backdraft

The newsletter of Fire Protection Engineering / Code Consulting

Fire Protection Engineering

viewpoint

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From the Editor

Hello and welcome to the new issue of Backdraft, ESH Consultants' irregularly published newsletter. I think I started preparing this newsletter one or two times in the past six months, only to stop because of work schedule conflicts or the desire to change the main topic of the newsletter. I hope you will enjoy this expanded issue.

Education comes in many forms, some very obvious and others not so obvious. As humans, we have the ability to constantly learn or relearn, as long as we are paying attention to the world around us.

Most of us do not have enough time to go back to school to learn the latest techniques and sciences that involve our field of endeavor. We attend continuing education classes when time permits, and read about new applications and techniques. Yet there is never enough time to learn all the latest and greatest, while still making a living or spending quality time with our families and friends.

We must rely on one of the simplest and most efficient methods of learning: observation. While doing our jobs we must learn to observe what works and does not work.

For the past year I have spent more than 600 hours as an in-house consultant to two regional offices of a State of California government agency. In that position, I am responsible for fire and life safety plan review, as well as sprinkler, change order and addendum reviews for compliance with state regulations and national fire protection standards, for educational occupancies, K-12 and community colleges. The plan reviews have encompassed everything from multi-floor parking structures, high occupancy assembly facilities, to a 94 million dollar combined middle school and high school campus. More than 150 sprinkler systems have been reviewed as part of the deferred submittal process.

This has been a great learning experience, better than any education you would get in college. Learning by doing and observing reality is a much better form of education than theoretical teachings that most of us received in school. Theories and cookbook methods do not always work in the real world.

Remember, when working on a project or design, always discuss the proposed results and future use with the end user and not just the project manager. Talk to the fa-

cilities staff to see what will make their lives easier since they are the stakeholder that has to live with your design.

With this issue of Backdraft, I hope to review some of the interesting issues that have surfaced during the past year. Each has a lesson to learn or an opinion for thought.

Hope everyone has had a great holiday season and I wish everyone a safe, healthy, and prosperous New Year.

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Insurance

In medium and large businesses, the main contact between the firm and the insurer is usually the Risk Manager and the insurance broker. This typically works fine when developing the proper insurance coverage and deductibles, but lacks depth from the actual field implementation of fire and loss prevention programs and systems. This is not to say that the Risk Manager or broker are not doing their jobs, instead it must be understood that as in any business, the lower you go in the food chain, the closer one is to the real situation.

When working with insurance clients, the best place for providing input and for gathering data lies with the site engineer, the facilities department, or the property manager. These people are responsible for the day to day operations which result in a safe and healthy work environment.

Architects and engineers typically design buildings, structures or processes that must meet building, fire and safety codes and regulations. These requirements are exceeded when the company decides to follow insurer recommendations and guidelines. The reader should be aware that codes and regulations are a bare minimum, prepared to allow the occupants to safely evacuate the area or building, while providing a level of acceptable protection to the emergency responders. Thus you can meet the code and still burn down or collapse your building.

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According to FEMA, there are three classifications for seismic design of buildings. These are based upon the need of the building to survive a major earthquake. Seismic design requirements are based upon whether a) the building must continue in operation after a major seismic event, b) whether a building must be able to be placed back in operation within a short period of time after a major seismic event (weeks), or c) those buildings that must withstand a major seismic event in order to allow safe building evacuation, but would not be safe to re-enter or repair, thus would need to be condemned and torn down.

Why the seismic analogy? It is basically the same for the building codes with respect to fire and life safety. The purpose of the codes is to get everyone safely out of the building.

To proceed beyond that level requires a decision by management as to what level of building protection and fire suppression is needed for the business to survive. This

is where the Risk Manager and the insurance companies get involved. The better the level of protection, by using human element programs, and the use of additional or higher capacity fire suppression systems, the better the insurance rate.

Path to Highly Protected Rate (HPR)

I cannot provide all the answers to help your business become an HPR insured property. Your broker or insurance company should be able to provide the requirements; however, here are a few key items that most HPR insurers want you firm to meet in order to get the HPR rating.

Human Element Programs

These are programs that involve direct human intervention and are not dependant on either detection or suppression systems or other equipment.

- Hot Work Permit System to control hot work activities at your property. Required by FEDOSHA and other state OSHA organizations, as adapted from National Fire Protection Association pamphlet 51. The last thing you want is a hot work activity in an unsprinklered building, or with the sprinkler systems impaired. Although required by regulations, most businesses do not have a hot work permit program.

