backdraft

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Fire Protection Engineering

viewpoint

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Due Diligence

If you have been an investor during the past three years, there is a good chance that directly or indirectly you have been affected by the accounting failures at Enron, Global Crossing and others. Some information was available to stockholders as part of the "garbage" packaged in the annual and quarterly reports, however without close scrutiny this information was not recognized by individual investors. The public can rightfully blame the executives of those companies for playing with other peoples' money. In those instances we may not have been able to control or obtain information that was necessary for proper due diligence.

What does this have to do with loss control and fire protection? Due diligence is a necessary part of our jobs if we are to protect the assets of our stakeholders. By conducting inspections and evaluations there is a better chance of discovering risks or deficiencies that could lead to failures. As a business owner, company representative, consultant, or Authority Having Jurisdiction, it is imperative to conduct a complete due diligence evaluation and not just look for the obvious. The following are some real world examples of due diligence.

Property Evaluation

At a multi-billion dollar manufacturing company, the real estate and facilities manager asked the EH&S Department to evaluate a building that was being considering for lease. The environmental specialist and fire protection engineer were asked to do this last minute due diligence inspection. The occupancy would be storage of raw materials and finished goods. I say last minute because they were given about two hours to make the inspection and present the findings to management as there was a deadline for signing the lease.

An inspection was made of the site to identify the usual issues, contamination, exits, emergency lighting, and fire detection and suppression systems. As usual, the building had no fixed fire protection. The lack of sprinklers was based upon the code in effect when the structure was erected, the construction classification and the previous occupancy. At the time of the inspection the building was used as an indoor skateboard track. An outside inspection was conducted to identify fire department and transportation access issues, as well as to evaluate the condition of the parking area for possible evidence of ground contamination.

To most inspectors there would have not been any code related problems based upon the code enforced at the time of construction, however the inspectors determined that the building was unacceptable; the street had no sewer system to collect and remove rain water. The thresholds to the building doors were about 1-2 inches above road level. Sand bags were stored next to the building and water

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and water marks found on the outside of the building about one foot high. Apparently during large storms the street would flood and the sand bags were used to keep water out of the building. The inspectors recommended that the building not be leased or if it must, then all storage must be elevated a minimum of 2 feet above the street level.

Sprinkler System and Booster Pump Installation

ESH Consultants was involved in the design, specification and project management for the removal of existing sprinklers in a warehouse facility. The sprinkler systems were to be replaced with ESFR sprinkler systems and a new fire booster pump (2000 GPM). Originally the project specification had been completed years earlier however the project was delayed for a number of years. The warehouse was located at the client's property which was supplied by a combined domestic/fire main system connected to the municipal water district's main located just outside the property. Drawings indicated domestic consumption was limited to toilets and sinks; all low demand items. The previous consultant's specification did not mention any domestic consumption.

After completion of the construction, and during the testing of the fire pump, it was determined that the jockey pump (10 GPM) would not shutoff and the system pressure could not be maintained. It was determined that another operation on the site was using between 20 GPM and 500 GPM from the system on a continuous basis. The client and ESH both agree that we learned a valuable lesson. If at all possible do not connect the fire pump to the distribution main on the site. It should be connected directly to the sprinkler systems even if new underground mains are needed. See the Applications section of BACKDRAFT for a discussion on how the problem was solved.

Insurance company engineer conducting pump test

New Sprinkler Systems on Existing Underground Systems

A client has an industrial site with an existing domestic/fire main system. The piping in the underground is approximately 40 years old. The pipe from the meter to the existing sprinkler riser is approximately 1,200 feet in length with no sectional control valves. The public water supply located outside of the client's property was upgraded sometime in the past 30 years. It was changed from a 10 inch dead end to a 12 inch main feed on a loop, connected to a grid with 16 inch and 24 inch pipe. Using the local water department's flow test information, approximately 7,700 GPM is available at 20 PSI, with a static pressure of 85 PSI.

Based upon that information it appeared that a booster pump would not be needed for the new ESFR sprinkler systems. As part of due diligence, ESH had two water flow tests conducted using the private hydrants on the site. The first test to provide the static and residual pressure, and the water available, using the hydrants near the existing sprinkler riser. The second test placed pressure gauges on various hydrants and sprinkler risers to determine pressure loss between the measurement locations.

The second test was devised to determine the

Without this due diligence testing, the sprinkler system hydraulic calculations would have been based upon the information available in the original specification. In the future, had there been a fire, the sprinkler systems would not have been able to produce the required density. An alternative solution was found prior to awarding a contract for construction. For additional details, see the Applications Section of Backdraft.

