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Society of
Fire Protection Engineers
New Jersey Chapter

FUSIBLE LINK

MARCH 2005

NJ SFPE Membership Meeting
Minutes February 7, 2005

The meeting was called to order at 6:00 p.m. by our President Rich Reitberger. A salute to the flag was followed by all attendees introducing themselves as is our custom.

The December minutes were approved as published in the *Fusible Link*. The treasurer's report was read and accepted.

Rich talked about overdue membership dues and the letter that the board would write against NJ State bill S-2176. It will be sent to all members for their personal signature and faxing to their local legislators. He also reminded the membership that our June meeting conflicted with NFPA and will be June 13. Rich invited everyone to attend the NJ ASME annual awards dinner February 24, here at the Hanover Manor.

Rich also mentioned that the NJ SPE will be holding an Engineers Week event at Rutgers on March 17.

Chuck Gandy spoke about S 2176 and introduced Ray Lonabaugh of NFSA who spoke about the bill. Some of the points Ray made were that the bill incorrectly identifies the certification required for sprinkler tests as "all" when it is not. That the bill was not about sprinklers but was all inclusive for all types of suppression, clean agent, wet and dry chemical. He feels that this may be changed to cut out some opposition. The bill does not specify union fitters, however, where else will anyone get 8,000 hours work on sprinkler piping or 800 classroom hours. He further stated that any master plumber will be grand fathered with 10,000 hours of work on any piping system. Another complaint

that NFSA finds with the bill is the board of examinators will be made up of 4 journeymen with ten years of experience, one contractor and one member with no idea as to what pipe fitting or suppression systems have to do with each other. Another complaint is that fully trained and certified in-house fitters working for large industrial employers will no longer be able to perform test, inspection, maintenance or repair. Finally there are a number of conflicts between this new bill and the existing contractors' certification under NJ State Code section 5:74 which currently regulates sprinkler contractors. NJ has a law that a new bill cannot be in conflict with an existing one. We have reason to believe that 5:74 will be modified soon to allow qualified employees of building owners and occupants to perform the routine inspections and testing that fall beneath the requirements of NFPA 25'..

Our presentation this evening was "Current State of the Property Insurance Market Place" and was presented in three parts from three perspectives, that of Brad Hart, PE of Willis, Bob Baker, PE of FM Global and Mike Newman, PE of Johnson & Johnson.

Brad opened the presentation with mixed news such as the Property/Casualty reports for 2004 showed the 3rd quarter to be the worst property quarter on record; however, the reinsurance markets are healthy with abundant capacity. Brad mentioned that the US Government was not currently thinking about TRIA and this was something that can sneak up on them when it as currently written expires this year. The summary of catastrophic losses for 2004 worldwide excluding flood and Tsunami was $30 Billion plus property and time element insured losses. $9 to $12 Billion was commercial losses.

Brad informed us that the property market in underwriting showed a profit for the first 9 months of 2004 after three years of major losses. Rate reductions for 2005 appear to be in the neighborhood of 10% which is good news for the market. Brad advised us to look for revisions of CAT Model Loss Estimates. If they are up expect more reinsurance or less capacity and a price increase. He explained that CAT modeling was partly art and showed the difference between three different sources with estimates running as much as $5 billion difference for 2004's Florida hurricanes. Brad took the time to explain the perils of wind and floods and how each occurrence can be defined. Brad finished up with a couple of different definitions of "Wind Event" and what we as consumers need to know and consider when buying insurance.

Bob Baker spoke about the trends in property insurance from the FM Global point of view. He feels that the Human Element is the key to control of ignition sources and the supervision of automatic sprinkler control valves. Bob stressed the importance of proper hot work requirements and the need to control any operation involving open flames or producing heat or sparks. Detailed permits and following the details were essential.

As for control valves FM's Red Tag permit program includes taking precautions and providing temporary protection were essential whenever a system is valved off. To handle the impairment safely and rapidly and finally to insure that the shut or red tagged valve is restored will keep fire loss to a minimum.

Bob's parting points concerned the habit of keeping fuel oil for emergency generators to a minimum as the influence of stored diesel fuel increases the level of hazard as it applies to the influence of stored diesel fuel on the level of hazard applied to the buildings protection.