- Fire Protection Impairment System – A controlled program that only allows certain individuals to approved impairments of fire detection or suppression systems. This system provides a method of monitoring the impairment to reduce the potential for systems remaining impaired for more than a short period of time. This system should be closely coordinated with the staff that issues the hot work permits.

- For high valued properties, a redundant water supply is usually required to supply the site hydrants and fire sprinkler systems.

- Locking and monitoring all water supply system controls and valves. This provides a supervisory alarm should a valve be set to the wrong position, or if a fire pump is turned off.

- Regular, documented loss prevention inspections of the buildings and site.

- Regular visual inspections of sprinkler and water supply control valves (weekly, monthly).

- Preventative maintenance and inspections of critical equipment. Special inspections would include thermographic or infrared inspections of critical electrical systems. Regular preventative maintenance of critical process equipment could prevent the failure of equipment that could cause a

"bottleneck" in the production process.

- Regular testing and inspection of the fire detection and suppression systems per the requirements of the National Fire Protection Association or other local government standards.

Fire Protection Systems

- Properly designed sprinkler systems for the type, shape and size of the storage commodity, or for the hazard in the building. Many buildings have been designed with Ordinary Hazard Group 1 or Group 2 sprinkler designs, which may have been required by the local Authority Having Jurisdiction when the building was constructed as a shell.

Depending on the occupancy, or the storage, this design may not be sufficient.

As an example, a client leased a warehouse that had been used for floor storage of materials on pallets. They installed racks for storage of Class IV or Plastic commodities to 17 feet. The local fire department informed the client that they would not be allowed to use the building in such a manner without a redesign of the sprinkler system for the anticipated storage configuration and materials. The estimated cost to convert the sprinkler system was in excess of $450,000. When asked, the client stated that if they had known, they would have leased a different building.

- Lack of sprinkler protection in a combustible concealed space, such as above a drop ceiling where the roof or floor structure above is of combustible construction. Sprinklers would need to be added to the concealed space.

Exposure

Depending on the construction of the building, the insurer may want to have 65 feet to 150 feet of separation to the adjacent building or exposure. The requirement is limit the Possible Maximum Loss (PML). The PML is based upon a fire occurring in a building with all the fire protection systems impaired, and no fire department response. A situation that could be expected after a major regional natural disaster.

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Problems Discovered During Inspections

While conducting the insurance surveys some interesting situations were discovered. In each instance, the problems could have been identified by the property owner, the Authority Having Jurisdiction, or the service contractor. Most could have been prevented by proper control and auditing practices.

- A service contractor had conducted 2 inch drain tests on four sprinkler systems located in four buildings. By some coincidence the static and residual pressures measured on each system were identical. Considering the accuracy o sprinkler pressure gages, and the needle fluctuations, this is highly suspect. The client was advised to audit the tests the next time the service contractor was on site conducting 2 inch drain tests.

- A 2 inch drain test on a sprinkler riser did not cause a large pressure drop. When the hydrant outside of the building was used for a flow test, the available pressure and flow was not sufficient to meet the base of riser demand indicated on the hydraulic data plate. The local water department was contacted and a few weeks later they conducted a water supply test using their hydrants just outside of the client's property. The available pressure was at least two times that shown with the on-site test. The only shutoff valves between the hydrant and the public water supply were part of the backflow preventor system. The client was advised to have the backflow preventor inspected as that had not been done in more than 20 years.

. . . the technician was removing the switch cover and using a jumper to complete the circuit . . .

- A 2 inch drain test was conducted on a sprinkler system in an office park. There was more than a 50% pressure drop at the riser. A hydrant test outside of the building indicated a minor pressure drop with a larger flow. The client was advised to have the inside of the lead-in pipe inspected as well as the post indicator valve (which indicated open). The system had recently been inspected by a sprinkler contractor and no mention was made of the lack of sufficient pressure.

- While inspecting an industrial property, the central station service technician was conducting a test of the water flow switches for the sprinkler systems. It was noted that the technician was removing the switch cover and using a jumper to complete the circuit, thus causing the alarm. This only tests the circuit and not the mechanical operation of the switch. The client was immediately contacted about the

situation. A few weeks later the client indicated that the same situation was found at another of their plants.

- A 2 inch drain test was conducted on the sprinkler system for a 5 story office building. The system pressure dropped to 0 PSI. The system had been impaired for more than 4 days while the building engineer was waiting for the local fire department to inspect the new lead-in for the sprinkler system. The old one had been replaced as a similar one in the adjacent building had failed. The system could have been left on while waiting for the final inspection. There was no fire watch during the impairment which occurred over a long weekend.

