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**Archive, Gedächtnis und Wissen**



# Preservation - Fire Fighting

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**Fire Prevention, Detection and Suppression in Archives**  
**A Survey of Regulations in Australia, France, Italy, New Zealand, Spain, Sweden, United Kingdom, USA**  
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## **1. Introduction. Why this study?**

The purpose of the present study is to explore the possibility of drafting general guidelines for the design of new archive buildings, or the restructuring of existing ones, on the basis of a comparison of the relevant standards in a number of nations.

As a first phase, we chose to survey the specifications concerning the protection against fire risks, as it is obvious that the control of such risks is one of the most important factors for the survival of the documents stored in archives.

The survey examines specifications about fire prevention, fire detection and fire suppression in eight countries (Australia, France, Italy, New Zealand, Spain, Sweden, United Kingdom, USA) which were selected because they were represented in the ICA/CBTE Committee and their representatives supported the project by providing copies of the national specifications. A list of the 8 specifications that we were able to use is annexed to the present paper.

Even if the study is limited to a single topic and to a small number of nations, we cannot claim that it is a complete survey because fire regulations concerning state archives invariably refer to local building codes and general fire prevention regulations which in most cases were not available to us.

A complete analysis would require, therefore, a massive search job and a detailed analysis for the extraction from the general documents of the information that is relevant to archive protection.

The material we collected was divided into two main groups and each of these into several subdivisions, as indicated below.

### Fire prevention:

- Fire escapes, crowding (exit routes and maximum crowding allowed);
- Fire hazards, electrical;
- Fire loads and fire compartments;
- Fire resistance of doors and partitions;
- Shelves in the repositories (rules concerning fire risk);
- Ducts (chimney ducts, flues);- Inspection and maintenance (concerning fire hazards and fire suppression equipment);

### Fire detection and suppression:

- Fire detection;
- Automatic fire suppression;
- Fire suppression, hydrants;
- Fire suppression, extinguishers.

The first stage in processing the information that we collected was a compilation of abstracts of the relevant parts of the specifications, arranged by nation.

Next, the topics listed above were separated and a synthesis of the relevant information was placed in into comparative tables, one column per nation.

A further step towards producing a readable report was the drafting of three review papers discussing areas in which the comparison of the national specifications appeared to yield the most interesting results, namely:

- some topics in fire prevention: fire resistance of walls and doors, fire loads, compartments;
- fire detection;
- fire suppression, portable and automatic.

All of this material will not be presented at the ICA general meeting, for obvious reasons, but will be made available on the ICA/CBTE internet site to persons wishing to get more detailed information on specific points.

The paper presented at the ICA Congress is a shorter compilation, summarising the three review papers mentioned above, in order to fit into the 6000 words limit set by the organisation.

## **2. Fire prevention**

### **2.1 Fire resistance ratings – walls and partitions**

The resistance to fire of structural material is normally expressed as the time (in minutes or hours) for which the material can stand a fire from one side without losing its ability to protect persons or properties on the other side.

Ted Ling in his book [1] states that normally a fire resistance rating is composed of three numbers representing structural adequacy, integrity and insulating capacity of the material or structure; he does not quote, however, the actual ratings required to qualify a material for use in archive buildings and archive repositories in Australia.

In some of the other nations included in our study, fire resistance ratings of structural materials or partitions are included in the building specifications, but always as a single figure.

Michel Duchain [2] cites a rating of 120' for walls and floors in his book on Archive Buildings and Equipment, but no fire resistance rating appears in the documents emanating from the Archives Nationales de France.

A 120' rating for all partitions is applicable also in Italian Archives (according to Presidential Decree 418/1995), in Swedish Archives (according to the Statute Book SEC 8559/95) and in US Regional Archives (according to the Regional Archives Prototype). In the latter case, there are reductions in the rating for load bearing walls outside the repositories (90'), roof construction also outside repositories (60'), partitions between miscellaneous storage rooms (60'), exterior walls non-load-bearing (0).

The US NARA 1571 specification (emanating from the National Archives) sets down no rating figures and refers to NFPA 232-2000 (not available to us so far) for further details.

In United Kingdom's BS 5454.2000, the fire rating is limited to the structure of the storage area and to all sectioning walls inside it and the rating indicated (240') is well above the Italian, Swedish or US-regional requirements.