Mike Newman the Manager of Property Loss Prevention Johnson & Johnson Risk Management provided us with a customer's viewpoint on property insurance in today's market. Mike explained that J&J approaches insurance

through a combination of first J&J's own insurance subsidiary a captive company and secondly a commercial insurance. If a loss occurs J&J has a local deductible a corporate deductible/ captive retention, a primary layer with their captive reinsured/commercial and finally an excess layer of commercial insurance.

Mike talked to us about J&J's "Good old Days" when they were able to get all risk coverage including EQ, flood and terrorism coverage included. Days of blanket limits, low corporate deductible ($1,000,000), no location percentage deductibles for natural catastrophe for Puerto Rico's wind and the West Coast's earthquake zones. When they only had to provide basic information for underwriting, unlike today.

Next Mike talked about the period just after 9/11 when terrorism coverage was excluded and J&J faced lower limits of PD - $2 B BI - $500 M, higher corporate deductible ($10,000,000), location percentage deductibles for natural catastrophe for Puerto Rico's hurricane winds and hot quake zones. J&J now had to provide more detailed information to underwrite the same risks. Varying underwriter Interest in J&J has resulted in J&J retaining $80 M of their first $100 M in captive insurance or their primary layer.

Today's market shows some change since 9/11, J&J finds that terrorism coverage can now be had with better pricing. However, the same limits for PD - $2 B BI - $500 M still apply as does the corporate deductible of $10,000,000. He sees some improvement in the location percentage deductibles for natural catastrophe, however the same detailed information to underwrite risk is required. He sees that some underwriters are showing interest in J&J and are willing to moderate premiums.

Overall Mike finds that property risk is now viewed very differently with higher profile in the company more attention to loss scenarios and the retaining of risks and need for self insurance. As to business continuity planning it has become a company wide program today. For J&J the emphasis on maintaining product availability to consumers in the event of a property loss is foremost in there plans.

After a short Q & A session the meeting was adjourned at 8:45.

The Case for Performance Metrics for Fire Protection Devices Part IV

The following technical article was written by John M. Cholin, P.E., M.E.E., F.S.F.P.E., J.M.Cholin Consultants, Inc.
101 Roosevelt Dr., Oakland, NJ 07436
This is the fourth of several installments.

These sensitivity metrics are NOT what most people quote when they are discussing smoke detectors. Usually the smoke obscuration as measured in the Smoke Box Test is used as it is these values that are required to be marked on the detector label. Unfortunately, the sensitivity marked on the detector is only valid in the UL 268 Smoke box and the FMRC equivalent; it cannot be used outside that context and is intended solely as a quality control metric to ensure that the product being produced has the same sensitivity as those tested during the listing evaluation. The UL 268 Smoke Box employs desiccated cotton lamp wicking in a carefully controlled airflow to produce a light gray smoke. It is a very reproducible test and serves a valuable role. Nevertheless, it is doubtful that the conditions in the U.L. Smoke Box test or its F.M. counterpart are intended to replicate the conditions one might encounter with an accidental fire involving random interior furnishings and architectural interior finish surface components. Consequently, the fire alarm system designer doesn't have any credible measure of smoke detector performance that can be used to substantiate the presumed performance of the detection system. Yet we continue to rely on this mode of fire detection for critical life-safety functions.

In the absence of validated performance metrics Appendix B of the National Fire Alarm Code recognizes three methods for estimating detector response. However, these methods are, at best, estimates.

The first method assumes a correlation between temperature rise and smoke concentration. Heskestad and Delachatsios used an assumed correlation between temperature rise and smoke concentration to illustrate how their method of predicting heat detector response could be pressed into service for estimating the response of smoke detectors. This illustration posited a smoke detector response when the temperature had increased by 20 Farenheit degrees. Much to the surprise of these authors, many concluded that such a correlation existed. Schifiliti and Pucci have since shown that this correlation does not exist. Nevertheless, one can obtain estimates of detector response when careful temperature increment correlations are posited. This method is especially useful in comparing the performance of one design versus a second as the assumed temperature correlation is held constant in such comparisons.

The second method used a mass optical density model. A solution volume for the plume and ceiling jet is defined and the mass of the smoke to achieve a given optical density is calculated using the relation:

$$DA = DmM/Vc$$

where:

DA = Optical density in compartment at alarm
Dm = Mass optical density of the material
M = Mass of smoke at time, t
Vc = solution (compartment) volume

A solution volume is computed using reasonable assumptions about the ceiling jet thickness. Values for the Mass Optical Density, Dm, are obtained from the literature or experimentation. Since the minimum sensitivity of U.L. Listed smoke detector is 0.14 m -1 for black smoke we can substitute that value for DA in the above relation. Depending upon the shape of the solution volume this relation is reorganized into different forms to yield a design spacing. In the case of a large ceiling surface the designer might choose a cylindrical solution volume and use the relation:

$$r = [DmM / DA\pi\ h]^{1/2}$$

where $D_A = 0.14/m$.