Due Diligence - Sprinkler Systems

- Conduct water supply tests for private and municipal water supply loops
- Check for domestic consumption
- Check condition of interior of water main piping
- For renovation of older sprinkler systems, visually inspect interior of feed and cross mains, and branch lines.

fire protection

> code discussions

Having been in the fire protection engineering profession since the early 1970's, I sometimes believe all fire protection engineering students should be required to take classes in law and interpreting the law. When using model building codes or NFPA standards we almost always find exceptions to the requirements. What is interesting is when there are multiple exceptions and compounding exceptions. When we finally apply all the exceptions we may decide that the requirement was the exception.

An example comes from the 1997 edition of the Uniform Building Code, Section 302, Mixed Use or Occupancy. This section is four lines of one column of the page. There are nine detailed exceptions that occupy about one third of the page. Isn't great when the code authority cannot find a clear way to provide a standard, thus they provide more exceptions than the requirement.

For this issue of BACKDRAFT, we will look at Section 302. The information provided here is a summary of a discussion from the 1997 UBC Handbook. The example shows there is more than one way to evaluate a multiple occupancy structure to determine required area separation. Depending on the method used, both of which are acceptable, an area separation may or may not be required.

This example involves a hotel with the guest rooms in a separate wing, and public areas (shops, restaurant, lobby and offices) near the main entrance. The objective is to determine if area separations are required and where. The hotel guest wing and lobby are classified as a Group R, Division 1 occupancy. The shops and offices are classified as Group B and Group M. Table 3-B requires a one hour separation between the Group B and Group R occupancies, and between the Group M and Group R occupancies, *except*, according to Section 302.1 exception 2.3 "Gift shops, administrative offices and similar rooms in Group R, Division 1 Occupancies not exceeding 10% of the floor area of the major use". If the offices, shops and restaurant floor areas exceed 10% of the hotel and lobby floor areas, then separation is required.

Also, the restaurant in the example is large enough to be considered as a Group A Division 3 occupancy which requires a one hour separation from the lobby which is part of the Group R, Division 1 occupancy. This separation requirement would impair the use of storefront windows for the shops, and eliminate the potential for the restaurant to be open to the lobby except via a fire door.

Is there an alternative that would reduce the number of fire separations while allowing better visibility to the shops and allow the restaurant to be open to the lobby? Yes!

restaurant to be open to the lobby? Yes!

The lobby could be considered a public area with respect to its surroundings. If the public could enter the building and pass into the lobby while going to the stores or restaurant, then the lobby would be classified as an Assembly Occupancy, Group A. In this example the occupancy loading for the lobby is less than 300 people, thus the area is a Group A, Division 3 occupancy. That occupancy does not require a fire separation from Group B or Group M occupancies. The only required separation would be between the guest room wing of the hotel and the offices, shops, lobby and restaurant.

When designing the hotel and accessory areas, it is important for the designer to evaluate the placement of these areas with respect to other occupancies. Location and proximity could change the occupancy classification to one that is more favorable with the surrounding occupancies, thus leading to a more useful design and a reduction in costs associated with fire rated separations.

real world fire protection

> applications

Sprinkler System Water Supplies

In the Viewpoint section of this issue of BACKDRAFT there are examples of situations where due diligence resulted in a change of the system design. Additional details are included below.

New Booster Pump and ESFR Sprinkler Systems

A client with a high rack warehouse was upgrading the sprinkler protection to comply with an Insurer recommendation. Storage in the racks had changed to a higher hazard commodity classification. The client did not want to install in-rack sprinkler protection to supplement the existing overhead ceiling systems. It was decided to modify the existing systems and install ESFR sprinkler systems. An evaluation of the water supply indicated that a pump (churn pressure of 165 PSI) would be needed to boost the system pressure and flow for sprinkler operations.

A review was made of the drawings of the existing combined fire/domestic private water supply loop that surrounded the client's site. The drawings indicated domestic consumption for restrooms and employee break rooms, as well as a potential use at a vehicle washing facility. Based upon the expected domestic consumption, the jockey pump was sized at 10 GPM. During the final acceptance test of the pump, it was determined that one of the production operations at the site consumed 20-500 GPM on a continuous basis. This would exceed the capacity of the jockey pump and it was expected that the booster pump would stay on continuously.