The most detailed treatment of fire resistance of structures in archives is offered by the Spanish specification "Recomendaciones para la edificacion de archivos" where the archive building is divided into sections according to the functions and specific ratings are attributed to each section, with a further differentiation into 4 categories according to the dimension of the building.

Insofar as repositories are concerned the required Spanish ratings are equal to the British ones (240') only for the largest buildings. The actual ratings are:

- 120' in category 0 (building up to 5 m height, 500 m<sup>2</sup> useful surface per floor)
- 120' in category I (building up to 8 m height, 700 m<sup>2</sup> useful surface per floor);
- 180' in category II (building up to 11 m height, 1000 m<sup>2</sup> useful surface per floor);
- 240' in category III (building with no limit of height and of useful surface per floor).

The fire ratings also equal the British ones in the computer room (240' in all categories) while lower ratings are required for less sensitive areas such as meeting rooms (60', 90', 120', 180') or offices (0', 0', 90', 120').

No fire resistance data are included in the New Zealand specifications that we collected so far.

### **2.2 Fire resistance, doors and other closures of openings in firewalls**

Australian specification AS 2118.1 states that all openings in firewalls must be closed by imperforate materials which are non-shatterable under fire conditions, but no testing method is indicated.

In France, only the 1966 document by the Direction des Archives de France mentions fire resistant doors, and these are required to conform to another specification emanating from the Ministre de l'Intérieur (1965). Today there is, most probably, an official document setting the rules of fire protection in public buildings and such rules are applied also to archive doors and partitions, but we have not found it yet.

On the contrary, Michel Duchein's book contains a description of fire resistant doors and the mention that they should sustain the attack of fire for one hour without distortion. Doors in theory should be always closed, but in practice they may be kept open when needed, but in such a way that they can be automatically closed if a fire alarm is given. Anyway, it must be possible to open the doors from inside without difficulty (in case anybody is trapped inside).

In Italy the Presidential Decree 418/1995 requires a fire resistance rating of 120' and the use of doors with automatic locking devices in the storage areas.

In the Spanish document "Recomendaciones para la edificación de archivos" it is specified that:

*"- in the repositories the doors shall be fire resistant metallic doors RF-90, anti-panic locking with an automatic mechanism that closes the door in case of a fire alarm;  
- doors in the working areas shall be like the ones in the repositories but may be substituted by cellulosic or synthetic materials treated for fire resistance;  
- doors in the other parts of the building shall be conventional ones unless NBE-CPE-96 requires the use of fire resistant doors;  
- metallic doors shall have sufficient clearance to avoid that thermal expansion may block them in case of fire."*

The RF-90 class required for the doors by NBE-CPE-96 (not available to us so far) might well imply a 90' resistance rating. It is interesting to note that the clearance requirement indicates the worry that the door might become locked because of thermal expansion caused by the heat of the fire (Duchein mentions the distortion of the door as the danger).

According to the Swedish Statute Book SEC 8559/95 the doors of the repository shall be self closing and the windows of the repository shall be so designed that they do not reduce the fire protection. Shutters shall have the same fire protection class as the rest of the wall, i.e. 120'; also fire classified window panes may be used. This is the only document, among those we studied, that mentions the existence of windows in the documents storage area.

The British BS 5454.2000 requires that doors and all openings in fire resistant walls, including ducting, should be effectively fire and smoke resistant to the same extent as the walls that contain them (240' in the case of storage areas). No door should have a grille or other opening that would allow the passage of air. Any door or shutter assembly should be self-closing in the event of a fire. The passage of electrical cables through walls must be fire stopped.

In USA the NARA 1571 specification mentions only that penetrations in the walls must not reduce the specified fire resistance ratings. If we assume the same ratings required for walls in the Regional Archives Prototype apply, then the ratings for doors and other closure systems in the repository walls would be 120'.

In conclusion, the fire ratings for doors, and other systems of closing openings in firewalls, appear to be spread between 60' and 240' in the documents that we were able to study, the highest rating being that required by BS 5454-2000. The same was true in the case of walls. The most frequent figure is 120', specified in Italy, Sweden (if we take the rating for windows shutters) and US regional archives.

