Sprinkler Systems

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Résumé

Il existe deux avis concernant l'utilisation des sprinklers – système d'extinction automatique incendie – dans les musées et les bibliothèques. Certains pensent que les dégâts par l'eau causés par le sprinkler sont beaucoup plus conséquents que ceux entraînés par le feu. Cependant, les sprinklers aujourd'hui se sont perfectionnés et ils peuvent être utilisés dans les zones les plus sensibles d'un musée. Quel que soit le système d'extinction automatique choisi (alimenté en eau en permanence ou sous air après action), il reste bien préférable d'avoir à restaurer des objets qui ont été mouillés par le sprinkler, plutôt que de devoir assister passivement à leur destruction par le feu, faute d'avoir un système d'extinction automatique opérant.

What are the greatest threats (hazards) facing your buildings and collections?

Imagine asking a worldwide audience of people responsible for preserving cultural heritage properties and/or their contents to list their response to that question. The responses received would probably vary by geographical location, and encompass a wide range of hazards and risks. Flood, earthquake, theft, insects, mold, fire, vandalism, time, volcano, etc., may be among those answers. Now imagine circulating these lists among the group, asking each person to strike from the lists everything that does not apply to them. Recollect the lists and you would probably find the one common threat everyone faces is FIRE. Fire is the single greatest threat all cultural institutions face; none are immune from it.

Damage from fire is usually permanent and irreparable. Objects reduced to ash can never be restored. Fire is also much more cunning and less discriminating than a thief. It can travel (spread) through very small openings and concealed spaces to reach other parts of a building, deprive occupants of a life supporting environment, and cause partial to total destruction. Unless cultural institutions develop plans for dealing with

this threat, they place their staff, visitors, collections, and buildings at risk. The complexity of these plans may vary from a simple evacuation plan, to a fire prevention program, to incorporating passive and automatic fire protection systems.

Ignoring the fire problem (which some institutions have been known to do) could someday result in charges of criminal neglect against irresponsible management officials should there be a fire resulting in an injury or loss. As a minimum, each institution should have an emergency self-protection plan that spells out how to report a fire and safely evacuate the building. A good fire prevention program which focuses on continuous staff training and awareness in both recognizing and eliminating fire hazards (ignition and fuel sources), may preclude most (but not all) fires from ever starting. Incorporating early warning fire (smoke) detectors, whose alarms are monitored and promptly responded to 24 hours/day, reduces the risk of a serious fire even further.

Is it enough to have an excellent housekeeping and fire prevention program, and to have incorporated a state-of-the-art fire detection system?

Most people would probably say yes, but actually no, fire is too unpredictable. Arson or other incendiary fires may be difficult to guard against. Lightning is a threat in certain parts of the world, and there are always the unforeseen careless actions we humans occasion. A fire detection system will be helpful provided that it 1) responds quickly to the fire condition (fire detectors react to very specific types of fire conditions, which may not always be present), and 2) human intervention is almost immediate. The latter point is especially critical since fire detectors can only detect a fire, and not extinguish it. Being properly prepared for a fire, however, means incorporating an automatic fire suppression system also. A suppression system, designed to quickly control or extinguish a fire that is beyond the means of a portable extinguisher, is the best insurance against a large loss fire. Speaking in global terms, the percentage of cultural institutions properly prepared for (protected against) fire is sure to be very small.

