Safety Design to Preserve Artifacts and Critical Functions

Jeanne Tebera, is a senior electrical engineer with Henry Adams, LLC, a Baltimore mechanical, electrical and plumbing engineering design firm, who has 24 years of engineering experience. Henry Adams, LLC offers fire protection design services for educational and healthcare facilities, theaters, student centers, laboratories, churches, community centers, museums and government facilities, as well as preservation and renovation of historical structures.

Do you need any special education for integrating aspiration systems into fire alarm system design?

As a design firm, our company specifies and designs systems in order to provide biddable construction documents. To keep up with the latest in products and technology on the market, technical training seminars are attended. Our engineers also rely on their experience with designing fire alarm systems, so that the appropriate interfaces with the fire alarm systems are correctly specified.

In what applications has your company used aspiration systems?

Four years ago, our company was selected to design the fire alarm system incorporating the high-sensitivity smoke detection (HSSD), or aspiration system, for the National Park Service Hampton Mansion in Towson, Maryland.

Was this the first time you designed an aspiration system?

Our company has worked with aspiration systems in computer rooms. We replaced an entire fire alarm system where the building already had several aspiration systems in place. With the new fire alarm control panel, we provided interfaces for the aspiration systems, so that it would go into alarm when any of the control panels sent it an alarm signal.

Why was it important to integrate the aspiration system into your fire alarm system for the Hampton Mansion project?

There was a need to detect a fire in its very earliest (incipient) stage. Because the Mansion did not easily lend itself to alternative fire suppression systems such as water mist or chemical suppression, the main objectives were to protect the Mansion and all of the artifacts inside from fire, as well as water damage from the sprinkler system. Facilities personnel needed very advanced notice of an impending fire in order to investigate early, so that the activation of the automatic sprinkler system would only be a last resort.

The building is an artifact. It was owned by seven generations of the Ridgely family, including Charles Carnan Ridgely, one of Maryland's first governors. The house dates back to the 18th century and was turned over to the National Park Service after 1948.

In addition, the National Park Service acquired the Hampton Collection, which currently contains 45,000 artifacts and 100,000 archives dating from the 18th through the 20th centuries, including furnishings, portraits, rugs and many other items from the family. These are on display in the Hampton Mansion. The purpose of installing this system was to protect all of the assets.

In addition to providing very early warning, use of the aspiration system was important for aesthetic reasons. To preserve the historic fabric of the building as much as possible, the design team did not want to have visible spot-type smoke detectors on the ceilings. The aspiration system was designed to follow the new concealed sprinkler pipes that were trenched into the plaster ceiling. The aspiration system wasn't designed into the entire Mansion project because of cost. Instead, seven small panels for the piping system were used for areas open to the public.

The air sampling nozzles are smaller than sprinkler heads and blend well with the ceiling, so they aren't noticeable. But in areas that aren't considered to be public viewing areas, regular ceiling-mounted, spot-type smoke detectors were used.

Which building or NFPA codes need to be followed when designing an aspiration system?

One is NFPA 72 for the placement or location of air sampling intakes. There are a series of interrelated codes based on the occupancy classification of the building, or space within the building being designed, in addition to the other systems being interfaced, such as HVAC, fire suppression sprinkler, pre-action, deluge, chemical suppression and life safety. There are many other codes that need to be followed, depending on the project and the jurisdiction in which it is located.

What criteria do you use to determine the necessity of adding aspirated smoke detection systems?

- The need for very early warning of an impending fire.
- The value of the items in the protected area.
- Aesthetics: sensitivity to the historic fabric or appearance of the building.
- Controlled environment, no operable windows, especially if the protected area is near a roadway.

What are the basics to know before incorporating an aspiration system into a fire alarm system?

Know the ceiling heights and whether the ceiling will be smooth or sloped. Be familiar with the manufacturer's specific limitations on sampling pipe run lengths in order to comply with air sample transport time. Discuss acceptable locations for the smoke detector panel with the design team. The air sampling tubes and ports might not be visible, but the smoke detectors will be.

Which steps are essential in designing a fire alarm system with an aspiration system?

The aspirator system is a smoke detector device. It alone will not notify occupants when it is in an alarm condition. The aspirator detector needs to be interfaced with a fire alarm system so that it can activate the appropriate alarms on the main fire alarm control panel, such as occupant notification. The design must include a main fire alarm control panel; the aspiration system is the smoke detection portion of the system on the main panel. First, lay out the room. Next, determine the area to cover with the aspirator sensors, and then design it so the system interfaces with the main fire alarm system.

Where else do you see applications for aspiration systems?

Normally, an aspiration system would be used in computer rooms or data centers, especially where the function of the data center is important for society, such as banking or security facilities. It can also be used in a facility where it would be beneficial to use chemical suppression or sprinkler systems as a last resort, so that investigators can figure out what's causing the alarm.

*Statistics and historical information provided by the National Park Service, U.S. Department of the Interior Web site at nps.gov.