Fire resistance ratings for doors etc. are not indicated in Australia and New Zealand in the specifications relevant to archive buildings that we had at our disposal so far.

### 2.3 Combustibility of materials, including furnishings and finishes

Besides the fire resistance ratings of structural materials and partitions, frequently the archive specifications consider also the degree of combustibility of materials to be used inside archive buildings. In some specifications we find only such general statements as "*the ensemble of materials shall be non combustible*" (La Pratique Archivistique Française, Annexe 1) or "*materials, surface layers and coverings shall make a negligible contribution to the spread of fire within the premises*" (Swedish Statute Book SEC 8559/95).

In other cases the non-combustibility requirement is limited to a particular part of the building, e.g. "*storage areas should be free of internal hazards, such as flammable finishes or furnishings*" (Storage Standard, National Archives of New Zealand) or to a particular part of the equipment as in British Specification BS 5454-2000: "*electrical cables must have flame retardant insulation, according to BS 4066-3, LSF type (low smoke & fume)*".

In the US Regional Archive Prototype a combustibility test (ASTM E-84) is specified, in addition to other requirements listed in the national building code for sprayed-on fireproofing (cementitious or fiber). The data reported in the document concern the surface burning characteristics: a maximum flame spread rating of 10 for concealed fireproofing, a maximum flame spread rating of 5 for exposed fireproofing, and a smoke development rating of 0 in all cases.

In two nations (Italy and Spain) a general combustibility rating is indicated. In Italy (Decreto del Presidente della Repubblica 418/1995) the combustibility is rated on a scale from 0 (incombustible) to 5 (highly combustible). According to the decree, floor materials shall not exceed class 2, while materials that may ignite from both sides and padded furniture shall not exceed class 1.

In the Italian system, the rating of the combustibility of all materials (structure and furnishings) present in a given section of the building is tied to the concept of "fire load" (see next paragraph) used to define the total quantity of combustible material existing in that area.

In Spain combustibility grades are given on a scale starting from M0 (minimum combustibility) and including at least three more steps M1 to M3, but very likely going up to a M5 level (we could not see the relevant specification, NBE-BCE-96, but we think that the scale of combustibility might be similar to the Italian one). In the Spanish table the maximum combustibility allowed for walls, floors, roofs and ceilings is specified in each section of an archive building, according to the degree of risk existing in that area.

#### **2.4 Fire compartments and fire loads**

In most specifications it is recommended that, in order to achieve a satisfactory protection against fire, archive buildings should be divided into compartments separated from the rest of the building by fire resistant walls.

The Australian specification AS 2118.1 includes a definition of the term compartment: "a space completely enclosed by walls and a ceiling. The walls may have openings to an adjoining space, provided there is a minimum depth of 200 mm from the ceiling to the top of the opening." But this is not followed by an indication of the desirable dimensions of the compartments, the fire resistance of the separation walls nor the amount of combustible material that is allowed inside.

The French documents do not offer definitions or detailed data on the characteristics of compartments, aside from the fact that Michel Duchéin in his book [2] insists on the concept that the storage area must be isolated from the rest of the building to ensure its protection against fire.

As mentioned above, in Italy the concept of compartment is tied to that of fire load: according to the Decreto Ministero Beni Culturali e Ambientali 569 (1992), "fire load" is the amount of heat that can be produced by burning all combustible material present in a compartment; it is expressed as the amount of wood per square meter that would produce the same effect. It is specified that any increase of the fire load of any room caused by the introduction of combustible furniture is forbidden. If the fire load of a compartment exceeds 50 kg/m<sup>2</sup>, an automatic fire extinction system must be installed. These requirements are amplified by the Decreto del Presidente della Repubblica 418 (1995) stating that the fire load due to furniture and stored material (with exclusion of structures and door or window frames) shall not exceed 50 Kg/ m<sup>2</sup> in any single room.

Also in the archives regulations of other nations we find the concept of avoiding an excessive concentration of combustible material in a single area and the prescription of a subdivision into fire resistant compartments above a given limit of potential danger.

