# DISASTER PREPAREDNESS, RESPONSE, AND RECOVERY

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*Editor's note: The content here draws heavily from the list of resources found in the bibliography at the end of this article.*

## 1. Introduction

The previous IASA journal published Kara Van Malssen's report about "The Recovery of EyeBeam Art&Technology Center's Multimedia Collection Following Superstorm Sandy." This case study gives extreme evidence that disaster preparedness is an urgent need for any archive even if it is a tiresome practice.

### 1.1. Definition

Risks, hazards, or dangers are threatening events. If they happen they may trigger a disaster, an emergency, or a catastrophe. The resulting impacts are different depending upon the nature of the triggering events.

Hazards/risks may develop into a disaster/emergency.

### 1.2. Basics

The word disaster is presumably derived from the Latin *dis astro*, which is interpreted as mis-star, bad star, or unlucky star, meaning mishap, collapse, catastrophe, calamity, fiasco, or debacle. Generally, a disaster is an unexpected event as a result of a risk or a hazard; it is an emergency for any living being, human beings as well as animals, and objects of all kinds. That is why the terms disaster and emergency are used synonymously in this context.

An archives disaster is an unexpected event that puts collections at risk. No institution can be excluded from or is immune to the possibility. Disaster planning is a matter of basic security for archives, their staff, and their collections. It is considered to be an essential part of any preservation programme to be implemented by any kind of archives.

## 2. Disaster management

Generally, disaster management or emergency management is the discipline of dealing with and avoiding risks. It is a discipline that involves preparing for disaster before it occurs, disaster response (e.g., emergency evacuation, quarantine, or mass decontamination), and supporting and rebuilding society after natural or human-made disasters have occurred. In general, emergency management is the continuous process by which all individuals, groups and communities manage hazards in an effort to avoid or ameliorate the impact of disasters resulting from hazards. Effective emergency management relies on a thorough integration of disaster/emergency plans at all stages that can be used to guide governmental and non-governmental involvement.

Practitioners in disaster preparedness come from an increasing variety of backgrounds. Professionals from memory institutions (e.g., museums, historical societies, libraries, and archives) are dedicated to preserving cultural heritage—objects and records contained in their collections and holdings. This has been an increasingly major component within these fields as a result of the heightened awareness following the September 11 attacks in 2001, the hurricanes in 2005, the collapse of the Cologne Archives, and the impact of superstorm Sandy in 2012.

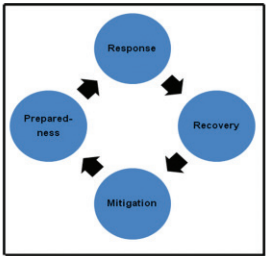
## 2.1. The eight principles

There are eight principles with which an emergency manager must comply:

1. Comprehensive: emergency managers consider and take into account all hazards, all phases, all stakeholders, and all impacts relevant to disasters.
2. Progressive: emergency managers anticipate future disasters and take preventive and preparatory measures to build disaster-resistant and disaster-resilient communities.
3. Risk-driven: emergency managers use sound risk management principles (hazard identification, risk analysis, and impact analysis) in assigning priorities and resources.
4. Integrated: emergency managers ensure unity of effort among all levels of government and all elements of a community.
5. Collaborative: emergency managers create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.
6. Coordinated: emergency managers synchronize the activities of all relevant stakeholders to achieve a common purpose.
7. Flexible: emergency managers use creative and innovative approaches in solving disaster challenges.
8. Professional: emergency managers value a science- and knowledge-based approach, based on education, training, experience, ethical practice, public stewardship, and continuous improvement.

## 2.2. The emergency cycle: four phases

An academic trend is towards using the term disaster risk reduction. This focuses on the mitigation and preparedness aspects of the emergency cycle. The process of emergency management involves four phases: preparedness, response, recovery, and mitigation.




2.2.1. Preparedness

Preparedness is a continuous cycle of planning, organizing, equipping, exercising, evaluating, and improving activities to ensure effective coordination and the enhancement of capabilities to prevent and protect against natural or man-made disasters.

Common preparedness measures include:

- Communication plans with easily understandable terminology.
- Proper maintenance and training of emergency services.
- Development of staff warning methods.
- Maintenance of disaster equipment.
- Staff training for the case of disaster.

Another aspect of preparedness is damage prediction. This gives planners an idea of what resources need to be in place to respond to a particular kind of event.

#### 2.2.2. Response

The response phase includes the mobilization of the necessary emergency services and first responders in the disaster area, for example, core emergency services such as fire fighters and ambulance crews. They may be supported by a number of secondary emergency services such as specialist rescue teams. In responding to a disaster there is a need for both discipline (structure, doctrine, process) on the one hand and agility (creativity, improvisation, adaptability) on the other.

