avoiding damage to the collections, if a full and efficient risk assessment exercise is carried out and the findings acted upon with the objective of eliminating or reducing any threats identified.

The term 'disaster prevention' refers both to measures to prevent an event happening and to protective measures to prevent or limit exposure of the collections to the effects of an event should it happen.

Areas of concern for risk assessment can be broadly divided into four:

- risks from outside the building;
- risks from the building structure and its services;
- risks from unstable material in the holdings;
- risks from people or groups targeting an institution.

The first and last group will be high on the lists of concern for some institutions depending on geographical location, cultural, or political problems faced, but low on the lists of others. Typically the first group will include threats from extreme weather conditions such as hurricane, it will include earthquakes, flood, landslip and damage to the building, explosion or impact threats associated with nearby activities. The second is common to all institutions and has proved to be a very real risk area causing much damage arising from inadequacies of building design and/or build quality. Typical are fire, flood from burst water pipes, building collapse, and buildings not resisting local weather conditions. The most common risk from unstable materials in holdings comes from nitrate film which may spontaneously combust if it is sufficiently degraded and stored in the wrong environment.

### 3.2 RISKS FROM OUTSIDE THE BUILDING

When an existing building already faces risks from outside there may be little that can be done short of relocation to a safer site. If the risks are serious this should be considered although political and financial considerations may prevent it.

If a new archive building is being planned there should certainly be careful consideration given when choosing the location and site to prevent exposure to unnecessary risks which may come from nearby activities or natural hazards. These include:

- industrial activities which carry a risk of fire, explosion, or pollution;
- aircraft flight paths;
- impact from travelling vehicles;
- natural flood hazards eg. Rivers, streams, flood plains or channels, tidal surges, and tsunamis;
- earthquakes and land movement;
- targeted destructive forces.

#### 3.2.1 Identify the earthquake risk

The risk of an earthquake occurring varies from one region to another. The first step in earthquake mitigation is to identify the scale of an expected earthquake and its re-occurrence period. Such information may be obtained from meteorological agencies or earthquake related research institutions in each country.

It is also important to identify any available information on past earthquakes which may have affected the place where an institution is presently located. Such information may be obtained from the above mentioned authorities, or the documents in the archives itself.

When considering the danger of building collapse the resistance of the structure to any expected earthquake should be assessed with the advice of structural engineers. Earthquake resistance varies depending on the type of building and period of construction.

When considering the fire risk from an earthquake it is important to identify and measure the risk of fire spreading from surrounding buildings. The fire fighting authorities should be able to offer advice.

### 3.2.2 Identify flood risks

Low lying land in delta or coastal regions are likely to be vulnerable to high tide or tsunami. In such areas the following actions are important:

- check for a past history of flooding;
- identify the height of any embankment and check the expected water level from a high tide or tsunami - information may be obtained from public works offices in local government;
- if there is an identified risk of flooding, use of higher storage levels should be made.

Locations at the side of rivers and below river water levels are also vulnerable to flooding. Information on flood situations and emergency arrangements may be obtained from river management divisions of local government. Countermeasures for floods are the same as for high tide and tsunami.

## 3.3 RISKS FROM THE BUILDING STRUCTURE

The building housing an archive is fundamental to the preservation of collections and is a first line of defence, a barrier, against harmful or fluctuating external influences. It is a protective 'envelope' providing a safe environment and should not itself present any unnecessary threats to the holdings.

It is a fact that many disasters are caused by faulty or badly designed water systems and many fires result from badly designed, faulty or poorly maintained electrical systems and plant.

Archive buildings should be self contained to ensure maximum security but those who share building accommodation may have problems with assessing, and ultimately managing, risks associated with other occupants of the building. Such archives carry a higher disaster risk than many others because of the lack of control over parts of the building and its occupation. It is important in such cases that the full cooperation of any other occupants of the building is sought. The results of the exercise should be as beneficial to others as it is to the archive.

The whole of the archive building and its services should be the subject of a risk audit, an intensive study by relevant experts to assess any risks faced. Of particular concern is:

- resistance against local weather conditions;
- quality of the building fabric;
- structural loadings of the building;
- the fire risk
  - *electrical circuitry*
  - *plant and equipment*
  - *gas installations*
  - *flammable compounds*
  - *smoking restrictions;*
- siting of water carrying installations
  - *heating pipes*
  - *water pipes*
  - *drainage systems*
  - *air conditioning systems*
  - *laboratories*
  - *kitchens*
  - *washroom facilities*
  - *fire suppression systems;*

- design of water carrying installations;
- condition of water carrying installations;
- maintenance policy and programmes for all of the above.

#### 3.4 RISKS FROM UNSTABLE MATERIAL IN THE HOLDINGS

Nitrate film is often found in archives. This is unstable material which may spontaneously combust and therefore needs to be identified and acted upon.

#### 3.5 RISKS FROM PEOPLE OR GROUPS

This area of concern will include the threat of arson from individuals with a grudge, others simply because they enjoy causing damage and loss, and the threat associated with being in a war zone or the political target of parties intent on destroying a cultural identity.