The Spanish Recomendaciones Para la Edificación de Archivos (1997) specify that the maximum extension of a non-partitioned section of repository is 200 m<sup>2</sup>. The table annexed to the Recomendaciones sets down the fire compartments in which an archive building is to be divided and defines the minimum fire resistance rating of all structural and limiting elements and also the maximum degree of combustibility authorised for the materials present in the compartment. Another requirement of the Spanish recommendations is that the repository shall communicate with other sections only through fire resistant vestibules (as defined by NBE-BCE-96).

The notion of "filter areas" connected to sensitive sections in a public building is present also in the practice of fire protection planning in Italy (but is not codified in legislation concerning archives) as the Fire Authority ("pompieri") may request the creation of smoke free (ventilated or overpressured) filter areas ("filtri") connecting some fire compartments to the rest of the building.

The concepts of fire compartment and fire load is found also in the National Archives (Sweden) Statute-Book SEC 8559/95 where "fire cell" is a space separated in such a way that a fire there can be prevented from spreading to another space in the building within a certain length of time. "Fire load" in a fire cell is the total amount of heat, expressed in MJ/m<sup>2</sup> (mega-joules per square meter) released by complete combustion of all materials in the fire cell (including structures). Repositories shall constitute an individual fire cell; sectioning is necessary if the repository is larger than 1200 m<sup>2</sup>. The sectioning shall have a fire-limiting function for 60 minutes. In a letter to Bertini, dated 19/8/2002, Alain

Droguet reported that the Swedish Archives were now planning to express fire loads in MJ/m<sup>3</sup> (mega-joule per cubic meter), which should be more suited to high rooms, and also that the dimension of 1200 m<sup>2</sup> for the repository compartment was considered excessive.

Also British Standard BS 5454.2000 mentions the fact that the repository may be divided into compartments. It goes on to explain that when the repository is divided into compartments, internal/external walls, floors, ceilings and doors between storage compartments, and doors between storage and other areas of the building, should be constructed so as to prevent fire, water and smoke from spreading into a neighbouring unit, but it sets no limit to the dimensions of the compartments or to acceptable fire loads, in or around the repository.

In US the NARA 1571 specification offers a definition of the record storage fire compartment (without actually using the word compartment): “*Record storage area means an area containing archival records that is enclosed by four firewalls, the floor and the ceiling. The term includes general stack areas, vaults, and storage areas for exhibits and museum objects, but does not include reference space, staff offices, public spaces (e.g. restrooms and lobbies) or processing areas.*” Fire loads, and their relation to the dimensions of the areas, are not mentioned. In the document Architectural and Design Standards for Regional Archives the importance of the creation of compartments is repeatedly stressed:

*“Fire protection for regional archives consists of non-combustible construction materials and building elements, including walls and floors; compartmentation of spaces through the design of walls and spaces that prevent the migration of fire and smoke to other spaces of the building until the source of fire and smoke can be eliminated.”*

Also the division of the storage area into compartments is considered a critical element of fire protection design but, as in the case of BS 5454, no data on the desirable dimensions of the compartments are offered and fire loads are not mentioned.

### 3. Fire detection

#### Summary of detector types mentioned in fire protection for archives

| Nation         | Types of detectors   |
|----------------|--|
| Australia      | Heat/Smoke <i>for paper storage</i><br>VESDA (Very Early Smoke Detection Apparatus)<br><i>for photographic, magnetic and misc. materials</i> |
| France         | Smoke or Combustion Gases (Ionisation)<br><i>for repositories</i><br>Heat or Flame (infra-red) <i>for other areas</i>                        |
| Italy          | Type not specified   |
| New Zealand    | Heat and Smoke   |
| Spain          | Smoke  |
| Sweden         | Smoke  |
| United Kingdom | High sensitivity, early detection system<br>Smoke, Heat or Flame   |
| U.S.A.         | Smoke (NARA 1571)<br>Ionisation (Regional Archives)  |

The type of detector most frequently mentioned in the national documents we studied is Smoke (7 mentions on 8), followed by Heat (3 mentions, plus 1 for use out of repositories), Flame and Combustion Gases/Ionisation (both 2 mentions).

It is important to note that the most recent specifications (Australia, UK, US) tend to stress the importance of an early response: “very early (VESDA)” for special materials in Australia, 5 minutes for any case in US (Regional Archives).