Recommendations for preparedness must be achievable and will depend on many factors including:

- Availability of funds.
- Availability of facilities.
- Availability of trained personnel.

#### 2.2.3. Recovery

The aim of the recovery phase is to restore the affected area to its previous state. Recovery efforts are primarily concerned with actions that involve the repair of essential infrastructure and rebuilding destroyed equipment. Efforts should be made to "build back better," aiming at reducing the pre-disaster risks.

#### 2.2.4. Mitigation

The implementation of mitigation strategies can be considered part of the recovery process if applied after a disaster occurred. Mitigation efforts attempt to prevent hazards from developing into disasters altogether, or to reduce or, even better, to avoid the effects of disasters when they occur. Mitigation differs from the other phases because it focuses on long-term measures for reducing or eliminating risks. Measures for mitigation can be structural or non-structural. Structural measures use technological solutions, e.g., flood levees. Non-structural measures include legislation or insurance. A precursor activity to mitigation is the identification of risks. Physical risk assessment refers to the process of identifying and evaluating hazards. The higher the risk, the more urgent are preventive measures against the hazard by mitigation and preparedness efforts. Mitigation is the most cost-efficient method for reducing the impact of hazards. It is, however, not always suitable.

## 3. Principal causes of disasters

Natural disasters cannot be prevented, but measures can be taken to eliminate or reduce the possibility of trouble. Regardless of the many forms a disaster may take, the actual damage to collections is usually caused by water or fire. Even when they are not the initial factor, floods and fires almost invariably occur as secondary causes of archives disasters.

First, we need to distinguish between natural and man-made disasters.

### 3.1. Natural disasters

- Rain and wind storms (heavy thunderstorms, cyclones, tornados, hurricanes)
- Bush fires
- Floods, tsunamis
- Landslides
- Avalanches
- Biological agents (micro-organisms, insects or vermin infestation)
- Earthquakes
- Volcanic eruptions

### 3.2. Man-made disasters

- Acts of war and terrorism
- Civil disturbances, social struggles
- Water (broken pipes, leaking roofs, blocked drains, fire extinguishing)
- Fire
- Explosions
- Liquid chemical spills
- NEMP (Nuclear ElectroMagnetic Pulse)
- Building deficiencies (structure, design, environment, maintenance)
- Power failures, outages
- Criminal activities such as theft, vandalism, burglary, looting
- Absence of surveillance, maintenance, and security routines
- Gaps in the line of supervision and responsibility, when changes in the executive staff take place
- Ignorance of the risks due to high temperature together with high relative humidity
- Obsolescence if ignored—chemical obsolescence as well as format obsolescence
- Negligence and carelessness of staff, lack of skills, and lack of foresight

### 3.3. Some major effects of disasters on AV material (in particular fire and water)

Concern has to be given to the fact that AV archives hold collections that are unique and that disasters can destroy them forever (contrary to libraries where most books exist in other libraries).

These are the most common AV carriers:

Mechanical carriers
- Cylinders (wax, celluloid)
- Grooved discs (wax, shellac, vinyl, acetate, laminates)

Magnetic carriers
- Open reel
- Cassette/cartridge

Optical carriers
- CD
- DVD
- BluRay
- MiniDisc
- MOD
- LaserVision

Film, photographs
- Nitrate
- Diacetate
- Triacetate
- Polyester

Mechanical instrument devices
- Rolls
- Music box discs

Not to forget: all backup materials such as cardboard boxes, sleeves, cases, books, containers and any other combustible, in particular paper-based material.

The only method to avoid destruction is to digitize the AV documents and store at least two copied files of each item at different sites. Consequently, the necessary IT devices, hardware as well as software, are objects with increasing significance for disaster planning.

The following two sections focus on the impacts of disasters most common in AV archives: fire and water.

### 3.3.1. Fire

Fire prevention and extinguishing must be given utmost importance. Beyond the safeguarding of invaluable material it must be understood that burning audio-visual carriers produce highly toxic fumes, which are of considerable risk to health. In addition to irreplaceable losses of holdings, complicated and expensive decontamination of premises may be the result of such incidents. Any audio-visual material can be completely destroyed or damaged beyond repair, as a result of fire extinguishing. The large quantities of water used for fire fighting may cause considerably more damage than the fire itself.

#### 3.3.1.1. How do fires occur in AV archives?

Fires may result from natural phenomena such as lightning or earthquakes, or from unnatural events such as wars, terrorist activities, or arson. However, the primary threat of fire in libraries and archives is caused when fire safety rules are ignored or not adopted in the first place.