Areas of concern will include

- adequate security on the perimeter of the building, especially on all entrances and exits and during closed hours;
- adequate security checks on the identity of persons entering the building during open hours;
- security checks on the articles and bags of users of the building.

## Chapter 4 – Managing the disaster risk

### 4.1 INTRODUCTION

Following the risk audit there should be a list of identified risks which the institution is facing. If the risk audit is a thorough and professional one the result can be quite terrifying and frequently shocks those responsible for the safety of a collection. At the worst little can be done to reduce the risk and the required solution is to plan for an ultimate replacement building with design features that guard against loss through disaster or disaster related incidents. Frequently though, much can be done through changes to building design, building services and their arrangement, fire control measures, and the application of efficient and adequate security measures. Such actions can be described as representing part of a risk management programme and significantly reduce the risk of suffering from a disaster incident.

### 4.2 NEW BUILDINGS

After assessing the building risk and any external forces which may be faced, the result may prompt the consideration of provision of a new building. In such cases, or in the case of the provision of a new building for other reasons, the choice of geographical location and site is crucial to managing the risk most effectively. The possible external risks which may be faced due to location are repeated here:

- natural flood hazards eg. Rivers, streams, flood plains or channels, tidal surges and tsunamis;
- earthquakes and land movement;
- industrial activities which carry a risk of fire, explosion, pollution, or are strategically important sites;
- aircraft flight paths;
- impact from travelling vehicles.

Careful choice of the geographical and site location should eliminate most of these risks. When necessary the services of an earthquake engineer should be recruited at the building design stage to reduce the risk of damage or loss from structural collapse due to an earthquake. While there may be little that can be done to guard against earthquake damage in older buildings, current knowledge of building requirements in earthquake zones is high and can be applied to new structures.

### 4.3 EXISTING BUILDINGS

Archive buildings already existing and exposed to external threats may be restricted to available measures to reduce risk. These include

- external barriers to prevent vehicles impacting with the building;
- measures to waterproof the building at ground level up to a required height if at risk in a flood area;
- structural reinforcement of the building;
- establishing links with the necessary authorities to ensure effective early warning arrangements are in place to enable timely action to prevent and mitigate damage from floods, both in and out of business hours;
- movement of parts of the holdings to a more protected location within the building, or movement of the entire archives to a safer site, if the building is located in an area affected by armed conflict.

#### 4.4 BUILDING SERVICES

Services are an essential part of a building structure but, where heritage material is stored, should be installed to a design and quality level with an ongoing maintenance programme that does not present any threat to the collections from water release or fire ignition.

#### 4.5 WATER PROTECTION

The threat from water carrying installations is much greater than is often realised. Water ingress is the most common type of damage, often caused by the design of installations and/or poor maintenance. Virtually all buildings have water installations of some sort, from wash rooms to sophisticated heating and air conditioning systems. To manage the risk from such installations, the following are areas for action:

- water carrying installations should not run through, or directly above, areas of the building which house any part of the collections;
- all water carrying installations should have a high specification with regard to materials and jointing systems with quality control checks at the time of installation;
- water carrying systems should have a regular maintenance programme for the purpose of ensuring the system remains in good condition to minimise the risk of an accidental release;
- water carrying systems should have sufficient flow control valves strategically placed so that in the event of an accidental release of water, the flow can be quickly stopped;
- floors should be waterproofed as far as possible so that any release of water is contained and not allowed to spread to other parts of the building. Consider raising the level of doorway openings to contain water spills but beware of the safety factor where people are required to step over them. Small ramps can help this problem and facilitate the movement of trolleys;
- water alarms (sensors detecting water) can serve to warn of the presence of water from an accidental release. The siting of the sensors is difficult and warning should be given about the difficulty in choosing a location that gives the earliest warning. Because of this, there should not be too much reliance on their use. Water rarely travels in a straight line and damage can be suffered before the water presence is detected;
- provide barrier systems such as boxes. Boxing which is normally used in archives has provided a remarkable level of protection against water, contamination and even fire for quite some time. Boxing has also proved to be protective in earthquakes;
- when contractors are working on the building or its services there is a particular risk of an accidental release from water carrying systems, or water ingress through temporary weaknesses in the building fabric.

#### 4.6 FIRE

The risk of fire is perhaps the greatest and the most destructive risk all institutions face. It is of particular concern because of the high risk often carried and the devastating and irreversible result of a major fire affecting collections.

A great deal of study has taken place in recent years on the containment and suppression of fires in libraries and archives. Some of the results in tests have been quite terrifying indicating how quickly a fire can develop. In one case simulating a fire in a storage area temperatures of 1000°C were reached in only a few minutes. The work has produced an increased knowledge of the requirements in fire protection for libraries and archives.