This provides a maximum permissible radius between the fire

$$S = 1.414r$$

The third method is one that relies upon the observation that the measured sensitivity of U.L. Listed smoke detectors as determined in the U.L. 268 smoke box is very dependent on the test air velocity, controlled at 0.152 m./sec. (30 ft./min.). Small variations in the air velocity through the chamber produce large variations in measured sensitivity. This has given rise to a response estimation method that uses the 0.152 m./sec. (30 ft./min.) ceiling jet velocity criterion as a predictor of smoke detector response. Alpert developed a now popular correlation that relates ceiling jet velocity to fire size and ceiling height.

$$U_r = 0.195(Q_{CR}^{1/3} H^{1/2})/r^{5/6} \quad \text{for} \quad r/H > 0.15$$

where:

U = velocity at distance, r, from centerline
QCR = heat release rate
H = ceiling height above top of fuel.

This relation can be reorganized to be explicit in the radius at which the velocity is predicted.

$$r \leq [1.28\ Q_{CCR}^{1/3} H^{1/2}]^{6/5} \quad \text{(meters)}$$

The result is a value for the radius between the fire center-line and the point where the ceiling jet velocity has decreased to the limit value for the U.L. Smoke box test velocity. As before, the radius is converted into a spacing using the relation:

$S = 1.414\ r$

This estimate is also limited. The Alpert correlations are only valid for steady-state fires. Uncontrolled fires are generally t-square fires. Consequently, this method is only useable as a first order approximation when the rate of the fire growth, α, is small. Just how small is subject to debate. Furthermore, this method does not consider the smoke concentration at the detector location at all. Consequently, while we have three methods for "estimating" the response of smoke detectors they are far from a credible performance prediction model. The results obtained are extremely dependent upon the inputs introduced by the user and can be used to produce utterly ridiculous results if the user is not very careful. As disquieting as it might be, until we acquire performance metrics for smoke detectors we have no credible method for determining smoke detector response. Even the notorious "30-foot spacing" for smoke detectors has little if any justification in the physics or research. The fact remains, there is NO validated method for predicting smoke detector response. Unless and until we develop credible performance metrics for smoke detectors we have tenuous basis, at best, for justifying the detector spacing we have in the National Fire Alarm Code. We are guessing!

On the surface the it would seem that developing a performance metric for a smoke detector would be almost as simple as that for a heat detector. In the case of a heat detector there are two metrics necessary. The first is the temperature at which the detector transfers from the quiescent state to the alarm state. The second is the speed with which heat can pass from the ceiling jet to the detector. Once these two metrics are known the designer can calculate the velocity and temperature of the ceiling jet at the detector location as a function of fire size an using the rate of heat flow into the detector and detector mass determine when the detector attains the alarm state.

A smoke detector should have a similar set of performance metrics. The first is the actual sensitivity of the detector - how much smoke does it take to produce a transition from the quiescent state to the alarm state. The second is the speed with which the smoke can enter the detector. Once these metrics are known the designer can compute the smoke concentration and ceiling jet velocity as a function of the fire and compartment dimensions to develop a prediction of detector activation. It sounds simple but it isn't. The difficulty lies in how we measure smoke concentration.

Smoke concentration and detector sensitivity have been measured using optical obscuration, mass optical density, mass density and particle density. Each alternative has its strengths and weaknesses as a metric for detector performance. The use of optical density as a metric for smoke detector performance is limited by the fact that this metric is dependent on the color of the smoke, the wavelength of the light source used in measurement and the fact that light beam attenuation does not necessarily correlate with light scattering. The use of mass optical density makes the metric fuel and fire specific. The use of mass density is limited by the fact that there is no correlation between the mass of the smoke in the air and the optical density humans perceive. Likewise, the use of particle density suffers from poor correlation to optical properties. Of these alternatives the use of mass density currently appears to provide one benefit - it can be directly related to the fire. For a fire of given fuel, burning at known equivalence ratio, mass density (mass per unit volume) is proportional to the temperature (heat per unit volume) of the gas. But sufficient research has not yet been concluded to provide a clear direction regarding the form of the performance metric for smoke detector sensitivity.