The highest fire risk is posed by motion film recorded on cellulose nitrate. Cellulose nitrate is the plastic commonly used for film-based photographic materials (stills, movie, and X-ray films) manufactured up to the early 1950s. It contains a high proportion of nitro-cellulose, otherwise known as celluloid. Cellulose nitrate is extremely flammable. The most dangerous aspects of cellulose nitrate motion picture film are its ease of ignition, its very high rate of combustion, and its extremely poisonous combustion gases. Therefore, cellulose nitrate film should not be stored in an AV archive. If it is not possible to copy the film onto a safety base film, then it should be stored in a separate building in a vault especially constructed for this purpose.

The high fire risk from cellulose nitrate film increases as it ages. Old cinematographic films and old photographic negatives (including X-ray films) may be made from cellulose nitrate.

It is hazardous because:

- It can start to decompose and become unstable at temperatures as low as 38°C, giving off large quantities of poisonous gases, which could cause an explosion; warmth and humidity (moisture) accelerate this decomposition.
- It catches fire very easily and burns extremely quickly, with a hot and intense flame.
- It produces very dense, poisonous smoke containing copious amounts of choking nitrogen dioxide fumes.
- Unlike many other flammable materials, nitro-cellulose does not need the oxygen in the air to keep burning and once it is burning it is extremely difficult to put out. Immersing burning film in water may not extinguish the fire and it could actually increase the amount of smoke produced.

Keep them away from any source of heat (e.g., radiators and light bulbs). Do not run cellulose-nitrate film through a projector or put negatives on an enlarger; they can catch fire simply from the heat from the lamp or from friction caused by the film passing over the projector sprockets. On no account should cellulose nitrate film be sent by post, carried on public transport, or disposed as refuse.

Diacetate, triacetate and polyethylene terephthalate films provide a more stable and safe film base. They meet the requirements of international standards on the safety of cine film.

Shellac melts when heated and gives off a pleasant scent. It burns with a shining flame.

Magnetic tape is practically non-combustible. To ignite the polymer materials, of which magnetic tape is composed, the tape has to be exposed to a much higher percentage of oxygen than is found in atmospheric air.

Polycarbonate is inflammable. Manufacturers of magnetic and optical discs have certified the upper temperature limit for discs at +65° Celsius. At higher temperatures the physical properties of the discs, the magnetic layer, and the casing change. Magnetic and optical discs catch fire at temperatures in excess of 500° Celsius; the flame goes out as soon as the ignition source is removed. Therefore they are not dangerous as a fire transfer medium. However, a 100% loss of information takes place in case of fire in a magnetic disc storage room due to the heat damage to the disc.

PVC (Polyvinylchloride), vinyl, burns with a yellow, intensively sooting flame and goes out quickly without further external ignition source. PVC is hardly inflammable due to its high chloride content, contrary to other technical plastics such as polyethylene or polypropylene. However, PVC on fire creates hydrogen chloride, dioxin, and other products.

3.3.1.2. Climatic characteristics on fire safety

Hot climates tend to have larger and more diverse populations of rodents and insects that can infest AV archives. Rodents can be particularly destructive to electrical wiring by damaging the insulation, thus causing a short circuit that may create a fire. Termites or other insects that undermine the structural elements of a building may weaken the interior supports; in case of fire the flames could spread quickly, causing parts of the building to collapse, thereby allowing the fire to spread throughout the building.

3.3.1.3. Fire prevention and protection measures

The storage area has to be separated by firewalls into fire zones. If there are no windows, exhaust ducts for the smoke removal should be provided by remotely controlled valves. The emergency smoke-evacuation ducts should have a cross sectional area not less than 0.2% of the floor space of the room affected. The ducts should be fire-resistive for at least one hour. Smoke evacuation systems must keep smoke out of stairwells/stairways/staircases and remove smoke from corridors used for the evacuation of personnel. Fire doors will prevent the spread of fire, smoke and heat from one level to another. Architects should be aware of the requirements for fire exits for staff, users, and visitors from the various areas of the premises, and sufficient evacuation routes.

Consideration should be given to the proper selection of interior finishes and furnishings, flammable wall and ceiling finishes should be avoided. Floors and walls should be made of non-combustible material, and they should be constructed using fire-resistant techniques.

3.3.1.4. Requirements for electrical equipment

The electrical wiring running through an AV archives building must be airtight. Wiring should be grounded and protected from short-circuits by means of fuses. Lighting should be limited to vapour-proof or explosion-proof lamps controlled by a 2-pole switch equipped with a pilot light outside the storage room. Light fixtures should be placed at least 0.5 m from storage material. Emergency lighting should be provided with its own independent and fireproof power line.

Electrical equipment should be maintained regularly and checked routinely for malfunctions.

3.3.1.5. Requirements for storage room equipment

The primary equipment located in storage rooms is stationary and/or mobile shelving. Only metal shelves should be used, as wooden shelves create a constant fire hazard. Any additional equipment used in storage areas such as bookcases or card catalogue cabinets should also be made of metal, because any wooden or otherwise combustible material will increase the fire hazard.