##### 4.6.1 Detection

Detection of fire at an early stage is essential to activate systems and procedures to counter loss;

- an automatic fire detection system with a sufficient number of detectors and linked to a central monitoring panel should be provided. The system should respond automatically to the presence of smoke or other products of combustion. Smoke detectors are preferable to heat detectors in an
-

- archive because of the quantities of smoke produced at an early stage of a fire. An efficient fire detection system is essential to provide an early warning of ignition;
- a manual fire alarm system should also be provided as a back-up;
- alarm systems should have the means to send an automatic signal to the emergency fire services;
- storage areas should be enclosed and shielded from other operational areas by walls and doors with a fire rating of at least two hours. All doors should be self closing;
- checks should be made for unstable materials within the holdings and appropriate defensive measures taken
- to reduce the danger of ignition there should be no equipment or work areas located within storage areas;
- compartmented storage areas and special collection rooms should have their electrical circuitry isolated with a system requiring the circuits to be activated by the person requiring entry, and deactivated on exit. Various types of control can be used including warning lights, and perhaps an audible signal, or time switches to ensure the circuits are not accidentally left on when not in use.

#### 4.6.2 Suppression

An automatic fire suppression system should be considered to deal with any ignition which might take place. There is a choice between water based systems (sprinklers) and gaseous based systems (carbon dioxide).

Halon is a gas which has been used to suppress fires but is generally no longer available for this use due to its damaging effect on the environment. Newer gases such as Inergen and FM200 offer potential as replacements for Halon but have yet to be proven in this kind of use.

Water mist systems also offer potential with advantages over conventional sprinkler systems but, at the time of writing, such systems for use in libraries and archives are still under development. One of the principle advantages is that when correctly designed and installed the water discharged should turn to steam leaving little or no residual water.

*Gaseous systems* deal effectively with fires in confined areas and are useful in special collection rooms and computer suites because of their ability to suppress the fire without causing permanent damage to the equipment or collections. However, the gas is difficult to deploy efficiently in larger areas. Furthermore, a deep seated fire can retain enough heat at its source to reignite once the gas has dispersed.

*Sprinkler systems* have understandably been feared in libraries and archives because of the fear of sustaining water damage. This fear is beginning to disappear as there is a greater appreciation among librarians and archivists of the efficiency of water sprinklers and because of the development of design features which meet the needs of libraries and archives. It must be understood that once a fire has reached a stage of development, frequently after only 10 minutes, the only efficient suppressant is going to be water. If a fire has reached this stage then water will be used to put it out and a suitably designed sprinkler system will use less water than the fire services with hoses (a sprinkler head releases typically 70 litres a minute compared with several thousand litres from a fire hose) and, importantly, the water will be applied at an earlier stage and therefore on a smaller fire.

It is the opinion of fire experts that virtually all the large fires suffered in libraries would have been suppressed at an early stage had sprinkler systems been deployed. If ignition has occurred and a fire is developing damage is already taking place. The damage suffered by water from a sprinkler head is minimal compared to that suffered in a large scale fire. Most conservators will say there is a chance of some sort of recovery from water damage but that fire is all consuming.

#### 4.6.3 Sprinkler design features

The services of a qualified fire engineer should always be employed by an institution considering a sprinkler installation. However, certain required design features for an archive are now established and are outlined below:

- a wet pipe system is preferred to a dry pipe system as it requires a shorter period from receiving the activation signal to discharging water. In view of the potentially rapid development of a fire in archive storage areas, a swift response is needed;



- consider using a material for the piping which does not corrode. Stainless steel or galvanised steel piping are superior considering the needs of archives. Normal steel piping can release very contaminated and dirty water due to a reaction between the water and steel piping. Plastic piping is unacceptable because it will burn in a fire and may quickly be put out of action;
- fast reaction heat sensing sprinkler heads (bulb type only) are preferred. The composition of the liquid in the bulb can be chosen to operate at a required temperature. They are fast reacting and provide a response from individual sprinkler heads allowing no more water than is needed to suppress the fire;
- provide a sufficient number of sprinkler heads to allow the system to be efficient. Remember, with the above requirement no more than the required number of heads will be activated;
- provide protective cages fitted to each sprinkler head to avoid damage and water release from collision. Sprinkler heads fitted in a position above the pipe instead of protruding downwards will also reduce this risk;
- do not fit sprinkler heads close to heat sources. This can trigger accidental release. If the heat source needs to be resited then do so;
- provide flow control valves in sufficient numbers and at appropriate locations so that, if the system is activated by a fire, the water flow can be quickly stopped once the fire is out. Such valves must be protected by a suitable security system (perhaps linked to an alarm if closed) to avoid interference to the operation of the system by accident or sabotage;
- sprinkler systems should be installed to a high standard with appropriate tests applied to each sprinkler head and to the joints to test the system for pressure resistance. The application of such measures together with an appropriate maintenance programme will provide protection against an accidental release of water.

#### 4.6.4 Hand held portable fire extinguishers

Portable hand held extinguishers should always be available at strategic points throughout a building;

- a minimum of one water extinguisher, approximately 20 litres (or equivalent), should be provided for each 200 m<sup>2</sup> of floor area with a minimum of 2 extinguishers on each floor. Foam and powder extinguishers are not recommended because of their residues affecting archives materials;
- both carbon dioxide and water extinguishers should be held at each fire point. Carbon dioxide only should be used on electrical fires and used first on any other fire to minimise damage to the collections.

#### 4.6.5 Water hose reels

Water hose reels should be available as a back-up system at strategic points immediately outside the collection areas to be available to fight any developing fire which becomes too large for hand held extinguishers to deal with;

- all parts of a building should be no further than 6 metres from a fully extended hose.