Normally a pump controller starts the driver when the pressure drops below a predetermined level. A review of the pump controller options indicated a set of contracts marked "Deluge" that would cause the controller to start the driver if the condition of the contacts were reversed (from normally open to closed or normally closed to open). The new sprinkler systems have 8 water flow switches which are connected as individual signals to a Central Station control panel. Upon receipt of a signal from any of those switched, a circuit from the control panel to the pump controller will reverse state causing the controller to start the driver. As a backup, the mercoid switch in the controller was set to a level below the

expected system pressure when 500 GPM was flowing. The jockey pump was turned off as it no longer served any purpose.

Fire Pump Controller with Deluge Contacts

New Sprinkler Systems on Existing Underground Systems

A client had an existing warehouse facility that was more than 40 years old. A private combined domestic/fire main looped the property. As a result of an increase of the commodity hazard rating, modifications to the existing sprinkler systems were proposed. Water supply data for the public system serving the private main was provided by the local water utility company. Based upon the expected consumption for the sprinkler system, it was assumed that the water supply was sufficient.

ESH Consultants requested a series of water supply tests on the private main to determine a) the actual water supply data near the building, b) the condition of the interior of the private mains. The results of the test indicated about 1,500 GPM available at 20 PSI, and the "C" value (the lower the value the higher the friction in the pipe) was substantially lower than that of new underground pipe. The water meters from the utility company to the private main were tested and were in good operating condition. There were no sectional control valves, thus a partially open valve could not be the problem.

Two alternatives were reviewed with the client. The first, to have a TV camera inserted into the pipe to find the blockage and the second was the installation of a booster pump connected directly to the new sprinkler systems. It was decided to install a booster pump, as finding a partial blockage in the pipe did not necessarily provide a cost effective means of solving the problem. Calculations were provided by a sprinkler contractor to determine the amount of water needed to supply the pump. The existing underground mains could provide the necessary water without dropping the suction pressure of the pump to an unacceptable level.

The final solution, which is in the process of implementation, is the installation of a pump room within the warehouse with a booster pump dedicated to the new sprinkler systems. A new main will be connected from the existing underground piping to the suction side of the pump.

What lesson should we learn from this situation? Always test the water supply near the building, and on older underground systems, a "C" value water supply test must be conducted. Had the sprinkler systems been designed based upon the utility company's data, and not the on-site water test, the sprinkler systems would not have operated at properly during a fire.

ESH Consultants specified pre-fabricated pump house with diesel driven fire pump, controller and jockey pump.

News from around
the industry

Fires

San Jose, CA: Aug. 19, 2002
An eleven alarm fire occurred at the Santana Row development. This multiple building complex, consisting of residential and mercantile property, was under construction with a possible Spring 2003 opening date. The fire occurred in Building 7, the largest building in the complex. The fire quickly engulfed the entire building and flying brands caused fires as far as ½ mile away. It is estimated that the loss is approximately 20% of the $500,000,000 construction cost for the development. In addition, almost 100 families lost their apartments as a result of fires that started when the flying brands caused fires on the buildings wood shake roofs. It was reported that the sprinkler system had not yet been installed. (Reported in the San Jose Mercury)

Codes

Title 24 of the California Code of Regulations will become effective November 1, 2002. For those of us in the fire protection business, you will need to have a copy of the 2001 California Building Code (Part 2) and the 2001 California Fire Code (Part 9). Copies are available from ICBO either online (www.icbo.org) or phone (800) 329-4226.

Engineering Licensing

California Department of Consumer Affairs, Board for Professional Engineers and Land Surveyors

Just a reminder that effective January 1, 2001 a professional engineer must have a written contract for doing work with clients. Before starting work the following must be included in a signed contract:

- The contract must provide a description of services,
- A description of compensation and method of payment,
- The name, address and license number of the engineer,
- The name and address of the client,
- A description of the procedure that the Professional Engineer and client will use to accommodate additional services,
- A description of the procedure to be used by any party to terminate the contract.

There are exemptions from this rule. Please contact the Enforcement Unit of the board at 916-263-2283 for additional information.

Products

Tyco Fire Products has introduced an ESFR-25 Freezer Storage System. This suppression mode protection system uses a fluid that stays in the liquid state to -20 degrees F. Be advised that for hydraulic calculation purposes, at this time only the Tyco sprinkler program will properly calculate the system. For more information contact Tyco Fire Products (800) 381-9312 and ask for their data sheet TFP314 (3-1.4) dated Feb. 2002 or later.