3.3.1.6. Requirements for fire detection equipment

Heat and smoke detectors are absolutely a must. They require a signal transmission system to report the fire to the local fire department, to sound the local alarm, and/or to activate fire suppression systems and ventilation controls.

It is also helpful to co-operate with the local fire department. Periodic inspection tours together with the fire prevention officer will improve the fire fighters' response time and their knowledge about the chemistry of special collections, e.g., cellulose nitrate film.

3.3.1.7. Requirements for fire extinguishing systems (according to TC-05)

Ideally, the entire building housing an audio-visual collection should be separated in fire divisions of appropriate dimensions and equipped with a fire detection system. The storage area should be fireproof, and equipped with an automated fire extinguishing plant. In the 1970s and 1980s, halon gas was widely used as a fire extinguishing agent for sensitive cultural materials, replacing sprinkler systems. This was also recommended by IASA in 1981 (TC-02). Because of its effect on the depletion of the ozone layer, halon and other fluor-chlorine-carbon-hydrogenic agents were banned in the Protocol of Montreal in 1989. Today, a number of more environmentally friendly halon replacement gases (e.g., INERGEN) are available for traditional materials as well as for server rooms of digital archives, which are also recommended for audio-visual materials.

INERGEN is a mixture of nitrogen, argon, and carbon dioxide and is used as an extinguisher for fire fighting. Contrary to pure carbon dioxide, INERGEN is tolerable for human beings; provided correct calculation of the quantity, people can survive in rooms flooded with INERGEN. The gas concentration within flooded rooms is rather constant over a longer period. INERGEN is used only in stationary installations, but not in handheld extinguishers. It is stored as gas in gas cylinders; one cubic meter room requires about 2 litres of INERGEN. When welling out from its cylinder, no fog is produced which is the case with carbon dioxide.

So called "dry fog" or "water mist" systems, spraying water in a very fine dispersion into the vault, are gaining popularity, as the cooling effect is of great support for the protection of carriers, while water damage is rather minimal. In water mist systems, water is forced through micro nozzles to form a water mist with the most effective fire fighting droplet size. The water mist can give optimum protection by its cooling effect and also by the "inerting" or elimination of oxygen effect as water expands by a factor of 1700 when it evaporates. Thus when water mist comes into contact with the fire, then heat and oxygen, two of the essential ingredients of fire are much reduced or eliminated. Less water is required in water mist systems than with conventional fire sprinklers systems. Water mist systems are almost like the spray from an aerosol where conventional sprinklers are more like the water coming from a domestic shower. Such systems can be used for all kinds of archives. They are unsuitable, however, for electrical installations such as digital repositories (e.g., servers).

Hand-held fire extinguishers should contain CO2. Water, foam, and powder, the most popular agents used in office-type extinguishers, must not be used. Although these are chemically harmless, the removal of the fine dust from powder extinguishers from contaminated audio-visual carriers is extremely time consuming and sometimes not sufficiently achievable.

### 3.3.1.8. Fire protection plan

Every AV archive should have a fire protection plan that covers the need to:

- Remove potential causes of fire.
- Create conditions that impede the spread of fire.
- Ensure the safety of staff, users, and visitors.
- Set up a fire evacuation plan for particularly valuable AV material.
- Install fire-extinguishing devices that cause minimum damage to AV material while ensuring that the fire is extinguished with minimum losses.

It is the emergency manager's responsibility to set up an evacuation plan for staff, users, and visitors. This includes sufficient fire exits and unlocked fire doors in case of fire. Furniture blocking fire doors has to be removed instantly. Evacuation plans have to be tested in regular intervals by unannounced fire drills.

## 3.3.2. Water

Most disasters affecting archives involve water damage. The water can originate from a variety of sources. How does water enter an AV archive? Basically, it can come from all sides: from the ceiling, from the floor, from walls, due to burst water pipes, due to a leaking roof, due to blocked drains, from cyclone damage, as a result of ageing, of bad maintenance, or often as a result of fire extinguishing. All audio-visual materials are vulnerable to water, and the damage depends on the type of the material, the length of exposure to water, its temperature, or its pollution level. Consequently, all key personnel should be familiar with salvage methods for wet archival materials.

### 3.3.2.1. How does water influence AV carriers?

Water is the greatest natural enemy for all audio-visual carriers. It has direct chemical and indirect influences on the stability of carriers. Direct chemical influences are hydrolysis and oxidation of several carrier components as well as dissolution of some carrier materials. Hydrolysis (meaning dissolvable by water) is also an indirect and long-term chemical reaction involving water as the central agent, omnipresent in form of humidity in the air. Some polymers are prone to hydrolysis. Acids and metal ions act as catalysts in supporting such processes. The reaction changes the chemical and therewith the physical properties of the original polymer, often producing a by-product which acts as an auto-catalyst that enhances the destructive process. Some hydrolytic processes are (partly) reversible; some are not. A widely known hydrolytic polymer breakdown is the so-called vinegar syndrome.