Plan Review

Plan review is an interesting situation, especially in California. In most states, plans are reviewed against the requirements of the local or state building and fire codes. In California we use the California Building and Fire Codes. At the beginning of these codes there is a matrix table. The matrix indicates which specific paragraphs of the code are to be enforced depending on which state organization had jurisdiction.

When reviewing plans for code compliance, the reviewer must know if a specific state regulatory agency had authority over the occupancy. This could involve educational, institutional, healthcare or other uses. Here are some suggestions to follow before submitting a plan for review.

- Provide a code analysis work sheet with the drawing set. This may or may not be required by local permit regulations. This sheet provides the reviewer with specific information that will aid in reviewing construction and exiting requirements. In most cases, if this is not provided, the reviewer may reject the submission. When preparing the code analysis work sheet, make certain that the information you provide is specific to the project and the design.

As an example, Chapter 5 of the Uniform Building Code provides area and height increases when specific criteria is met. At times, I have reviewed code analyses where the designer used every area and height exception allowed by the code even though most were not required. By indicating the use of some exceptions that were not needed for the project, other exceptions were voided, resulting in a need for higher rated fire walls. Using exceptions and allowances that are not needed may indicated to the reviewer that the designer did not know how to use the code properly. This also leads to confusion while reviewing other aspects of the design. The best suggestion is to provide information that is needed for the exceptions that apply to the project. If you are not certain how to prepare the document properly, contact a

building code specialist or fire protection engineer.

- Provide a diagram indicating the number of occupants for each area/room of the building. Indicate the path of exit travel and the number of occupants using the path to the appropriate exit doors. It is not the responsibility of the plan reviewer to calculate the number of occupants for each area of the building, and to then figure out the occupant loading applied by the designer for each exit. Reviewers will usually reject the design and ask for the information before continuing with the review.

- Make certain a hallway is not a corridor. There are different code requirements for each in the UBC.

- Coordinate electrical and mechanical drawings, as duct detectors and fire/smoke dampers locations must match on both drawings. It is not unusual for the mechanical engineer to indicate the locations, or to indicate the need for smoke detectors in the HVAC systems, but the information is not included in the fire alarm design on the electrical drawings.

- Provide a complete fire alarm riser diagram indicating all devices, and if addressable, show all device identification labels.

- For addressable systems, make certain the address label on the fire alarm system readout also includes a description of the device type and location. There is no value to the fire department if the readout says "Smoke Detector 1I-24". They will have no idea where device 1I-24 is located.

- Voltage drop calculations for Class A circuits shall be based upon the longest wiring run for the circuit. That means a break on the far end of the circuit at the point where the circuit reconnects to the fire alarm control panel or the auxiliary power supply.

Sprinkler Submittals

While reviewing sprinkler plans (deferred submittals) I have not been able to approve a set on the first review. In many instances it requires three submissions before the plans or hydraulic calculations are correct. Just because the plans are signed and stamped by a PE in Fire Protection Engineering, Mechanical Engineering, or as a NICET Level III or IV, does not guarantee a proper, errorless design.

In California we use the 1999 edition of NFPA 13. It is important to review Chapter 8 and find the listing of items that must be included with each set of working plans. With the latest edition of NFPA 13, this may be included in another chapter. Many sprinkler contractors fail to include the items listed in Chapter 8. I agree that some of these items should no longer be included, but until the Chapter 13 committee

deletes these items, they are still required by code. To make it easier for the reviewer, make a checklist based upon the table, and include it with the submittal, indicating compliance where needed.

The following is a list of common issues noted during sprinkler plan reviews.

- Water supply test data is not current. In some cases the data was 10 years old.

- Water supply data is provided by the local water department using a computer model. It is interesting to note the disclaimer that is included with this data. In most cases the disclaimer indicates that the data may not be sufficiently accurate for the design of fire protection systems, and that the data should be modified, or a flow test should be conducted. In many cases water test data was requested and the water department would not conduct the flow test. Request an actual flow test by either the water or fire department, meeting NFPA testing criteria.

Make certain that water supply test information includes a map of the water supply system

- Make certain that water supply test information includes a map of the water supply system with sufficient detail. In some instances, a flow and gage hydrant have been on the same street, yet fed from different water supply systems, or pressure zones, thus erroneous data.

- Recheck all hydraulic data inputted into the computer program versus the information shown on the design drawings. Typical errors include incorrect pipe sizes, pipes connected to wrong nodes, pipes not connected to other pipes, or flow from the wrong sprinklers.

