PRIEST & ASSOCIATES
CONSULTING, LLC

www.priestassociates.com

FIRESIDE

Volume 2
Number 1
Spring 2014

FROM OUR VIEW

We are pleased to present the latest edition of our FIRESIDE Newsletter. We hope you find it useful and informative. As always, we stand ready to receive comments and suggestions of ways we might improve its content or specific subjects to cover.

All of us at PAC would like to take this opportunity to wish everyone a prosperous 2014

PAC is approaching its fourth year of operations, and is proud to announce a new offering for our clients: design and construction of fire resistance and flamespread testing equipment. This will include the construction and commissioning of ASTM E84 and fire resistance testing equipment such as ASTM E119, writing custom software to drive this equipment, and training our client's staff in the correct operation of each.

This addition to our services is directly due to requests of our clients and we are proud to meet these demands.

Industry Alerts!

Glass-Reinforced Fiber (GRP) Gratings

Discussions are beginning in the International Standards Organization (ISO) on developing a standard test method for exposing GRP Gratings to a hydrocarbon pool fire. (See GRP Gratings, page 3.)

Water Resistive Barriers in the IBC

While these changes have been around for a couple of years, (See Water Resistive Barriers in 2012 and 2015 IBC, page 2.), there remains enough confusion that we felt it worthwhile to bring them up again.

To Subscribe to FIRESIDE, please click here: Fireside@priestassociates.com
To Unsubscribe, please click here: Unsubscribe@priestassociates.com

THE CODE CORNER
By Howard Stacy

The ICC ES Evaluation Committee is constantly considering changes in existing Acceptance Criteria, or the development of new ones. Some highlights of this activity are mentioned below.

Two significant issues relating to fire resistance and flammability will be addressed at the upcoming Evaluation Committee Meeting in February, both of which relate to fire retardant treated wood (FRTW):

AC124- Proposed Revisions to the Acceptance Criteria for Rim Board Products. Revisions are proposed to add a new section on factory-applied fire-retardant surface coatings. This has generated debate over the manner in which surface-coated fire resistant rim board products should be evaluated for flame spread in comparison to FRTW. These revisions were held for further study in October 2013, specifically to look at a specimen configuration for the ASTM E84 test that would address uncoated edges in rim board applications. Additions to Section 7.2.2 of the criteria are being proposed specifically to address this issue.

AC66- Proposed Revisions to the Acceptance Criteria for Fire-retardant-treated Wood.
Two commercially available FRT plywood products were obtained by an independent consultant and tested in order to verify compliance with the 30-minute extended E84 test required under Section 2303.2 of the IBC and Section R802.1.3 of the IRC. FRT plywood products from two manufacturers were acquired from various locations in the United States and the test results were evaluated. The results indicated nonconformity with the codes to varying degrees, prompting ES to consider the need to modify the quality control procedures and retesting requirements in the acceptance criteria.

ICC Code Development

With the completion of the 2013 code development cycle, several code changes affecting fire testing issues have been promulgated in the IBC, IRC, IMC and IUWIC for 2015.

- The IRC will allow ¾ inch plywood as a thermal barrier for Class B foam to be exempted from the thermal barrier fire test requirement of NFPA 275 (R316.4).
- Requirements for plenums have been moved to the IMC from the IBC.
- New E84 mounting methods have been added to Chapter 8 of the IBC.
- Bathroom partitions must be tested to NFPA 286.
- Surface burning characteristics for foam plastics will include the requirement for testing the maximum density, along with thickness, intended for use (R316.3).
- A proposal to exempt foam plastics from surface burning requirements when protected by a thermal barrier was rejected.
- Several clarifications were accepted for requirements for fire classification of building-integrated photovoltaic modules (BIPV) and rooftop mounted photovoltaic panel systems (PVMs). With the advent of an update to UL1703, the testing and regulation of these systems has become more practical.
- A change to the IWUIC covers ignition-resistant materials incorporating reference to ASTM E2768 and the requirement that panel products be tested with a ripped or cut longitudinal gap.

These developments are by no means all-inclusive, and the relevant codes must be referenced.