### 3.3.2.2. Direct contact with water

Direct short contact with water is only dangerous for some kind of instantaneous discs, especially those made from gelatin or cardboard. For the majority of carriers water is not immediately dangerous, as long as the contact is short, carriers are carefully cleaned if water was dirty, and carriers are thoroughly dried in due course. The major problem with carriers exposed to water influx is the logistical challenge of cleaning and drying the contaminated carries, specifically of magnetic tape cassettes. Another logistic problem is the separation of carriers from paper and cardboard materials, such as LP albums, tape boxes, and other paper-based containers, and the drying of those, before they become affected by mold and fungus. If greater quantities are affected, vacuum freeze drying, successfully developed for the rescue of paper and book materials, may be the only chance to safeguard paper and cardboard materials accompanying audio-visual material. The applicability on audio-visual carriers themselves, specifically on magnetic tape, has, as yet, not been sufficiently investigated.

Oxidation is another chemical reaction triggered by water. It is a potential threat to non-oxidic pure metal particle magnetic pigments, as used for compact cassettes IEC IV, for R-DAT and for most digital video formats. Oxidation also affects the reflective metal layers of optical discs, in particular aluminium and silver, except those having a reflective metal layer of gold. The polycarbonate substrate itself is water-resistant.

The following picture illustrates a water inrush that happened in the 1990s in the radio sound archives of my company on a Friday night at about 10pm. There had been a thunderstorm with an unusually heavy rainfall for several hours that resulted in rainwater seeping into a gap between the building's wall and an adjacent building. Fortunately, a staff member was on duty until midnight, and he succeeded in constructing several overflow tanks. Nevertheless, we had thousands of wet tape boxes that had to be removed and exchanged.


3.3.2.3. The indirect influence of water

The indirect influence of water relates to bio-degradation, specifically mold (fungus growth), which happens at prolonged exposure to relative humidities (RH) of 70% and higher, which may happen when drying actions after direct water contact are delayed. Fungi of various kinds are present everywhere in the world. They affect nearly all audio-visual carriers. Fungi "eat" the surface of analogue discs, which leads to excessive surface noise, specifically with wax cylinders. They grow on magnetic tape pigment layers, which renders replay difficult to impossible. Fungi are also known to affect CDs, rendering them unplayable. Chemical prevention of fungus must be seen critically, as unfavourable chemical interaction, specifically with the variety of magnetic pigment binder formulation, can never be safely excluded. Chemical treatment may also endanger the health of archive staff.

Because of its potential to directly and indirectly influence carriers unfavourably, fungus growth must be prevented by keeping relative humidity low. Any direct contact with water, where in principle permissible, must be kept as short as possible.

3.3.3. Further impacts

3.3.3.1. Earthquakes

Shelving may collapse and the contents may be thrown to the floor. Few AV materials can withstand such treatment. Fire and water damage often result from seismic activities.

The following photograph illustrate a disaster in the radio sound archive of my company when a young man tried to shift a stationary shelf loaded with approximately one thousand tape boxes. The effect was that the shelf did not move but toppled, dragging along all the following shelves like dominos. The impact of an earthquake could look like these.

3.3.3.2. Biological agents

Materials may be eaten, soiled, stained, and shredded. In humid and hot zones the risk of collection losses due to biological infestation is by far greater than those posed by chemical aging or mechanical damage.

3.3.3.3. Nuclear electromagnetic pulses (NEMPs)

For audio-visual preservation, the NEMP would be the one produced by a nuclear bomb. The strength of its magnetic field would depend on various factors (force of detonation, design of the bomb, most of all altitude of explosion), possibly strong enough to erase unshielded magnetic recordings, but also indirectly hazardous by destroying electronic hardware, electric installation and construction through fires caused by high voltages induced in metal conductors and short circuits.

Although, theoretically, audio-visual archives may be considerably endangered by NEMPs, their probability is extremely minimal. Protection against a NEMP for AV equipment and magnetic carriers can be provided by encapsulating them into a Faraday cage and by using appropriate protection circuits of all power lines (galvanic separation, excess voltage diverters). Buildings and single rooms can be protected by completely coating them with metal wire netting. Generally, the higher the frequency of the electromagnetic radiation there is, the smaller the meshes of the wire netting will need to be. As the spectrum of pulses is very broad, effective shielding will require a completely sealed shielding of electrically well-conductive metal sheeting, e.g., copper, which is well grounded.