A factor that does not appear to be sufficiently considered in the national specifications for the fire detection in archives is the risk of false alarms, because in most cases the detection system is required to trigger the automatic fire suppression system (a notable exception to this is Sweden, where no automatic fire suppression is foreseen). An

unnecessary fire suppression discharge is not an event to be taken lightly in an archive repository because it may either cause damage to the stored material (in the case of water sprinklers or nebulizers) or may involve a considerable cost for the recharge (case of the clean gases). A false alarm may be caused by an accidental surge of smoke, dust or heat not connected to a fire, or to electromagnetic fields produced by many types of common use equipment (e.g. cell phones); the latter disturbance showing a continuous increase in the latest years.

According to some industrial literature (Siemens Cerberus) false detection of fires is avoidable through the use of dual detection systems and an “intelligent” software that must be specifically calibrated in each case.

Some specifications reviewed here do mention the fact that fire detection must be entrusted to systems of detectors, e.g. the US Regional Archives document stating that “*such systems shall be fully addressable, direct digital control systems*”, but no description of their characteristics is provided.

Although it is possible that the description of the software governing fire detection systems is covered in the general national specification that is cited in several cases (i.e. NFPA 72, National Fire Alarm Code for the US) we believe that a further study of the specifications of fire detection systems suitable for use in archival repositories would be useful.

## 4. Fire suppression

### 4.1 Portable fire extinguishers

In Australia the type of extinguisher depends upon the material stored. If the stored material is paper, specification AS 2118.1 (1996) requires the presence of extinguishers without definition of the type, whereas in the case of photographs, magnetic recordings and miscellaneous materials carbon dioxide extinguishers are specified.

In France, the most recent document emanating from the Direction des Archives Nationales (La Pratique Archivistique Française, Paris, 1993, Annexe 1) doesn't mention fire extinguishers; they are discussed in great detail by a much earlier document, a “circulaire” of 1966 (Direction des Archives de France, Circ. AD 66-35, 26 Sept. 1966). Following a general statement that “*fire extinguishers are never too many*” and that there always should be two of them in each room, if they are of large dimensions. Seven types of extinguishers are compared:

- a. water jet
- b. water spray
- c. extinguishing liquids (containing water)
- d. foam
- e. carbon dioxide snow
- f. powder
- g. hydrocarbon halides.

The French document of 1966 reaches the conclusion that water spray extinguishers are the most suitable for archive storage rooms as they are less damaging for the documents than the water jet types. They may even be used on electrical equipment, if the voltage is not very high, but it is mentioned that powder and carbon dioxide extinguishers are the most suitable for fire suppression on any kind of electrical system. The preference for water spray extinguishers in 1966 may have to be reconsidered now because the 1993 document mentions the damage that water may inflict to the stored documents and formally forbids the use of water sprinklers as an automatic fire suppression system in storage rooms.

In Spain, the document emanating from the Subdirección General de los Archivos Estatales includes a detailed table where the number and type of extinguishers to be placed in each area of an archive are specified. In storage areas it requires the presence of 2 extinguishers (per room, we suppose) of the powder type, model 13A (the latter classification is not explained in the document, as it is probably defined by a national specification).

The 2000 edition of the British Specification for archives (BS 5454) requires that in any location where fire protection is needed both a water type and a non-aqueous extinguisher be installed. The detailed specifications of the extinguishers are not included in this document.

In Italy the Decreto 569/1992 defines the area that can be protected by one extinguisher as a function of the risk level existing in a particular building (this area is 200 m<sup>2</sup> in a low risk building) and the maximum distance to be covered (30 m) to reach an extinguisher. As to the type, we find only the general statement that for class A fires (solid materials) water, foam and powder extinguishers are the most frequently used.

Also the Swedish Specification for archives (SEC 8559/95) is concerned with the area coverage by the extinguishers (the distance to reach one of them must not be above 25 m) but does not set any requirements as to the type.

In the U.S.A. portable fire extinguishers are mentioned in the specification addressed to regional archives (Architectural and Design Standards for Regional Archives, 2000) but as to type, dimensions and number to be installed, the reader is directed to the national specification (NFPA 10) regulating the use of fire extinguishers.

The types of extinguishers mentioned in the specifications we reviewed are summarised in the table, here below.

