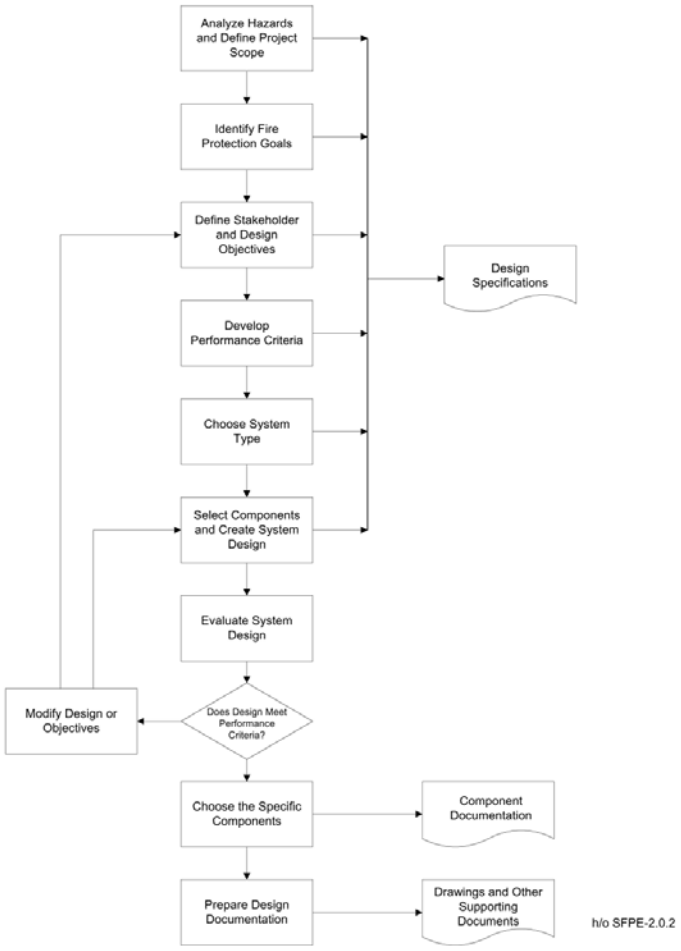
Applying Performance-based Fire Alarm System Design – Part 1

by Dean K. Wilson, P.E.

Last issue I shared that one of the hottest topics in the fire protection community today, performance-based building design, has a direct impact on the design of fire alarm systems. I presented a graphical representation of how this performance-based design process or procedure might work.



Following this concept, the designer applies a methodical procedure to the development of a fire alarm system design. This procedure helps ensure that the result meets the specific needs of the project and provides a comprehensive solution to whatever fire protection problems the procedure has identified.

The procedure begins with an analysis of the hazards at the facility. This form of needs assessment makes certain that the fire alarm system design has a firm root into the soil of the real world, site specific hazards. The hazard analysis will take into account the management of the facility, the construction materials, the interior protection systems, the nature of the special hazards, the exterior protection systems and surveillance requirements of the facility. It will measure the impact each of these intervening variables has on the overall risk of damage.

It will measure the impact of each hazard on life safety, property protection, mission continuity, heritage preservation, and environmental protection. It will consider how the fire alarm system will assist in the containment of each hazard, or participate in hazard abatement. It will measure any other variables that affect the nature and extent of the hazard, including any seasonal issues or other time factor variables.

It will consider the capabilities the facility has to respond to each hazard. This may include exit capabilities and the evacuation plan for hazards that affect life safety. It will assess the ability of the occupants to promptly and safely move away from the hazard in an emergency. It will also consider the other protection systems that provide means to safeguard the hazards.

It will also assess the ability of personnel to make manual hazard response. Perhaps the facility has a trained emergency response unit. Or, maybe the facility wholly relies on outside emergency response from the public fire department.

For example, perhaps a process using flammable liquids constitutes one of the hazards. The designer will need to determine exactly what materials the process uses. He or she will also need to determine the quantities of flammable liquids consumed during a given period of time. Where does the facility store the bulk quantities of the materials? What protection has been provided for the storage facility?

At the process itself, what ignition sources are present? How does the process handle the flammable liquids? What residues are left? How are they removed? Are human operators present during the process? Does the process expose the operators to threat of injury? What mechanical failure potential exists? Will this mechanical failure cause sparks that might ignite the flammable liquids?

Is the process cut off from the surrounding portions of the building? Is a continuity of combustibles present that will allow a fire in the process to spread beyond its boundaries? Is the combustible loading such that a high rate of heat release may occur during a fire? In short, every possible factor relating to this particular process will have to be identified and explored.

In any case, once all the hazards at a facility have been identified, analyzed, and thoroughly evaluated, then the designer can define the actual fire alarm project scope. The needs assessment that the hazard analysis represents provides vital information that will allow the designer to carefully choose the framework for the fire alarm system.

This prevents the “one size fits all” mentality that tries to take an off-the-shelf approach to fire alarm system design. It makes certain that the complexity of the fire alarm system design matches the complexity of the hazards at the facility. This helps assure that the protection afforded by the fire alarm system will integrate into the overall fire protection scheme for the project.

Documenting the results of the hazard analysis and documenting the project scope become important steps in this process. This documentation serves as the first two parts of the specifications for the project. By writing a report on the hazard analysis and the resulting project scope, the designer has created a written baseline to which all future project decisions can refer.

In the next issue of *IMSA Journal*, I will discuss how this performance-based design procedure for designing fire alarm systems identifies the fire protection goals of the facility and defines the stakeholder and design objectives.

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