The rate of smoke entry metric is less difficult. There is general consensus that this metric would take a form of either a characteristic length, l, as suggested by Heskestad and Delechatsios, or as a delay time per unit of ceiling jet velocity. Either form is equally useful and will enable the designer to address the delay produced by smoke entry into the active sensing portion of the smoke detector. Clearly, before we can embrace performance-based design as a legitimate means of providing equivalent levels of fire-safety to the prescriptive requirements in our building codes we must have a credible means of predicting performance. The prediction of performance relies absolutely upon having an objective measure of performance. Lacking a performance metric we are essentially guessing. Yet this is exactly the situation we have with the two types of fire detection we use most frequently to achieve life-safety objectives. If we are to rely on either heat detectors or smoke detectors for critical life-safety objectives we have not alternative to developing the performance metrics we will use to demonstrate the achievement of a performance objective. Without a valid performance metric we are merely guessing that the system will work.

The Economic Case

There are some that hold the opinion that the development of performance metrics for fire detectors would be damaging to the fire alarm industry. We can find no basis for such a conclusion. There is no product category that has not benefited from the free and open competition that performance measurement produces. One only has to look at the development of the computer industry to see the benefits of an open market in which the best products are free to prevail. Arguably, the lack of independently verifiable performance serves as an impediment to innovation and improvement because the upstart producer is deprived of the opportunity to demonstrate the superiority of its approach.

Last Installment in the next Fusible Link

Meeting Dates/Program 2004-2005

(Programs Subject to Change)
Watch web page concerning cancellation In case of possible inclement weather conditions

March 7	"Mitigating Earthquake Damage - Reinforcing Techniques - Rich Reitberger, FM Global
April 4	"Fire Trailer & Dynamics" - NFSA Fire Burn Trailer & Fire Burn Dynamics
May 2	"Chubb Lab" - Visit and Demonstration of Chubb's Fire Protection Systems Lab in Warren, NJ.
June 13	**NOTE: DATE HAS BEEN CHANGED** - "Annual Meeting - Election of Officers Topic: Loss Lessons by John Cholin of JM Cholin Associates.
June 27	Joint NY/NJ Chapter Joint Scholarship Golf Outing at West Point

POSITIONS TAKEN BY SPEAKERS ARE NOT NECESSARILY THE POSITION OF THE NJ S.F.P.E.

All meetings are held at the Hanover Manor, Eagle Rock Road, Hanover, NJ (approximately 1½ miles west of Eisenhower Parkway). Get Acquainted Hour 5:00-6:00 p.m. Adjournment is usually before 8:30 p.m. The Executive Committee meets at 4:00 p.m.

Editors Note--If you would like to advertise your company and help offset the cost of this publication, as well as having your business card in front of over 150 Fire Protection Professionals please call John Cholin at (201) 337-8621 for further information. The cost is $100 for fiscal year.

PE EXAM TRAINING

The NJ Chapter has historically supported our membership in preparing for the Professional Engineering License test in Fire Protection. Preparing for this course takes an enormous amount of time on behalf of the instructors and a minimum number of students are required to make this worthwhile. If anyone is interested in taking this course, they should contact John Cholin at jmcholin@bellatlantic.net. as soon as possible. There is very little time left for candidates to submit their applications (with the materials required) to one of the states in our area that recognize the Fire Protection PE (PA or CT).

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MEETING NOTICE

Date: March 7, 2005

Place: Hanover Manor
16 Eagle Rock Avenue
East Hanover, NJ

Price: In Advance - $22 At door - $25

Dinner: 5:00-6:00 (Cash bar for mixed drinks)
Dinner at 6 PM

Speaker(s): Rich Reitberger - FM Global

Topic: Mitigating Earthquake Damage - Reinforcing Techniques

Please note for this meeting:
All officers, directors and committee chairman are requested to attend a meeting at 4:00 p.m. at the Hanover Manor.

PLEASE COMPLETE AND RETURN WITH YOUR CHECK PAYABLE TO "SFPE NJ CHAPTER" TO:

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ALL RESERVATIONS SHOULD BE RECEIVED BY FRIDAY, FEBRUARY 25, 2005. TELEPHONE RESERVATIONS OR CANCELLATIONS SHOULD BE RECEIVED BY NOON OF THE MEETING DAY.

Fusible Link Editors NJSFPE
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2004-2005 Chapter Committees

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