## 3.4. Risk categories and examples

3.4.1. Four categories

| | |
|---|---|
| Category 1. | High probability, high effect: Fire, cyclone, flood, earthquake, dust storms, burst water main. |
| Category 2. | High probability, low effect: Leaking tap, poor environmental conditions, theft, vandalism. |
| Category 3. | Low probability, high effect: Earthquake, nuclear war, civil unrest, bush fire. |
| Category 4. | Low probability, low effect: Collapse of shelves, theft, vacuum cleaner malfunction. |

Risks are not static; they vary as conditions change.

3.4.2. Mitigating disasters

Most disasters in Category 1 cannot be prevented but the effect of some can be mitigated by implementing appropriate procedures. Preparedness plans are usually the most important in coping with disasters in Category 1, including:

- Insuring collections
- Creating and periodically updating contingency plans
- Assembling emergency supplies
- Allocating salvage priorities
- Identifying alternative storage sites
- Providing adequate fire protection
- Providing opportunities for staff to be aware of what is expected of them in the event of disaster.

The most common and repeated risks in Category 1 are water and fire related damages. The most feared is fire, representing the risk of total loss. Water extinguishes fire but also presents rapid destructive sequels such as massive fungus attacks or swollen supports. Most wet archival material is salvageable, so comprehensive preparedness plans for coping with water are essential.

The aim of a disaster plan is to minimize risks and to move as many as possible into Category 4.

## 4. The disaster plan

### 4.1. Basics

A disaster plan is a document with several sections that describe the procedures devised to prevent and prepare for disasters and those proposed to respond to and recover from disasters when they occur. It is advisable that a disaster plan engages the highest institutional level of authority, providing for its necessary allocations in the budget.

To increase the opportunity for a successful recovery of valuable records, a well-established and thoroughly tested plan must be developed. Disaster planning is a matter of basic security for any institution, its staff, and its collections.

A formal written plan enables an institution to respond efficiently and quickly to an emergency and to minimize damage to the building and its contents, holdings, and facilities. This plan must not be overly complex but rather emphasize simplicity in order to aid in response and recovery.

Due to the unique nature of every disaster, recovery plans can never be formulated in detail.

### 4.2. The disaster team

The responsibility for performing these tasks is allocated to various staff members who form "the disaster team." There are also suggestions for two or even three teams, one for prevention, one for response, and one for recovery, depending upon the size and complexity of the institution as well as the variety of its holdings.

The disaster team is headed by the disaster plan manager, along with one or more specifically identified deputies. The members of the disaster team must be selected from all relevant fields of the institution. The disaster plan manager must be given full support and all staff must know that in the event of a disaster this person and their deputy(s) speak with the full authority and responsibility of the entire institution.

The disaster team has primary responsibility and authority. Its members are responsible for the following tasks:

- To prioritize collections
- To prepare and distribute materials on alert procedures for staff orientation
- To establish and stock lockers/rooms with emergency supplies and equipment
- To train appropriate personnel in each unit
- To make sure that support staff is, in turn, trained in recovery procedures

It goes without saying that human life takes precedence when formulating the priorities of an emergency plan. A rescue plan for personnel will usually take into consideration a number of points, including:

- General emergency procedures
- Building alarms
- Evacuation instructions
- Health services for emergencies
- Power outages
- Elevator safety instructions
- Correct procedures to follow in the event of bomb threats or explosions
- Correct procedures in case of chemical spills, fire, and flood

### 4.3. Four phases, four plans

Every disaster passes through a temporal development characterized by three parts: Before, During, and After. Therefore, a comprehensive disaster plan consists of several independent but interrelated smaller plans in order to cope with each of these sections.

In the Before-part, which corresponds to everyday routine operations, two phases should be distinguished: a *mitigation/prevention phase* and a *preparedness phase*. For both phases different plans should be in operation.

In the During-part a response to the disaster must be made. The effectiveness of the *response phase* is governed by the thoroughness of the preparedness plan.

In the After-part, plans for a *recovery phase* are implemented.

In each of the four phases and their respective plans it is essential that consideration is given to all areas likely to be affected by the disaster. These areas are:

- Personnel including staff, users, and visitors.
- Collections, holdings, and records, including all categories of archival records, in particular sound and video recordings and their related catalogues and backup materials. It is also important to consider the protection of the institution's vital records.
- Building(s) and facilities, including equipment, vehicles, air conditioning plant, plumbing, electrical services, and computers.

The following section outlines recommended action in all four phases, but prevention is the best protection against disaster, natural or man-made.