#### 4.6.6 Dry risers

Dry risers are large diameter pipes rising vertically through a building to enable water to be pumped to various parts of the building to fight a large fire. Such a system has outlet points compatible with fire hose connections and is held available in dry state. A connection point on the outside of a building at ground floor level enables fire fighters to connect a pumped supply of water and so enable the system for fire fighting purposes;

- dry risers serving each floor of the building with fire hose outlets on each floor of the building should be installed in buildings more than 30 metres in height or where a single floor exceeds 1000 m<sup>2</sup>.

#### 4.6.7 Smoke control

There is enormous potential for suffering damage from smoke in a fire, even a small one which is suppressed at an early stage. In small events there can be more damage from smoke than from the fire, often in areas of a building otherwise unaffected by the incident;

- air conditioning ducts should be equipped with automatic fire dampers and fan motors should be automatically switched off;
- smoke extraction systems should be installed if possible.

#### 4.6.8 Compartmentalisation

The theory of compartmentalisation can be applied to storage areas in archives. Compartmentalisation is dividing areas of storage, or a building, into smaller compartments using barrier materials with a fire delay capability of at least two hours. This measure does not provide any means of suppressing a fire, only delaying its spread and therefore growth outside the area compartmentalised. Such a measure provides more time for the fire to be extinguished but all material that is within a compartmentalised area affected by a fire is at risk of being destroyed if no automatic suppression system is also deployed. In cases where no automatic fire suppression system is possible more attention should be given to the use of compartments which delay the spread of the fire.

#### 4.6.9 Contractors working within a building

Experience has shown that there is a high risk of suffering a disaster as a result of contractors working within the building. Measures should be taken to protect the holdings when contractors are present;

- issue instructions to contractors and their workmen to comply with the rules of the disaster prevention policy of the institution when they are present in the building;
- require a "special permit" to be issued before any work using a heat source can be started. This way the institution can be aware of any increased fire risk and apply appropriate measures;
- when a "special permit" is issued for work using heat, require details of the work and equipment used and take appropriate measures to
  - prevent ignition which could start a fire
  - require both carbon dioxide and water type hand held extinguishers to be held in the work area so that any outbreak of fire can be extinguished at an early stage;
- ensure workmen conform to the smoking regulations;
- establish severe penalties against the contractor for any breach of safety regulations.

#### 4.6.10 Fire risk from adjoining buildings

If adjacent buildings are located close by they may present a risk of fire spreading from them if they suffer such a fate. In such cases systems providing a "water curtain" on affected walls can be installed. These systems provide a cascade of water down the outside surface of the wall to provide a cooling effect. The system is activated by heat sensors suitably directed.

### 4.7 SECURITY

High level security measures should be in place to protect against intruders, vandals and arsonists. An alarming number of incidents of theft and arson are thought to have been the actions of staff members, often bearing a grudge;

- have adequate intruder alarms to warn of unauthorised entry of the building;
- if possible employ a 24 hours human security presence in the building;
- ensure necessary security measures are also applied to staff of the institution;
- have only authorised levels of entry to high security areas;
- take special precautions when contractors are working in the building.

Special measures may need to be applied in an area of armed conflict.

A risk management programme should not stop with measures applied to the building. Although efficient risk management significantly reduces the risk of suffering an incident, the risk can never be removed totally and some will always remain. The programme should therefore also include measures to provide barrier systems and other measures within the storage systems to protect the collections from contact with harmful substances or fire, or to delay contact until a reaction to an incident can suppress and remove the threat.

#### 4.8 STORAGE SYSTEMS

- provide barrier systems such as boxes;
- store materials above floor level to allow time to react to a water release. A minimum of 150 millimetres from the floor is recommended;
- provide fire proof safes for the most important of the treasures in the holdings;
- provide shelf hoods to protect from falling water.

#### 4.9 SURROGATE FORMS

Surrogate forms such as microfilm may exist as copies for preservation reasons or because they are simply the only copies held of some material. Microfilm may also be used to duplicate material so that it can be held simultaneously but at an alternative site from the original. The likelihood of two sites being struck by a disaster incident at the same time is remote. Such action reduces the risk of the loss of the information.

The UNESCO "Memory of the World" programme recommends such a strategy in order to protect against the loss of important heritage material.

It is important to also protect finding aids, e.g. catalogues and inventories, etc.;

- copy on to microfilm all material which is deemed to be the most valuable, important as a heritage record, or which is vulnerable because of its condition or particular threats faced;
- make at least two copies of the microform, the camera negative and a copy negative or positive;
- locate all master copies (original camera negatives) of microforms in an alternative safe building at another site;
- in cases of the threat of armed conflict, such microfilm copies should be kept at an alternative site well outside the identified war zone in protected and secure accommodation.

#### 4.10 ARMED CONFLICT

Action taken to manage the risk in situations of armed conflict will depend on how much time is available before the threat becomes immediate. Experience has pointed to certain needs. Lack of time may be a problem pointing to the need to predict any threat and take appropriate action, such as the formation of inventories, conversion to surrogate forms and evacuation, long before a threat becomes a reality.