Water Resistive Barriers in 2012 AND 2015 IBC

In 2012, Section 1403.5 was incorporated into the International Building Code in order to regulate the incorporation of combustible components on or in exterior walls required to be tested in accordance with NFPA 285. The code section reads as follows:
1403.5 Vertical and lateral flame propagation. Exterior walls on buildings of Type I, II, III or IV construction that are greater than 40 feet (12 192 mm) in height above grade plane and contain a combustible water-resistive barrier shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

This code change created some significant concern in the WRB industry, because it seemed to indicate that each manufacturer would be required to run their WRB product in every NFPA 285 wall assembly for which it was intended for use with a potentially significant testing cost.

This concern led to the revision in Chapter 14 in the 2015 IBC which allows exceptions to facilitate the use of various WRBs in exterior walls without the need for full scale testing. Three exceptions were incorporated into Sec. 1403.5:

Exception 1:
Walls in which the water-resistive barrier is the only combustible component and the exterior wall has a wall covering of brick, concrete, stone, terra cotta, stucco or steel with minimum thicknesses in accordance with Table 1405.2.

Exception 2:
3 requirements to be met;

1. **WRB is the only combustible component in the wall.**
2. **WRB has the following performance in ASTM E1354:**
   - **Peak HRR <150 kW/m2**
   - **Total HR <20 MJ/m2**
   - **Effective Heat of Combustion <18 MJ/kg**
3. **WRB has a Class A FSI/SDI**

Exception 3:
Windows and doors and flashing for windows and doors shall not be considered to be part of a water resistive barrier for purposes of this section.

What this means is that WRBs meeting these exceptions can be used in various exterior wall assemblies without having to undergo the full test.

THE STANDARDS BOX

A new draft standard "**Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement"** will be going out for concurrent ballot in the ASTM E5 Committee on Fire Standards.

As mentioned above, a complete revision to **UL 1703 "Flat-Plate Photovoltaic Modules or Panels and Roofs"** has been done, effective October 25, 2013. This revision enables the compliance with relevant code requirements in the IRC and IBC. Discussions with UL are forthcoming to assess the potential for this as a possible ASTM standard.

ISO Fire Standards Update
By Deg Priest

The ISO TC92/Subcommittee 2 (on Fire Containment) working groups are developing new fire tests continuously. One which has been worked on for several years and is finally complete, is ISO 834 parts 10 & 11 on evaluating the fire resistance contribution to structural steel items of protective coatings such as intumescent sprays, as reported in our previous newsletter.

Work has begun on another part to ISO 834: a standard for evaluating protected beams with web openings; and, consideration is being given to the need to test steel bars protected with a fire barrier coating when under tension.

GRP Gratings

A growing concern about the performance of Glass-Reinforced (GRP) Gratings when exposed to hydrocarbon pool fires has been brought to ISO TC92/Subcommittee 2, to see if there is enough interest to begin a new work item developing a standardized test method for evaluating these products. The worry is that GRP Gratings successfully tested using the cellulosic fire curve (such as ISO 834 or ASTM E119) may not perform adequately when exposed to a high temperature, short duration hydrocarbon fires which may be experienced on off-shore facilities.
Read more at:
http://www.hse.gov.uk/safetybulletins/deck-gratings.htm

ACROSS THE PONDS
By Deg Priest

EUROPE/MIDDLE EAST/ASIA (EMEA)

Authorities Having Jurisdiction in the various Emirates making up the United Arab Emirates (UAE) and other Middle East countries have continued their move towards using North American standards, and adoption of many sections of the International Building Code. Commercial and industrial construction in the Middle East is running very strong, especially with an increasing number of programs such as:

Expo 2020 "Connecting Minds, Creating the Future," to be held in Dubai, which will be the first to be held in the MENA & SA (Middle East and North Africa & South Asia) region; and,

The **2022 FIFA World Cup Finals**, being hosted for the first time by an Arab state, which will be held in Qatar.

These and other venues will continue to drive new construction in the Middle East for years to come.