Most institutions still rely on their local fire brigade to handle all of their fire fighting needs. This was certainly the case for many institutions that completely burned to the ground or suffered heavy losses, despite the prompt response from well trained and equipped fire brigades. Immediately after the Windsor Castle fire (UK) in 1992, the Cabildo fire (US) in 1988, the Byer Museum (US) in 1984 (and probably many other cultural fires), government or museum officials were heard to have made remarks along the lines of *good thing there were no sprinklers, otherwise the (water) damage would have been much worse.* Why do so many myths and misunderstandings regarding automatic sprinkler systems remain entrenched in the minds of so many people in the cultural field today? Perhaps one answer is that television and movies have falsely portrayed their operation for decades (for special effects). These two medias frequently, and incorrectly, display sprinkler systems as deluge systems (i.e. all sprinkler heads discharging water simultaneously), and show them operating from the activation of a smoke detector or manual fire alarm. Many people in the cultural field also have an innate fear of having pipes filled with water overhead, a disaster waiting to happen. This fear is probably grounded in the many mishaps that occur with other piping systems, e.g. domestic water lines, roof and other drains, condenser lines, etc. Experience in the US and Canada has shown, however, that once educated about how sprinkler systems actually operate, their outstanding record for safety and reliability, and perhaps most importantly, their ability to drastically reduce water damage, people who were previously against sprinklers now favor them. Automatic sprinkler heads are manufactured in a wide assortment of shapes, sizes, styles, and even colors, to meet practically any aesthetic consideration. All sprinkler heads work basically the same way. Each sprinkler is held shut or sealed by an element that will melt or break away at a predetermined temperature (normally 57-77°C). In a fire situation, only the sprinkler head(s) nearest (exposed to) the fire will open. For a sprinkler head rated at 57°C, the temperature surrounding the head may be upwards of 300°C before it operates! In other words, sprinklers provide some measure of time for human intervention and extinguishment (and thus preclude operation of the sprinkler system), provided one knows there is a fire. Water leaving the sprinkler head is dispersed like rain onto the fire and its immediate environs. Typically, the water pattern covers a circular floor area of approximately 11 m^2. The vast majority of fires are controlled or extinguished by one or two sprinkler heads.

Sprinklers can be looked upon as individual firefighters, standing by 24 hours/day with their fire hose ready. The similarities end there however, as firefighters use much larger diameter hoses, which discharge larger quantities of water; heavy smoke may prevent firefighters from finding and directly attacking the seat of the fire; firefighters need sleep and breaks – sprinklers do not; and firefighters can be injured or killed. A typical sprinkler head may discharge 95 l/min, while fire hoses may discharge 550 - 950 l/min. Remember, almost all water discharged from a sprinkler head goes onto the fire; water from firefighting operations may not always be directed onto the fire, thus causing unnecessary damage. In the 1986 Los Angeles (US) Central Library fire, it is estimated that 11-15 million liters of water were used by the fire brigades to bring the fire under control. The post fire investigation report stated that had sprinklers been installed, only two sprinklers would have probably been needed (perhaps up to 1000 liters of water). Estimates on the amount of water used for the Windsor Castle fire are not available yet, but based on the duration and size of the fire, 50 million liters may not be unrealistic, and the fire damage was staggering. Had sprinklers been installed, perhaps less than one or two thousand liters of water may have been necessary, and fire damage would, again, have been limited to the area of origin.

With the information provided thus far, *can a rational conservator, curator, registrar, or other expert or authority in the cultural community claim that sprinklers would be worse than the fire?* Given a choice of having a wet object or a burned object, a wet object is always better. The fear of potential water damage from these systems, however, still remains high among those who do not fully understand them. What about accidental discharge due to system failure? Statistics kept by

insurance companies (who have to pay the claims), and fire/government organizations in countries like the US, Canada, Australia, and New Zealand, indicate that failure of sprinkler heads from manufacturing defect is less than one in a million.

Okay, so what about the water damage that occurs from the sprinkler head after the fire has been extinguished? True, most sprinkler heads will continue to discharge water until someone responds to close the valve, but help should be on the way as soon as the detection system or sprinkler water flow alarm occurs. In addition, there are sprinkler heads (and systems) available that automatically shut themselves (the water) off after sensing the fire is out, and are ready to cycle on and off should the fire rekindle. These types of sprinkler heads and systems are particularly appealing to a cultural institution, since only the bare minimum of water will be used to control or extinguish the fire. Conservators, preservationists, and others should be consulted for their preferences on selection of systems and heads where appropriate.

