J. of Fire Prot. Engr., 5 (4), 1993, pp 135–140

CHANGING THE REGULATORY SYSTEM TO ACCEPT FIRE SAFETY ENGINEERING METHODS

J. Kenneth Richardson, P.Eng.
National Research Council of Canada
Ottawa, Ontario K1A OR6
Canada

SUMMARY

Globalization of trade and elimination of trade barriers indicate the need for performance-based regulations supported by fire safety engineering methods. These new fire safety engineering methods are presently being constrained by existing regulations, and thus the regulatory "system" needs to be changed. Changes will be needed by those who develop codes to deal with such issues as the levels of safety. The fire safety engineering qualifications for stakeholders and regulators will need to be upgraded, and they will have to be prepared to be licensed to practice. Other measures are outlined for all parties involved to ensure that fire safety engineering methods become the basis for performance-based codes.

INTRODUCTION

With the globalization of trade today, there is a necessity that building and fire regulations in all countries be transparent and that they not be non-tariff trade barriers. With international agreements, such as NAFTA, this means that individual countries cannot use their building codes to block the entry of products from other countries or to give preferential treatment to domestic products. Countries such as the United Kingdom and New Zealand have already enacted performance-based regulations, and many others view such regulations as the direction for the future. Performance-based building regulations are those which state their objectives clearly, specify performance requirements that are verifiable and that permit any solution that meets the performance requirements. For such regulations to be successful, it is necessary that the structures supporting the regulations, such as fire safety (protection) engineering methods, be given full recognition and acceptance.

Without a doubt, the first roadblock that fire safety engineering methods will face is the codes and regulations in place in virtually every country. This present system of regulations is perhaps the most formidable barrier in the road toward the acceptance, adoption and use of performance codes based on fire safety engineering methods. Fire safety engineering methods include not only design tools to calculate such features as egress time, structural response to fire and response time of detectors, but also the comprehensive fire risk methodologies which address overall building fire safety.

At the Conference on Firesafety Design in the 21st Century, David Lucht, in summarizing the barriers to the use of emerging fire design methods, stated that the leading barrier is the lack of explicit public safety design goals—which he further explained to be a lack of definition of desired levels of safety, lack of measurements for success/acceptability of risk and lack of performance-based objectives[1]. Today, in dealing with fire safety, these design goals are usually implicit in building regulations and are not readily understood by the regulatory system which surrounds the regulations.

This paper will try first to define the regulatory "system" that needs to be changed to enable the goal of globalization of trade, will explore needed paradigm shifts for each of the participant groups (players) in this system and will explore ways to reach the goal of gaining acceptance for fire safety engineering methods within performance-based regulations. This discussion is applicable to virtually every country where a regulatory system exists.

Definition Of Regulatory System

This paper defines the regulatory system in terms of the "players" involved, since the system is governed by one or more of these players. The regulatory system will thus be assumed to consist of three distinct entities:

- the codes and regulation writers, including those who develop public policy (legislators);
- the regulators: those who enforce the laws and regulations;
- the stakeholders: those who use the regulations, including but not limited to the owners, operators and designers (architects and engineers) of buildings. Fire protection (safety) engineers will often be members of this community.

The involvement of the first two players in the regulatory system follows the traditional approach in most countries. The stakeholders are not often considered to be players in the regulatory system. In fact, the stakeholders are often considered to be antagonists of the regulators and code writers. In this paper, the stakeholders will be considered very much a part of the regulatory system since many of them use the present type of regulations as a crutch, claiming that the prescriptive requirements are more easily understood and applied than performance requirements[2]. Obviously, then, they are a part of the regulatory system that must be addressed.

Changes For Those Who Develop Codes, Regulations And Public Policy

Advancing toward acceptance of fire safety engineering methodologies and performance-based codes requires that public policy and building regulations deal with levels of safety and safety factors (performance) and not with the specific details of how to achieve such safety (prescription). Public policy and codes have traditionally specified fire safety equipment and architectural designs rather than addressing the basic question of how much fire safety is needed or expected from such policies and codes. The writers of these documents are, therefore, the first group that must be addressed. While it is contended that the focus of new regulations should be on performance goals, prescriptive details could still be provided for those wishing to deal with simple designs (often referred to as "deemed-to-satisfy" solutions).

A simplistic, but effective, measure is to assume that the overall level of fire safety embodied in the present building regulations (in their totality) is the level demanded by society. Since this level is already implicit in the present regulations of most countries, the use of this level avoids the debate by policy makers and code writers on how many lives may be lost and how much damage is acceptable. Beck and Yung[3] use this approach in assessing risks to life in their risk-cost assessment models. Hall[4] also states that the fire risk assessment approach is the preferred direction for the future.

The policy approach of accepting levels of safety, as embodied in prescriptive regulations, as a starting point has two major advantages. First, the present prescriptive regulations provide a simple approach to dealing with fire safety in smaller, uncomplicated buildings. It should be noted, however, that designing strictly to prescriptive codes could lead to unsafe buildings—especially where the occupancy or occupants differ from accepted norms. For that reason their application should be limited to the

smaller, uncomplicated structures. Lucht points out that fire safety engineering methodologies are more likely to be of value in more complex buildings[5]. Secondly, it avoids the policy question of how much safety is sufficient—an impossible question for legislators torn between public safety and economic reality. The approach of having both prescriptive and performance regulations in effect on parallel paths (rather than accepting fire safety engineering methodologies by variance) may prove to be an easier transition for public policy makers and code writers along the road leading toward acceptance of performance-based codes. It is suggested, however, that the performance approach be the basis of the regulations, not the prescriptive.