HOW IT WORKS
By Javier Trevino

<u>Estimating NFPA 259 Potential Heat Value using the Cone Calorimeter</u>

For some applications, the building code specifies that the Potential Heat of combustible materials be reported based on the NFPA 259 procedure. Although this is a relatively simple and inexpensive procedure, we have been asked to provide estimates of the potential heat based on cone calorimeter data prior to clients submitting specimens to laboratories for testing. We have successfully calculated the potential heat for spray foam using cone calorimeter (ASTM E1354) test results with 98.5% agreement. To those who are experts in fire science, this might not sound like an accomplishment worth mentioning. The reason being that potential heat (NFPA 259) and heat of combustion (ASTM E1354) are essentially the same thing, but the units of reporting (for code compliance) and fire dynamics of the two methods differ. For NFPA 285 applications, the units are in terms of Btu per ft^2 per inch of thickness for combustible insulation. If one were to convert cone calorimeter data directly to NFPA 259 data (in code units), one finds an error as large as 30% low. The reason for the error is, a correction is needed for incomplete combustion. In many E1354 tests, there remains unburned material, and the burning process is not 100% efficient. A proper conversion takes into account the incomplete mass loss and the relative burning efficiency. The final step in the process is to utilize material density in order to get units of Btu per ft^2 per inch. For more information about this subject, contact me.

DID YOU KNOW?
By Javier Trevino

<u>Fire Modeling Room Burns Using Cone Calorimeter Data</u>

Many fire models are not capable of modeling room corner scenarios from basic properties of the materials being evaluated. Of all the available fire models, CFAST seems to be one of the more widely used models. However, in order to use CFAST, one needs to input the Heat Release Rate (HRR) curve. For items which burn readily (i.e., an increasing HRR), one typically employs a T^2 fire with known peak HRR, time to peak HRR and fire duration. The problem is that the fire growth constant is unknown, so users revert to fire test data to approximate the input fire.

In response to this, for spray foam applications, Priest & Associates has developed a fire model which calculates the T^2 fire based on cone calorimeter and other small scale data. We developed the fire model (Labview Computer Program) to predict time to ignition and fire growth rate in the standardized room corner configuration using the 40 kW NFPA 286 gas burner as the ignition source. The results are based on published fire growth mathematics and material properties of the material being evaluated.

The properties needed as input are:

• critical heat flux;	* thermal conductivity
• ignition temperature;	* density
• Pk. HRR;	* specific heat

The model uses that information to calculate a T^2 fire which "burns" the room mathematically. The algorithm "burns" segmented areas, with each segment having a calculated time to ignition (selectable Mikkola/Wichman or Janssens model) and peak HRR. The model first calculates the time for the flame to spread to the ceiling. During this part of the algorithm, re-radiation based on the cumulative HRR is taken into account. This causes the fire to grow faster. As it does this, it calculates the HRR as a function of time in order to estimate the fire growth rate constant. When the fire reaches the ceiling, the calculation evolves to a T^2 fire (based on the fire growth rate in the corner) which is then used to estimate the time to flashover (a target HRR input by the user). The peak HRR is based on the amount of material available (surface area). In real fires, the peak HRR is ventilation controlled. This feature will be available in future versions of the program. The program then calculates the time to reach the peak HRR. At this point, the fire is assumed to be constant. Currently, the program does not "consume" material in order to determine the declining HRR profile. This can be incorporated in future versions of the program. For unventilated rooms, the time to self extinguishment is calculated based on oxygen depletion of the environment. The fire "self-extinguishes" when the oxygen level falls below a prescribed value. For the time being, this value is based on an actual fire test in order to predict the time to self-extinguishment of larger volumes. This has been tested to within reasonable agreement. The program is currently used for Priest & Associates evaluations and is not available to the public until ventilation controlled fires are taken into account, and material consumption is incorporated for the declining part of the HRR curve. At that point, model validation will be needed to finalize the program.


Deg Priest
President

Deg Priest has been involved with fire testing of building materials since 1977. His career spans a wide range of product development, fire test equipment design and construction, attendance on consensus standards setting organizations and P&L management of fire testing laboratories


Javier Trevino
Principle

Javier Trevino has been in the fire testing industry for 22 years. His expertise lies in flammability issues (E84, NFPA 286, NFPA 285, cones, etc.). He is our expert in fire modeling, computer programming, and field work involving refurbishing and commissioning of fire test equipment such as tunnels, cones, furnaces, HRR hoods.


Howard Stacy
Principle

Howard Stacy has more than thirty five years of experience encompassing a broad range of fire testing, product development, construction litigation support and 3rd party certification for the building products and construction industries. Howard is the Chairman of SC E05.14 "External Fire Exposures" under ASTM E5 committee on Fire Standards.