Actions recommended:

- prepare inventories listing priorities according to UNESCO instructions;
- inventories made should be copied several times and stored on different sites;
- copy holdings to microform and store in a safe and secure geographical location;
- evacuate holdings to safe geographical locations having regard for security and environmental conditions;
- organise cooperation and coordination between archives in the country;
- consider informing a broader audience e.g. police, security forces and the military, on the needs of archives.

#### 4.11 PRIORITISING

It is unlikely that an institution will have the financial resources to apply a complete programme of disaster prevention and disaster management measures. To provide a comprehensive list of expensive protective measures is not helpful without recognising the problems commonly encountered through lack of resources. Institutions should therefore form their own list of priorities for action and implement each of them as soon as resources become available. Consideration should be given to providing protection for the most important or vulnerable areas of the building, perhaps special material or an area carrying a high risk.

## Chapter 5 – Preparedness

### 5.1 DISASTER PREPAREDNESS

As stated earlier, total protection cannot be gained through preventive measures and although the risk will have been greatly reduced, some will remain. It is therefore necessary to have disaster reaction contingency plans for the purpose of reacting to an emergency situation. The objectives of such a reaction will be:

- to take action to remove the threat to the collections, if that is possible;
- to protect undamaged material;
- salvage material which has suffered damage;
- stabilise the condition of damaged material so that it can be recovered.

Disaster reaction plans should be contained in a document which is made available to all staff of the institution and kept for reference at strategic points within the building, and at points off site in case the building is temporarily inaccessible.

### 5.2 DISASTER REACTION PLAN DOCUMENT

The document should begin by defining an emergency and pointing out that even a small incident can be potentially very damaging. An emergency is any incident which damages, or threatens to damage any parts of the collections. Emphasis should be placed on the need for a fast and efficient reaction to even a small incident as it may quickly grow into something much bigger if not contained. The document should:

- define an emergency;
- make staff aware of the need for vigilance in observation and the part they can play in providing an early warning of an incident;
- clearly list emergency procedures to be followed;
- contain the names of senior members of staff who are first to be called in an emergency. These will be people with responsibilities for the buildings, collections and conservation. There should be a senior and suitably qualified member of staff designated to take charge of operations in the event of disaster;
- identify areas of special concern
  - *important material*
  - *vulnerable material*
  - *risk areas*;
- contain plans of the building showing locations of water supplies, control valves and power switches;
- list and locate emergency equipment and supplies;
- list external facilities for use in an emergency;
- list expertise to be called upon for advice in an emergency;
- provide guidelines for salvaging material.

It is essential that the disaster planning document is arranged and produced in a form that is easy to follow in an emergency.

### 5.3 EMERGENCY DEFINITION

Define an emergency clearly so that there is no confusion over the need to react to a situation. Emphasise the need to react to a situation swiftly and at an early stage.

Some types of emergency may be feared more by some institutions than others because of geographical location or vulnerability. Contingency plans should take account of these if necessary.

#### 5.4 STAFF AWARENESS

Make all staff aware of the need for disaster control measures and provide an understanding of what may be expected of them to play a part in protecting the heritage material in the care of the institution. Emphasise the important role they have to play as observers in drawing attention to developing risk situations and seeing the early signs of those that have begun.

Hold staff training sessions regularly, at first to make them aware of what might be expected of them in an emergency if the movement or salvage of the collections ever becomes necessary, and later with sessions to inform them of developments in the institutions disaster control plans as the capability is strengthened and perhaps knowledge is gained.

Staff should receive basic training in the operation of any disaster response equipment held, and be familiar with any systems compiled for the purpose of recording details of salvaged material.

Regular sessions also serve as a reminder and help to avoid complacency. One of the problems of a successful disaster prevention policy is that because of the reduction in risk and a resulting lack of incidents, people think that no incidents are going to happen. The risk remains and they need to be reminded.

#### 5.5 EMERGENCY PROCEDURES

Emergency procedures relevant to the institution need to be carefully compiled. List these carefully and clearly in the document. They should include the following listed in the order they should be called according to the situation faced:

- the means of sounding a general alarm in the case of fire;
- the senior member of staff designated to take charge of operations in the event of disaster, or the deputised person. This person should ideally be a senior member of staff who has conservation / preservation expertise, perhaps the person responsible for the preservation activities of the institution. This person will need to be given control of any salvage operations if material is affected or threatened and will need to make informed decisions. An emergency situation always requires a structured command with one person in charge. This person will frequently take advice (if available) and consult colleagues before decisions are made;
- the emergency contact for faults developing, or which have developed, in the building and its services, i.e. the "Buildings Manager" and "Disaster Reaction Coordinator" if the collections are affected or threatened (sufficient deputies need to be listed in case there is a failure to contact the first person listed);
- the relevant curatorial contact for the special areas of the collections in case they become threatened or affected. This may be one or a number of senior curatorial staff. People who have intimate knowledge of a collection area are invaluable to give guidance on priority decisions if movement or salvage becomes necessary;
- the senior member of staff responsible for the conservation/preservation of the collections. (This may be the "Disaster Reaction Coordinator".)

All procedures and people listed above must have more than one telephone number listed, e.g. office and home telephone numbers, so that they can be contacted at all times of the day and night. Emergency situations rarely seem to happen during office hours.