#### **Type of portable extinguishers in national specifications**

| <b>Nation</b>                                      | <b>Extinguisher</b>  |
|--|--|
| - material in storage                              |  |
| <b>Australia</b><br>- paper<br>- photo/magn./misc. | - type not specified<br>- CO <sub>2</sub>                            |
| <b>France</b><br>- electrical equip.               | water spray (1966)<br>- powder or CO <sub>2</sub> (1966)             |
| <b>Italy</b>                                       | water, foam or powder<br>“most frequently used”                      |
| <b>Spain</b>                                       | powder, multi-use  |
| <b>Sweden</b>                                      | extinguishers required<br>but type not defined                       |
| <b>United Kingdom</b>                              | Simultaneous presence of water type<br>and non-aqueous extinguishers |
| <b>U.S.A.</b>                                      | archive specification refers to<br>NFPA 10                           |

#### **4.2 Automatic fire suppression systems**

Automatic fire suppression systems may be classified in two groups: water systems and gas systems. The water systems may be further divided into sprinkler and nebulised water types according to the dimensions of the water drops; in nebulised water, drops in the 0.1 to 0.001 mm are used.

In all groups some further subdivision is possible, according to the type of equipment and operational details; the systems used most frequently are summarised in the following table.

### Types of automatic fire suppression systems

|               |   |   |
|---------------|---|---|
| water systems | sprinkler   | wet pipe<br>dry pipe<br>pre-action<br>deluge<br>special systems   |
|               | nebulisation  | water only – high pressure<br>water only – low pressure<br>tangential flow<br>twin fluids (gas + water) |
| gas systems   | hydrocarbon halides (Halon 1301, FM 200, NAFS III)<br>nitrogen (Cerexen N2)<br>nitrogen + argon (Argonite)<br>nitrogen + argon + CO <sub>2</sub> (Inergen)<br>CO <sub>2</sub> |   |

Ted Ling [1] in his book, published in 1998, reports the results of his inquiry about automatic fire suppression systems in 19 archives situated in various parts of the world: in 5 cases no automatic system was available (Australia 1, New Caledonia 1, Great Britain 1, Sweden 1, Norway 1). Wet pipe sprinklers were used in 7 cases (Australia 5, New Zealand 1, USA 1) and dry pipe in 3 cases (Canada 1, Germany 1, Singapore 1).

Four gas systems are reported, all of them using hydrocarbon halides. Two of them were used in China (probably due for substitution as the use of Halon has been banned). NAFS III (which may be used up to 2015) was used in Korea and FM 200 (which probably will not be banned because it doesn't contain chlorine) in Hong Kong. At that date (before 1998) nebulised water or inert gas systems had not yet been used. The national specifications that we were able to gather show that the picture is evolving now.

In Australia (AS 43906 – 1996) a sprinkler system is required for paper documents, while in the case of photographic, magnetic and mixed materials a carbon dioxide system is specified. We are aware, however, that there is now a tendency to avoid carbon dioxide fire suppression systems because of the toxicity of the gas.

In France La Pratique Archivistique Française, Archives Nationales 1993, Annexe 1, requires that an automatic fire suppression system be installed in the entire archive building. Sprinklers are not allowed and a gas system using Halon 1301 (or equivalent) is recommended; a footnote warns, however, that as the use of Halon is now banned, it shall be substituted by an inert gas, such as Inergen.

In Italy the Decreto 569, 1992 relies mainly on fire extinguishers but mentions the possibility of installing automatic fire suppression systems in high risk areas, without mention of the type.

In Spain, the Recomendaciones para la Edificacion de Archivos, 1997 states that in storage rooms a nebulised water fire suppression system may be installed, but under the condition that the system be properly compartmentalised and that water pipes be empty (in a dry pipe system, water is pushed into the pipes by a pressurised gas, usually nitrogen).

In high risk areas (boiler room, fuel storage, electric generators, transformers) a gas system is required: CO<sub>2</sub> or inert gas or FM 200. (The document specifies that FM 200 is heptafluoro-propane and that inert gas systems may use nitrogen, or nitrogen-argon or nitrogen-argon-carbon dioxide.)

The Swedish specification SEC 8559/95 does not mention automatic fire suppression of any type.