4.3.1. Phase 1: before | disaster mitigation and prevention plan (DMPP)

Any DMPP should consider three objectives—detection, awareness, and control—and should recommend actions that will prevent most disasters, that is to analyze, identify, and minimize the risks posed by the building, its equipment and fittings, and the natural hazards of the area. All preventive activities should be incorporated into the day-to-day operations of the institution. They include recommendations such as the repair of leaking roofs, the improvement of maintenance, or the upgrading of security measures. Absence of a DMPP can translate into risk increments. Insurance companies often request copies of written plans before issuing policies, most surely in the case of digital archives.

4.3.1.1. Recommended basic actions

A) Conduct a risk analysis:

- Identify those occurrences that pose the greatest threat to the institution and its collections.
- Develop procedures to eliminate those risks or reduce their impact should they occur.

B) Identify existing preventive and preparedness procedures, if the institution already has them. Such procedures will range from security measures, storage procedures, and cleaning practices—through binding and fumigation operations up to fire safety precautions.

C) Make recommendations to implement additional preventive and preparedness procedures, mainly to prepare for high probability disasters.

D) Allocate responsibilities.

E) Devise procedures to respond to and recover from disasters.

4.3.1.2. Recommended further actions

A) Check the place of the collection in its building; neither the basement nor the attic is an optimal place.

B) Assess what emergencies have occurred in the past and their potential for recurring in the future.

C) Assess the prevailing climate, in particular assess climate changes, and whether those changes have affected, or will affect, the capacity of the premises to continue to act as a protective and safe environment for the collections. Geo-climatic changes speed up a building's breakdown, causing materials to fail before what is normally expected.

D) Changes in use of the premises can generate unexpected risks. Carry out closely and critically an inspection of the building and its location; are there material failures accumulated with age, are there original or aggravated defects, has maintenance been neglected through the years?

E) Alter factors that constitute a potential hazard.

F) Establish routine housekeeping and maintenance measures to withstand disaster in buildings and surrounding areas.

G) Install automatic fire detection and extinguishing systems, and water-sensing alarms.

H) Take special precautions during unusual periods of increased risk, such as building renovation or repair works. Welding operations should be executed only when a supervisor is present since sparks of a welding apparatus can produce fire.

I) Make special arrangements to ensure the safety of archival material when exhibited.

J) Provide security copies of vital records such as collection inventories, and store these off-site. Identify important items in the collections. Have comprehensive insurance for the archives, its contents, the cost of salvage operations, and potential replacement and restoration of damaged materials.

K) Protect IT-equipment (e.g., computers, servers, network devices, and mass stores) through provision of uninterrupted power supplies. Natural and man-made hazards such as floods and fire affect digital collections in the same way as traditional holdings. However, digital collections are extremely susceptible to the world of technical risks such as hackers, viruses, worms, and Trojan horses with fraudulent intention. Also, mistakes by staff or misuse by users or visitors are hazardous. Backups must be made and security copies must be stored at different sites to safeguard data on IT-equipment before a disaster strikes. A lack of standards and the update or change of a platform may result in inaccessible data. Inadequate maintenance of hardware as well as software will cause data loss. Regular "data refreshment" will prevent irretrievable data loss.

4.3.2. Phase 2: before | preparedness plan (PP)

4.3.2.1. Recommended actions

A Preparedness Plan (PP) is designed to ensure that identified disasters can be managed. PPs recommend the following types of actions.

A) Determine, acquire, and keep together supplies and equipment required in a disaster and maintain them. Supplies could include:

- Plastic sheeting
- The provision of freezing facilities
- Plastic garbage pails
- Large sponges
- Pails and buckets
- Flashlight with extra batteries
- Protective clothing (plastic aprons, gloves, boots, etc.)
- Blotters to absorb standing water
- Inventorying materials (paper, notebooks, soft pencils, waterproof felt tip pens, colored pressure sensitive tape)
- Scissors, knives
- Duct/boxing tape, first aid kit
- Further: wet-or-dry vacuums, large fans to circulate the air, water-proof tape to seal leaks in pipes, battery-operated emergency lighting, emergency air support systems, zip-lock bags, plastic bubble wrap, a large quantity of absorbent paper towels.

Such supplies are useless if they are not readily available at all times of the day or night. Supply lockers and rooms with emergency equipment must remain unlocked at all times and be checked regularly and replenished as needed.

B) Regularly train staff to enable them to respond to a variety of disasters.

C) Establish and train an in-house response team and provide them with training in disaster response techniques.

D) Prepare and keep an up-to-date set of floor plans (blueprints) of the building(s). Identify and mark on these floor plans the locations of irreplaceable and important material for priority salvage. Also mark these blueprints with such information as:

- Previous problems (leaks, chemical problems, etc.)
- Place of the alarm boxes

- Location of emergency supplies
- In the event of the failure of lighting: what is the physical arrangement of the area so that personnel can move around with some confidence (where are the aisles, if using compact shelving, where are the controls to shift the stacks, etc.)
- Building floor-plans with locations of cut-off switches and valves
- Location of the sprinkler and other water shut-off valves; who has the keys to access them and authority to shut them off
- Place of the electrical switches, the master electrical boxes and shut-offs
- Place of hand-held fire extinguishers
- Escape routes

Distribute these blueprints to appropriate locations on- and off-site. They should be located in multiple, readily accessible places, not just locked in the director's office. Some of the areas where they should be placed are in the security office (if there is one), with the local fire department, and at the home of key staff members.