#### 5.6 LIST OF SENIOR STAFF

List all senior staff, and other authorities if necessary, who may need to be called and play a role in any disaster situation. From the Director of the archives downwards these will be curatorial and preservation staff including those listed as on call to respond to an emergency.

### 5.7 AREAS OF SPECIAL CONCERN

Identify and list all areas of the building where material which is of special concern is held and identify that material. This is to ensure that priority decisions can be made if protection measures or salvage procedures have to be applied in an emergency.

Linked to this list should be the curatorial expertise most familiar with each area so that a person with knowledge of an area affected can prioritise salvage, or movement to safety in special areas.

### 5.8 BUILDING PLANS AND SERVICES

Include floor plans of the building and indicate the points where water and power can be turned off. Indicate useful water supply points and drainage points. If water supplies are unaffected by the incident these might be needed in any salvage operation.

Identify areas within the building which might be used for intermediary stages of salvage operations such as packing damaged material for transport to a freezing facility.

### 5.9 DISASTER EQUIPMENT

Maintain supplies of emergency equipment which could be useful in an emergency situation. These are listed in Appendix 2.

Water pumps, wet vacuum machines and emergency lighting systems have been proven by experience to be particularly valuable items to hold in readiness.

Hold this equipment in sufficient quantities at strategic locations within the building/s. If the building is large, or there is more than one building, it may be beneficial to duplicate equipment and hold each at several points. The location of the equipment should be clearly indicated in the disaster plan document and generally known to staff.

### 5.10 DISASTER SUPPLIES

Supplies of materials useful in an emergency should also be held. These are listed in Appendix 2 and typically include plastic sheets to throw over unaffected areas threatened by water, paper towels, protective clothing, plastic crates, torches, forms for listed material moved or salvaged etc.

### 5.11 EXTERNAL FACILITIES

There is a need to identify available external facilities which may be required. An institution should hold sufficient emergency equipment and supplies to meet its needs in a first response or small incident but there is always a need to have available extra supplies to provide a response to a large incident. These will include blast freezing and freezing facilities, transport, supplies of plastic crates or boxes etc. List these back-up facilities and the addresses and telephone numbers of suppliers. Seek the cooperation of suppliers in providing out of hours emergency telephone numbers so that they can help at any time of the day or night.

### 5.12 EXPERTISE

List expertise which may need to be called in an emergency, e.g. conservation/preservation expertise. If there is a shortage of relevant expertise in the institution, there may be help available from neighbouring libraries or museums who have such expertise on the staff. Otherwise locate expertise which can provide advice over the telephone in an emergency until on the spot expertise can be brought in.

### 5.13 DISASTER TEAMS

Form lists of volunteers who are willing and able to form salvage teams if needed. Such people need to be prepared to be called at any time of the day and night, able bodied and capable of working to strict guidelines in an emergency situation. Small institutions with only a few staff may be able to obtain assistance from neighbouring institutions who are supportive. This cooperation may be reciprocal.

Team lists should be held in an organised way listing daytime and night time telephone numbers with any details of any relevant expertise which could prove to be useful in an emergency or salvage operation.

### 5.14 SALVAGE OF DAMAGED MATERIAL

Include guidelines for the salvage of damaged materials. These should be very broad guidelines, more a list of what to do and what not to do, but sufficient to give guidance to unqualified people in salvaging damaged archive materials.

## Chapter 6 – Disaster reaction

### 6.1 PRIMARY ACTION

The first person on the scene should raise the alarm and, if possible, act to prevent the cause and to protect undamaged material;

- sound the alarm alerting all necessary personnel (including the person designated to take charge of disaster reaction) and emergency services, if appropriate;
- take action, if possible, to remove the cause of the incident. I.e. turn off water, call for water pumps to be deployed, use fire extinguisher;
- take action to protect undamaged material, for example by covering it with plastic sheets to protect it from water.

### 6.2 MAIN DISASTER RESPONSE

If some sort of primary action as described above is applied, it will need to be followed by a more carefully measured response. In the case of large incidents, perhaps where the emergency services are first involved, this more measured response will be the first applied as access to the disaster area may be limited;

- the person in charge of operations should first assess what is being faced, how large is the incident, what sort of damage is likely to have been suffered. This will take time but is essential in order to make an efficient response;
- following assessment the person in charge of operations will
  - call on disaster reaction team members as appropriate
  - alert emergency services as necessary
  - call expert conservation opinion if necessary;
- a strategy for the evacuation or salvage of material is established;
- disaster reaction team members are gathered and briefed to understand the organised response and the parts they will play.

### 6.3 SALVAGING DAMAGED WET MATERIAL

Material affected by water is common in a disaster incident. Whether the incident is flood, perhaps from burst water pipes, or fire, water usually becomes involved and water damaged archive material needs swift and correct action. The objective is always to act to stabilise its condition so that no further damage takes place. For most materials the accepted method used is freezing. This does not correct damage already suffered but prevents further damage taking place and, importantly, provides an indefinite amount of time to begin the recovery.