In the United Kingdom specification BS 5454.2000 states that:

*“automatic fire suppression systems*

- for maximum protection the repository should have an automatic fire-suppression system that conforms to the appropriate part of BS 5306 and is designed to cause minimum damage to the stored documents if activated
- gas or water systems are acceptable
- where a water-based system is installed provision should be made for rapid drainage from all protected spaces

- *in general gas systems are only recommended for discrete spaces that can be made airtight*
  - *water-based automatic suppression (sprinkler) systems*
  - *where a water system is installed, its design should be in accordance with BS 5306-2 and an expert qualified in the use of systems in an archive or library should be consulted*
  - *the system should be monitored by water-flow switches so that any release of water activates an alarm*
  - *there should be strategically located valves to stop the water flow when the fire is extinguished; such valves should be secure against vandalism and tampering to ensure that the system remains operative*
- NOTE 1 particular attention needs to be paid to the routing of pipes and the position of sprinkler heads to ensure that the system is effective in archive and library shelving arrangements*
- NOTE 2 the use of pre-action sprinkler systems may reduce the possibility of inadvertent sprinkler discharge but at the risk of a delay in operation.”*

In the U.S.A. the Federal Specification NARA 1571-2002 requires that:

- a. “All record storage and adjacent areas must be protected by a professionally designed automatic sprinkler system that is designed to limit the maximum anticipated loss from any single fire event to a maximum of 300 cubic feet of records destroyed. Sprinkler systems for record storage areas must be separately zoned from other building areas.”*
- b. “A wet sprinkler system, installed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, must be used except as provided in subpart c.”*
- c. “Clean agent systems that comply with NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems, or pre-action sprinklers must be used in cold-storage vaults and museum storage areas. These systems also may be used in computer rooms and electrical and telephone closets.”*

The general picture that we gather from the review of national specifications is that English speaking countries (Australia, Great Britain, U.S.A.) tend to maintain sprinkler systems, in part probably to defend the investments done in the past, but provisions are introduced to reduce the risk of occasional discharge of water in the repositories.

In Europe, instead, the tendency to pass to more recent systems (gas or nebulised water) is favoured by the fact that few (or no) automatic suppression systems were installed in the past. In France sprinklers are banned in the most recent specification, while in Spain they are accepted only if they are of the “dry pipe” or “pre-action” type and as an alternative to a nebulisation system.

Actually Spain is the only country where nebulised water fire suppression is specified; the type proposed is a dry pipe system in which, after a fire alarm, water is pushed into the piping by a pressurised gas (usually nitrogen); this system has the advantage of not relying on a pump, a delicate item that requires frequent inspection and maintenance.

Nebulised water suppression was tested in one Italian archive (Agrigento), mainly from the point of view of potential damage to paper documents; a report written after the test claims that results were on the whole favourable, but further testing was advisable.

Fire suppression by inert gas (“clean agent”) is frequently specified for high risk areas and areas that can be made airtight.

## **Bibliography**

### Books

- [1] Ted Ling  
Solid, safe, secure. Building archives repositories in Australia  
July 1998
- [2] Michel Duchein  
Archive Buildings and Equipment. 2nd edition  
K.G. Saur, München, New York, London, Paris 1988

### **National Specifications**

#### **Australia**

AS 1851- Parts 1-10,1997  
Maintenance of fire protection equipment  
Part 1: Portable fire extinguishers and fire blankets  
(13-10-1995)

AS 2118 - Parts 1-10, 1999  
Automatic fire sprinkler systems  
Part 1: General requirements (163 pages)  
Note: (on an added sheet) : this document has expired  
Note: The complete specification includes 10 parts

AS/NZS 2293.1-1995 Emergency evacuation lighting for buildings.  
Part 1. System design, installation and operation  
Part 2: Inspection and maintenance.

AS 43906,1996 Australian Standard Record Management Part 6: Storage

#### **France**

La Pratique Archivistique Française, Paris, Archives Nationales 1993, Annexe 1

Direction des Archives de France, Circ. AD 66-35, 26 Sept. 1966

#### **Italy**

Regio Decreto 1564, 7 Novembre 1942  
Approvazione delle norme per l'esecuzione, il collaudo e l'esercizio degli impianti che interessano gli edifici pregevoli per arte o storia e quelli destinati a contenere biblioteche, archivi, musei, gallerie, collezioni e oggetti di interesse culturale.

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