- Some sprinkler contractors will only calculate the system to the base of the riser or to a point just outside of the building (known as their point of connection). All calculations must be from the location of the water supply test.

I have reviewed plans with 1,000 – 2,000 feet of 6 inch or 8 inch pipe, plus fitting, between the point of connection and the location of the water supply test. The friction loss in that piping was not included in the hydraulic calculations. The loss could have been sufficient to result in a deficient sprinkler design.

- Multiple configurations and varying areas of coverage per sprinkler will require multiple hydraulic calculations. Many sprinkler contractors simply choose the area they think is the most hydraulically remote and submit one calculation. This works fine when used in a symmetrical design or a

loop or gridded system, but when there are varying areas of coverage, no symmetry, and different design densities, no single hydraulic calculation is sufficient. In some situations a location closer to the source was more hydraulically remote.

If there is a sprinkler system below the ceiling and a different one above the ceiling, with different spacing and density requirement, at least two calculations are needed.

- Multiple buildings on a site require at least one hydraulic calculation per building. A single calculation is not acceptable even if the systems are identical. The reason being that the point of connection to the underground supply, and building elevations may not be the same.

- Contractors need to show hanger and seismic brace locations on the drawings. Placing a note on the drawing indicating that all hangers and braces must be installed per NFPA 13, is not sufficient. Neither is a conversation from the contractor stating that the installers know to install hangers on 12 foot spacing. NFPA 13 requires a minimum of one hanger per section of pipe, with limited exceptions.

A structural engineer needs to certify that the building structure will support the sprinkler system.

Codes

California has finally decided to use a modified version of the International Building and International Fire Codes instead of NFPA 1 and 5000. As a result, various groups of building and fire officials, consultants and stakeholders, are in the process of comparing the requirements of the International codes versus the 2001 California Building and Fire Codes. This process involves many committee meetings, hundreds if emails (I know as I get dozens every week), and telephone conference calls, to discuss the differences in the codes and to formulate recommendations.

Many fire officials are concerned that the International codes allow much larger building areas for many of the building construction types and occupancies than the 2001 building code. The basis being that the International codes give larger credits for sprinkler protection, whereas the former Uniform Building Code was oriented towards area separations and fire containment.

The other day I read an email from one of the committee members that clarified the situation with respect to the new codes and the review process. This individual pointed out that we have lost sight of the general purpose of the codes and are trying to change the codes to meet the needs of the fire service. The codes are written to

provide life safety to the occupants; to make the building safe to use and occupy, while at the same time making certain that the occupants can leave the building in an emergency situation. Basically, get everyone out. It is not the intent of the code to make certain the property owner or tenant has a usable structure after the emergency is mitigated. The building can be completely destroyed, as long as everyone gets out safely. This committee member pointed out that the code review process should proceed based upon life safety not building safety.

After reading the email it was as if a giant light bulb had lit up over my head. This is very simple and to the point, making it easier to identify the direction for the of code review process. The process should only look at the life safety issues, of both the occupants and the emergency responders, and not look into requiring any property protection measures. The addition of property protection features above and beyond the life safety features is a business or risk management decision. This is best left to the property owner, their stakeholders, and the insurers.

So why is it is code requirement to sprinkler educational occupancies within California. If this is not a life safety issue, why is it code? I can only answer with an opinion. California was experiencing an increase in fires in schools. These fires were occurring during off hours and resulting in large fire losses and sometimes a complete loss of the building or buildings involved in the fire. This resulted in many students needing to either transfer to other campuses, or to spend years occupying portable classrooms (a polite California term for a modular construction temporary structure).

For years the argument against sprinklers was based upon cost and the hypothesis that a fire in the schools was not a life safety issue; as the fires were occurring when the building was not occupied. It is my belief that the taxpayers and the fire departments finally decided that the costs associated with the fires were not acceptable. The costs involved the replacement or repair of the building, the cost of fire fighting a large fire, and the psychological effect on the students, teachers and parents.

A sponsor in the state legislature was found to bring a bill to the floor requiring sprinklers in school buildings subject to specific conditions and requirements. It was appropriate to have this discussion at the state level as public school funding and construction permits are controlled by the state government. And as we all

know, unless it is made into law, opinions made by government officials are not enforceable.

To summarize, building codes and fire codes are written as a bare minimum that will provide a reasonable level of safety to the public and emergency responders, to hopefully reduce the potential for loss of life and injury. It is not the intent of the codes to protect buildings so that they are usable after an incident (There are exceptions, such as hospitals, nursing homes, fire and police stations; critical or essential services buildings whose design and use are usually covered under different standards).