Wet archive material will usually develop fungal growth within 48 hours, sooner in warmer climates, if it is not properly dried or frozen. It is therefore important to consider the need to avoid secondary damage of wet material by stabilising it by freezing.

#### 6.3.1 Blast freezing

This is a preferred, but not essential, means of lowering the temperature of wet archive material to below freezing point. It is a fast method producing smaller ice crystals as result. After blast freezing movement to a conventional cold store with a temperature below freezing point should take place.

#### 6.3.2 Cold store freezing

If blast freezing is unavailable a conventional cold store can be used to lower the temperature but this must be to below freezing point. Do not confuse refrigerated (chilled) stores with freezing stores.



### 6.3.3 Packing for freezing

Material identified for a freezing process must be packed in plastic bags or wrappers to avoid them forming one solid block upon freezing, and to facilitate handling at the point of salvage and individual recovery from the freezer at a later stage.

Bundles of wet archive papers that sustain damage forming them into wet masses of paper should be packed into large plastic bags. Too much time can be lost in trying to separate material of this kind and damage may occur. In a large scale disaster time will be of the essence and a priority in salvage will be to pack and transport material to the freezing point as quickly as possible.

Always use plastic bags and wrappers to pack wet material for freezing. It is important at this stage to list and form an inventory of damaged material;

- pack items for freezing in plastic in containers for transport to the freezer. Do not exceed 15 kilograms in weight or they will be difficult to handle;
- pack volumes individually in plastic bags;
- label packed items and list details if possible;
- volumes which are recovered lying open should stay in that position and be packed flat;
- volumes should be packed standing upright or laid flat in containers in a way that means they are supported as far as is possible;
- do not try to separate single leaf material. Pack in bundles in plastic bags;
- large format items such as maps and charts should be interleaved with absorbent material (blotting paper) then polythene and placed on flat supports. There may be several on each support but each should be separated with the absorbent and polythene sheets. Beware of building up too much weight to prevent safe handling.

### 6.3.4 Air drying

Certain items can be safely air dried. These are generally lightly wet materials but excluding those with soluble inks and those on coated papers (see freeze-drying);

- select a suitable site at a safe distance from the disaster area. It should be well ventilated and have sufficient table space to accommodate the numbers being dealt with;
- stand volumes upright with pages fanned out;
- lay single page items and large format material such as maps on a clean absorbent surface but change the material regularly;
- deploy dehumidifiers in the area;
- try to pass cold air gently over the wet material.

## 6.4 VELLUM AND PARCHMENT

Do not air dry vellum bound volumes, vellum or parchment membranes, coated papers or items with soluble inks or pigments. Never subject vellum or parchment membranes to pressure in an attempt to flatten them. Such action may make them transparent. If in doubt, freeze. Call for relevant conservation expert advice.

## 6.5 PHOTOGRAPHIC MATERIALS

Because most photographic processes have a wet stage at the time of production, they will often stand contact with cold water for a short time and be recoverable, provided the water is not contaminated. Time for recovery is limited.

### 6.5.1 Negatives, prints & glass plates

- remove from envelopes;
- may be washed in clean cold water;
- air dry with the emulsion side up;
- never touch or wipe the emulsion.

There are various types of photographic processes some of which can be difficult to identify. Among these is collodian negatives on glass which must not be frozen. If in doubt, specialist advice should be sought.

#### 6.5.2 Photograph albums

- interleave with silicone/wax paper;
- if freezing, pack flat in individual polythene bags;
- freeze or air dry within 48 hours.

#### 6.5.3 Microfilm (silver halide)

- remove from boxes;
- if necessary hold temporarily in buckets of cold water;
- send to a film processing laboratory for passing through a microfilm processor.

#### 6.5.4 Microfiche (silver halide)

- separate and wash in cold water;
- air dry with emulsion side up.

#### 6.5.5 Diazo film and fiche

It is highly unlikely that this material will survive contact with water. All that can be done is to separate items and air dry.

### 6.6 SUSTAINING THE DISASTER REACTION TEAMS

Organise rest periods and accommodation for team members and make sure sufficient drinks and nourishment is available for them. Experience tells us that although team members and others from the institution who may be involved tackle the work with enthusiasm, there soon comes a period of exhaustion and even psychological trauma for many as the seriousness of the situation and work load takes its toll;

- organise work periods so that areas of work are dealt with through shifts with a fresh team replacing one which has been working for a predetermined time;
- organise rest stations and nourishment through drinks and food for those working;
- observe the condition of team workers so that early warning signs of trauma etc. can be recognised and dealt with.

### 6.7 ENVIRONMENT IN ADJACENT AREAS

Beware of the environment in adjacent areas being adversely affected by the incident. Take steps to deal with this potential problem if water is involved;

- take regular temperature and relative humidity readings in the immediate and adjacent areas;
- deploy dehumidifiers as necessary to reduce the relative humidity to safe levels. (The desiccant type are much more efficient than the refrigerated type, especially in cooler climates.)

### 6.8 PHOTOGRAPHS OF THE DISASTER SCENE

It is helpful in any subsequent analysis of operations, and to help inform others, if a photographic record of the disaster scene and reaction operations can be created.

