Hot Issues in Fire Engineering

1 August 2012

On the Proposed Design Fire in the New Fire Safety Code

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Since 1998, small fire scenarios of only up to 5 MW have been assumed in hazard assessment for many big halls while applying Fire Engineering Approach (FEA) [1]. Such assumptions were commonly made for crowded large shopping malls and underground public transport interchanges. The heat release rates of the design fire were much lower than the ones of real big fires as experienced in many cases [2,3] before. Such a low design fire was even used many years ago in Chek Lap Kok Airport [4]. Perhaps, this might explain why long-throw sidewall sprinklers were added in some areas for catering.

The Available Safe Egress Time (ASET) in an actual big fire will be much shorter than the estimated value derived from a small design fire. Occupants staying inside the crowded hall are exposed to more heat and smoke. It should be noted that apart from carbon dioxide and carbon monoxide, the tenability criteria does not include smoke toxicity of other toxic gases in the estimation of ASET in most FEA projects [1,5]. A very long ASET was estimated.

The Required Safe Egress Time (RSET) was not estimated under crowded conditions. Human behavior in evacuation has not yet been studied systematically in the Far East. Therefore, RSET will be much longer than the estimated value. This flawed ASET/RSET approach, which assumes ‘robotic motion’, has already been criticized by world-class scholars [6]. Social awareness on fire hazard is low in the Far East. There are extra problems as ‘fire resistance dampers’ are not installed properly. The associated fire code has to be reviewed, as discussed in June 2012. Long ASET and short RSET presumed in FEA projects are therefore very dangerous [1,7].

It is proposed that more realistic fire scenarios with higher heat release rate should be assumed to derive reasonable values of ASET in new projects. Fire safety management must be enhanced immediately in existing projects with long ASET and short RSET, which are derived from the assumption of small fire scenarios and low design occupant loading respectively. Appropriate fire safety management scheme must be implemented in crowded areas, such as public transport interchanges and underground subway stations. It is not clear

why fire suppression systems are not made in such places. For example, sprinkler system not provided in some station platforms without any justification.

Hong Kong has just released the building fire safety code [8] with the preliminary reports prepared after 10 years of study. This is a good starting point to identify the mistakes made in FEA, the fire safety provisions to be enhanced, and immediate actions to take in approved FEA projects. However, there are many different concerns, which will be discussed in a series of papers to appear later.

The first point is on design fire. In the building code [8] which is released for public consultation in September 2011 and implemented in April 2012, the design fires are not clear. Specific comments [5,9-12] on the design fire are listed as following.

p. 202 G6.5 Design fire:

Are there any experimental justifications with full-scale burning tests using oxygen consumption calorimetry on local combustible products ?

p. 207 Table G1: Item 5c

Using a range from 5 MW to 6.2 MW for train fire is too low. Note that Korean data [9] on train fire was up to 20 MW. Even a local report on Ma On Shan Rail got 17 MW [10]. Such tests were on empty train cars. Therefore, not clear why such low values were recommended.

p. 207 Note (2)

Reference 3 on CIBSE TM19 [11] is rather old. No wind effect for small residential flats in supertall buildings [12] with openable windows included to cater for high wind speed to give much higher heat release rates.

p. 208 point (3) Design fire based on survey load

Those are average heat release rate, not peak heat release rate. Peak heat release rate can be very high and burning duration t_B as in Fig. 1 can be very long. It can even be longer than 2 hours!

Any local data to support the CIBSE- Guide E [5] figure on Q_u to be 550 kW/m^2 for retail shops in Hong Kong with most of combustible products made in Mainland?

p. 209 point (6)

Are there any impact of sprinkler on burning gasoline in a car?

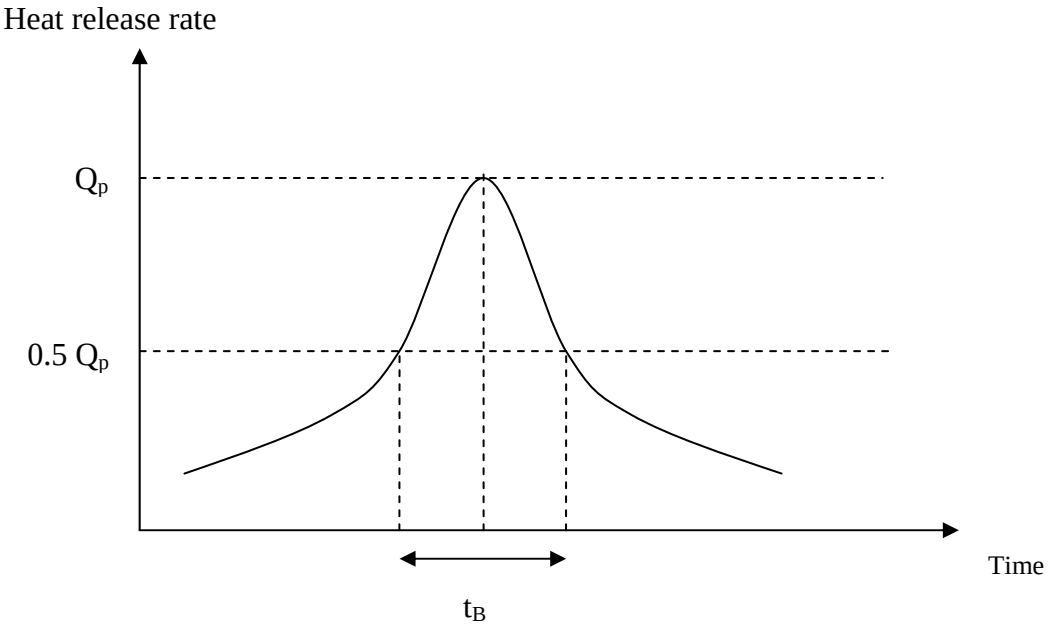

Fig. 1: Burning a combustible item

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