Disaster Recovery

From the Disaster Recovery Journal, Summer 2002 Issue

The cover story of this issue of the Disaster Recovery Journal is about NFPA 1600, "Standard on Disaster/Emergency Management and Business Continuity Programs". The article gives a background on the formation of the NFPA 1600 standard committee and how it has progressed since 1991. If you are interested in Disaster Recovery/Business Continuity, you should read this article. The NFPA committee will be meeting soon to discuss revisions to the next edition which is scheduled for publication in 2004. The author of the article indicates that NFPA 1600 may become mandatory as well as other industry standards thus having an impact on the industry. See WWW.DRJ.COM to find out how to receive their publication, and to get the user name and password for online access.

Comments and questions

from the Inbox

Recently, a local Fire Marshal asked a question on water supplies and fire department connections. Two new office buildings were build that were fully sprinklered. The sprinkler systems are fed from a dead end private main supplied from the municipal water distribution system located outside of the property. Connection to the municipal system is via a backflow preventor and control valves. The private system has a single hydrant, and a single fire department connection to boost the private main. Fire department connections have not been provided for each sprinkler system. Is this legal?

Rather than use the specific code for the jurisdiction, let's review the standards from NFPA 13 (1999), **Standard for the Installation of Sprinkler Systems** and NFPA 24 (1995), **Standard for the Installation of Private Fire Service Mains and Their Appurtenances**. NFPA 13 provides requirements for the installation and connection of fire department connections to single and multiple sprinkler systems. In most cases the fire department connection is connected directly to the sprinkler systems, however NFPA 13 Sections 5-15.2.3.2 and 5-15.2.3.3 provides an exception. "*Exception: Connection of the fire department connection to underground piping shall be permitted.*" Also NFPA 13 and 24 contains figures showing fire department connections directly to the underground, in valve pits or similar installations, downstream of the backflow preventor.

Thus, according to the information and requirements of those NFPA standards, the installation would be legal.

We must however look at whether it would be practical. In this specific installation, the fire department connection is located on the underground, far away from the backflow preventor, and near an on site hydrant. It is therefore possible that a responding fire department that was not familiar with the installation (mutual aid company or transfer company) could connect to the hydrant and pump into the fire department connection. Thus the fire department would be taking water from the underground and be putting it back into the underground at a higher pressure, thus creating a circulation system. If the fire department connection were connected directly to the sprinkler systems this would not be a problem. With a single site fire department connection, the backflow preventor check valves would close when the site pressure became higher than the municipal pressure, thus causing a temporary closure of the water supply.

To reduce this possibility, the fire department connection should have been located outside of the site, near a hydrant that was part of the municipal system. Thus water would be taken from the municipal system and pumped into the private main system downstream of the backflow preventor. As

the building owner and contractor will not agree to relocated the fire department connection, and this has been approved by the local Authority Having Jurisdiction, it would be in the best interest of the building owner and the fire department to prepare a pre-plan for fire fighting at this location. Also signs should be placed at the fire department connection and the hydrant indicating that the water supply for the pumper must come from a hydrant located outside of the property.

Please feel free to submit comments on this question, or submit new questions. ESH Consultants realizes that there is more than one way to solve a problem or interpret a code/ standard. Suggestions and comments are greatly appreciated. —ELG

> editorial

On September 10 I spent two hours watching and listening to the interviews with the FDNY firefighters who survived the collapse of World Trade Center Tower 1 while trapped in Stairway B. The next morning I watched the memorial events at Ground Zero. The events of September 11 still affect and amaze me. The average person could not believe the magnitude of the events in Lower Manhattan. For the fire fighters, police and emergency workers, none of their training could have prepared them for such an event, yet they did what they had to do, to save lives. My wife has asked me how the fireman could run into those buildings seeing the destruction and the risk to their lives. I told her that was what they were trained to do; to do their jobs to save others.

No amount of training or education could prepare those brave fire fighters/police/rescue workers for what they encountered on September 11th. Watching their faces on the documentary showed that they must have felt overwhelmed, yet they risked everything and did their jobs. They did what was needed not just because it was their employment but because it was their passion; they had the desire to help others.

So remember and honor those that risked their lives so that others could live. On a cold night when there is a fire in your neighborhood, crank up the coffee, tea or hot chocolate and bring it out to the crews. They will really appreciate it.

Elliot Gittleman

Editor's note:

I grew up in New York City, in Rockaway Park, just three short blocks from where the American Airlines plane crashed a few weeks after the attack at the World Trade Center. While living there I watched the engine and ladder company from the local FDNY fire house during an attic fire, a shed fire across the street from our home, at an 11 alarm fire that destroyed a historic landmark and at other events. Never did I see these firefighters hesitate to do their job.

In college I joined the local volunteer fire department at College Park, Maryland. I remained active as a fire fighter/EMT-A for almost 9 years until relocating to the West Coast.