### 6.9 MODERN MEDIA

Experience of recovering modern media (magnetic tapes, optical media or disks) is extremely limited. For this reason it is difficult to provide advice at the present time. Specialist advice should be sought.

## Chapter 7 – Recovery

### 7.1 INTRODUCTION

The recovery of material damaged in a disaster incident is really a post emergency phase and there is less need for the urgent and informed actions that are required in the emergency stage. For that reason it is not intended to devote a great deal of space in these guidelines to the subject. However, some points are worth comment for the purpose of clarifying some confusing processes and pointing to a correct approach.

Once a post emergency phase has been reached there are likely to be two main categories of affected material to be dealt with.

### 7.2 DRY DAMAGED MATERIAL

Material that has been damaged but is dry will need to be assessed to determine the type and degree of damage. The services of a suitably qualified conservator will need to be recruited at this stage, under a consultancy arrangement if necessary, to give expert advice. If different types of materials are affected, it may be necessary to employ more than one, according to professional skills.

### 7.3 WET DAMAGED MATERIAL

At this stage the condition of material affected by water will have been stabilised by freezing. It will still contain water which will have to be dealt with but is in a suspended state with no further deterioration taking place as long as it is held below freezing point. For this reason there is no urgency to dry the material. The main advantage of freezing is the creation of the suspended state so that time can be gained to take advice on subsequent recovery and make expert judgements. As above, the services of a suitably qualified conservation expert should be sought.

#### 7.3.1 Air drying

Because material is frozen the option of air drying is not lost. If this is a chosen course of action, then once thawing has taken place, according to the type of material affected, normal air drying procedures can take place.

#### 7.3.2 Freeze-drying

Freeze-drying is a specialist method of drying wet materials using sophisticated equipment operated by qualified technicians which, for damaged archive materials, should take place under the guidance of a conservation expert. This method is particularly useful for dealing with coated papers and materials with soluble inks.

In the process the frozen items are placed in a vacuum chamber and held at a temperature below freezing point. The vacuum in the chamber is held at 4.5 TORR, a pressure at which water cannot form as a liquid. By this process, known as sublimation, the ice is converted to water vapour without a water stage. Material can be overdried using this method and may need reconditioning by allowing it to take up moisture from the atmosphere once it has been removed from the vacuum. Over-drying can be damaging, particularly for vellum and parchment membranes. This is especially so if they have pigments on the surface.

#### 7.3.3 Vacuum-drying

A process similar to freeze-drying but the temperature in the vacuum chamber is above freezing and there is a brief water stage before conversion to water vapour. This process is less harsh but has disadvantages for some materials such as water soluble inks.

Both *freeze-drying* and *vacuum-drying* are specialist processes demanding equipment which is often not easily accessed. The processes have many advantages over air drying and have been

successfully deployed to dry water damaged library and archive material, but expert advice must be sought.

#### 7.4 CONSERVATION TREATMENT

It is not possible to say what conservation treatment might be required for damaged material following a disaster incident. Once material is dry it will need to be assessed for the degree of damage and recommendations for conservation work needed.

#### 7.5 BOXING

If a large amount of material is damaged, it may be necessary to phase the remedial treatment over a long period of time. If this is so the use of boxes is recommended to provide a temporary holding method and physical protection from further damage.

#### 7.6 DISPLACED MATERIAL

Recovering the order of affected holdings is important and expensive in terms of time. This should not be forgotten when costing a recovery operation.

#### 7.7 INCIDENT REPORT

A full report, including photographs if possible, should be made of any disaster incident suffered. This is valuable in learning lessons from the incident, and helps others to benefit if the information can be disseminated.



## Appendix 2

### Emergency equipment and supplies

The following lists some items of equipment and materials that are usefully held in readiness at strategic points for use in an emergency. The list is not exhaustive and should be added to and modified according to local needs and available resources.

#### **Equipment**

Wet/dry vacuums  
Hand water pumps  
Electric water pumps  
(submersible)  
Portable lighting systems  
Power extension cables  
Electric fans  
Plastic crates  
Mops & buckets  
De-humidifiers  
Thermohygrographs  
Thermohygrometers  
Water spray bottles

#### **Materials**

Plastic sheets  
Plastic bags (various sizes)  
Kitchen towels  
Silicone paper  
Clean unprinted newsprint  
Sponges  
Permanent markers  
Pencils  
Note pads  
Labels - self adhesive/ waterproof  
Scissors  
String  
Protective clothing  
Coveralls  
Waterproof clothing  
Rubber boots  
Safety helmets  
Surgical gloves  
Latex gloves  
Dust masks  
Fume masks  
Eye protectors

## Appendix 3

## Disaster control planning bibliography

This is a select bibliography with entries known to the Committee up to 1995.

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## NOTE OF THE EDITOR

A state of the art has been published in *Archivum XLII*, "Memory of the world at risk: archives destroyed, archives reconstituted", K.G. Sauer, München, New Providence, London, Paris, 1996. 359 pp.

L. Auer, 'Archival losses and their impact on the work of archivists and historians', pp. 1-10.

J. van Albada, ' "Memory of the World" - Report on destroyed and damaged archives', pp. 11-110.

Yuqing Xu, 'Records at risk kept at the Chinese archival repositories', pp. 111-117.

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