E) Keep an up-to-date inventory of all holdings.

F) Create a list of names, addresses and home telephone numbers of personnel with emergency responsibilities.

G) Create a list of names, addresses and home telephone numbers of the in-house disaster response team.

H) Create a list of names, addresses and home telephone numbers of trained conservators with experience in salvaging water-damaged materials, resource organizations, and other facilities able to offer support in the event of a disaster.

I) Create a list of disaster control services, in-house supplies, and equipment.

J) Create a list of suppliers of services and sources of additional equipment and supplies, including names of contacts and home telephone numbers.

K) Make arrangements to access freezing facilities if needed.

L) Make arrangements for funding emergency needs if needed.

M) Make copies of insurance policies.

N.) Prioritize collections to determine what is to be salvaged first. Most of us do not realize fully that time is a premium when an emergency takes place. Staff must be made aware of this decision and must be properly trained in how to evaluate the situation to determine if there is time to salvage even the most valued items in the collection. The staff should be trained to know how to handle those items.

O) Institute procedures to notify appropriate people of the disaster and assemble them rapidly. Install contacts to all relevant external security units, e.g., the fire department or civil defence bodies, by way of an invitation to participate in a workshop, seminar, or inspection routine to introduce the institution, its mission, its personnel, its holdings and collections, and its installations.

Preparedness must include an established communication system—a telephone tree, for example, with appropriate 24-hour contacts for the local fire department, the security office, engineers, and the staff of each unit. This information should be clearly posted for all to see and should be part of the at-home requirements of those in areas of responsibility and authority, and should have clearly designated alternates in the event someone cannot be reached.

4.3.3. Phase 3: during | response plan

When disaster strikes, a response to it must be made.

4.3.3.1. Recommended actions

A) Follow established emergency procedures for raising the alarm, evacuating personnel, and making the disaster site safe.

B) Contact the leader of the disaster response team to direct and brief the trained salvage personnel.

C) When permission is given to re-enter the site, make a preliminary assessment of the extent of the damage and the equipment, supplies, and services required.

D) Stabilize the environment to prevent the growth of mold.

E) Photograph damaged materials for insurance claim purposes.

F) Set up an area for recording and packing material that requires freezing, and an area for air-drying slightly wet material and other minor treatment.

G) Transport water-damaged items to the nearest available freezing facility. There is a maximum of 48 hours before hazards such as mold growth would begin. Even before that, binders will break down and paper will dissolve; ink on labels will run or be washed off; the building structure can be severely damaged; electrical circuits can be overloaded; and short-circuits can result in electrical fires.

4.3.4. Phase 4: after | recovery plan

4.3.4.1. Recommended actions

A) Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.

B) Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options and obtain cost estimates.

C) Develop a phased conservation programme where large quantities of material are involved.

D) Discard items not worth retaining and replace items not justifying special conservation treatment.

E) Contact insurers.

F) Clean and rehabilitate the disaster site.

G) Analyze the disaster and improve the plan in the light of experience.

## 5. How to avoid failures

Emergency preparedness must be viewed as an ongoing process, consciously and methodically cultivated so that it becomes ingrained into the very fabric of the institution; it must be a collective endeavour. A disaster plan must necessarily involve personnel from all functions and disciplines. It must concern itself not only with storage and preservation specialists, but also with engineers, technicians, senior administration, management, and the full range of service groups of the institution. It is important to revise the disaster plan frequently on a regular scheduled basis and to ensure that every staff member is familiar with its contents. One of the best methods of maintaining staff awareness is to practice the plan regularly. The key element in avoiding failure is for all staff, especially for senior staff, to remain committed to the plan.

## 6. Conclusion

Natural adversities or man-made disasters can take place day and night.

Be prepared for any type of disaster. Contact and consult both archives and archive associations to share information and experience with a view to regional co-operation.

Take advantage of educational sessions, particularly disaster planning workshops and preparedness exercises.

Seek expert advice and help from the preservation offices of national and international disaster management institutions.

Far more crucial than hours invested in restoration of AV carriers is the identification of liabilities and responsibilities and the eradication of hazards such as bad habits among staff, environmental laxness, inadequate shelving, missing safety devices, or non-compliance of safety measures, to name but a few.

Prevention is always better than the cure—concentration on efforts for prevention is absolutely recommended.

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