Now let's examine the various types of sprinkler systems available. Again, most people imagine that a sprinkler system represents an ever constant potential accident due to water being in the pipes. A wet-pipe sprinkler system is the most common system in use today, but only because of its tried and true reliability. Sprinkler systems have been in successful use for over 100 years. Installation of sprinkler systems is more strictly regulated than perhaps any other mechanical system in a building; requiring specific pipes, fittings, and valves, all of which must successfully undergo and pass rigid tests. But wet systems are not the only type available. In a pre-action sprinkler system, all pipes are dry, and water is introduced into the pipes only after a fire detection system has activated. The water, however, is not discharged until a sprinkler head activates. Simply put, a pre-action system converts a normally dry system into a wet-pipe system in the early stages of a developing fire. The advantage of this type of system is that should a pipe or sprinkler head somehow become damaged, no water would be released (very appealing to a cultural institution). The disadvantage to this type of system, is that more components must be installed and maintained to ensure the system will operate when a fire does occur. A third type of sprinkler system, a dry-pipe system, has normally dry pipes filled with compressed air which holds the water valve closed. Activation of a sprinkler head (or a broken pipe) releases the air, which in turn releases the water valve, allowing water to flow into the system and out whatever opening has been created. Dry-pipe systems are typically installed only in areas subject to freezing.

The first and single most important reason for having a sprinkler system is increased life safety. Sprinklers save lives! Many building and fire codes around the world now require installation of sprinklers in certain occupancies because of their proven life safety capabilities. It would be extremely rare to ever hear of a fatality occurring in a fully sprinklered building.

Can sprinkler systems be unobtrusively installed into historic buildings and other cultural properties? The answer is almost always yes! Sprinkler heads, as stated in the beginning of the paper, come in a wide variety of styles and colors. Concealed heads are completely invisible, hidden by small cover plates that are flush to and the same color as the ceiling. Some low profile and recessed heads only project from the wall or ceiling by one centimeter. Sprinkler piping can often be hidden along crown molding, or concealed within void spaces. Use of copper or plastic pipe can help reduce the size of the pipe, and sidewall sprinkler heads can be mounted along walls, often avoiding the need to run any pipes directly overhead. False soffits can also be created to hide piping and blend in architecturally. While there are certainly some spaces within a building where installation of a sprinkler system would provide little benefit (due to the construction and furnishing of the space), these situations are rare.

Is cost a reasonable excuse for not installing sprinklers? Too often the cry of *there is no money available* or *the system is too expensive* is heard as an excuse for not providing proper fire protection. That excuse can sound lame though, when there always seems to be money to rebuild after the fire (and include a sprinkler system in the rebuilding), and that cost can be hundreds to thousands of times more expensive than the cost of the sprinkler system. The cost for installing a sprinkler system in a new building in the U.S. is approximately $16.00/m² ($1.50/sq.ft.). This cost basis has remained unchanged for over 20 years! Retrofitting sprinklers into existing buildings can cost the same or much more, depending on the construction of the building, the architectural details, whether or not collections have to be moved or protected during construction, etc. Consider too, that some insurance companies offer substantial reductions on your insurance premiums for having such a system; in some cases the savings will pay for the cost of the system within a number of years! However, regardless of cost, the protection and peace of mind provided by these systems is well worth the investment. Unfortunately, it often takes a tragedy to rudely awaken people to the errors of their past. Money spent reactively is always considerably more than that spent proactively (something akin to preventative health care vs. heart surgery, or changing the oil in your automobile vs. having to replace the engine). The question isn't *can I afford to install a system?*, the question is *can I afford not to install a system?!*

The advantages to installing a sprinkler system in a cultural institution should now be obvious:

- minimize fire damage (your greatest threat) to the building and its collections;
- drastically reduce water damage (resulting from fire fighting operations);
- prevent injury or loss of life;
- proven reliability for over 100 years.

Cultural institutions and their collections should be viewed as monuments to humanity, to be preserved for perpetuity. Sometime in the life of a building a fire is likely to occur. It may not happen this year or next, or for the next 100+ years, but eventually it will. If proper fire protection safeguards are not provided, then individuals, nations, and cultures will continue to lose their heritage to fire. We cannot afford to take that risk when the technology and means to prevent it exists. Sprinklers protect and save lives. Sprinklers protect and save cultural objects and collections. Sprinklers protect and save historical buildings.