Having established a means to state the overall level of safety required by policy makers and code writers, the regulations themselves can contain the specific fire safety goals. Bukowski and Tanaka[6] propose a short list of such goals that could be examined by code writers:

- Prevent the fire or retard its growth and spread
- Protect building occupants from the fire effects
- Minimize the impact of fire
- Support fire service operations.

Code writers can, using the fire safety engineering methodologies, calculate the extent to which each of these goals must be met to achieve the required level of safety (risk) for building occupants.

In addition to the above, public policy developers and code writers must also address the following if fire safety engineering methodologies are to be accepted as the norm:

- A change for code writers to acknowledge and accept accreditation standards (levels of performance) for fire safety practitioners—both stakeholders and regulators. Such standards may be developed by engineering accreditation boards or professional societies. With performance-based codes and the new fire safety engineering methods, comes a significantly greater need for technically competent designers (users) and regulators. Similar to the manner in which structural engineers are presently addressed in regulations, "licenced" professionals will need to be accredited by non-biased professional organizations, such as the Society of Fire Protection Engineers or governmental licensing boards.

- A change by policy makers and code writers to accept the concept of cost effectiveness as a basis for the regulations. Since the present required cost-benefit studies have never been clearly defined as to form and content, major abuses have occurred and their acceptance limited. A change is clearly required to provide a mechanism for the proposal and acceptance of solutions that result from appropriate evaluations of cost effectiveness providing equivalent safety. One such methodology is proposed by Beck and Yung[3] which, in addition to providing an evaluation of fire risk, provides a mechanism for evaluating cost-effectiveness of fire safety solutions. This method evaluates cost effectiveness not only on the basis of capital and operating costs but also on the basis of potential fires that may occur in the building over its life.

- A change in the minds of public policy makers (and the general public) to accept the fact that compliance with codes of any type will still result in a certain risk-to-life for building occupants. Public policy makers can no longer claim that their codes provide an absolute elimination of risk-to-life from fire. A definition of reasonable risk, as noted previously, must be incorporated in the regulations and accepted by public policy makers.

Changes For Regulators

As a body, regulators tend to have high levels of knowledge of the codes themselves, but often lack a knowledge of the fire safety technology behind them. Many fire safety regulators have professional qualifications in other disciplines (such as architecture or mechanical or structural engineering) but have not had professional training in fire safety engineering[2]. As recommended by Lucht[7], upgrading of the fire safety engineering qualifications of the regulators is needed to enable them to review and accept engineering solutions based on the new fire safety engineering methods. Regulators, as well, will have to be prepared to be licenced or certified to deal with these more complex fire safety engineering methodologies or they will have to accept licensed or certified third-party professionals with appropriate credentials.

As we move towards more complex and performance-based codes, regulators will also have to recognize fire safety engineering as a legitimate discipline—necessary for the development of advanced fire safety engineering design solutions. While most regulators would not accept a structural design submitted by an electrical engineer, most today would accept a complicated fire safety engineering design from any engineer licenced in another discipline—or not licensed at all.

Lastly, regulators must begin to accept greater risks—within defined limits. Strict adherence to the letter of the law for a complex fire safety engineering solution will no longer provide a risk-free environment since there will be no prescribed solutions. With performance-based codes, fire safety engineering solutions will become the norm—and review and acceptance of these will involve making unique decisions for most cases, many times without code precedence. This will appear to be increasing the risk and possibly the liability to the regulator. The fire safety engineering solutions proposed, however, will allow regulators to make technically-based and not subjective decisions which should, in fact, lessen the risk. With the increases in technical fire safety knowledge discussed above, it is probable that most regulators will be able to meet this new challenge and will be prepared to accept technically sound fire safety engineering methodologies.

Changes For The Stakeholders

As with regulators, the stakeholders will have to greatly increase their competence in handling fire safety engineering methodologies. This will require that architects and engineers receive formal education and practice in fire safety engineering. The new fire safety engineering methods will require stakeholders to have an in-depth and current understanding of fire safety technology, as indicated previously for regulators. In addition to formal training, this will also require continuing education as the technology unfolds. A knowledge of what performance can be expected in real fires from analyzing small-scale test results will become imperative in the new approach. The potential problem of current stakeholders not being competent in today's fire safety technology is a major concern to the regulatory community[8].

As well as this need for increased knowledge, stakeholders will have to be prepared to be licensed (or certified) to practice fire safety engineering. This certification will need to be based on standards acceptable to the code writers and the regulators. The concept of a generalist doing many forms of engineering, including fire safety engineering, will disappear. This will mean that stakeholders will have to pass examinations or interviews to demonstrate ongoing competence to remain licenced.

Lastly for the stakeholders, there will have to be an acceptance that they will have significantly greater freedom to design and operate buildings, and the age-old excuse of blaming the codes for poor designs or performance will no longer be a defence. Stakeholders may continue to use the prescriptive (deemed to comply) codes, if the

parallel paths concept is adopted, but these stakeholders will not be the leaders in their profession. As well, stakeholders will have to accept the significantly higher perceived risks (professional and legal) associated with design to fire safety engineering principles and not to specific "code" requirements. Until experience with the new methods is available, liability insurance may be a greater issue than with prescriptive codes. At the same time, however, capable stakeholders will be free to devise cost-effective, innovative solutions without compromising safety — and probably achieve significant economic benefit with the new designs.

The Challenges

This paper has identified a number of changes that are needed in the regulatory system prior to the general acceptance of new fire safety engineering methods and performance-based regulations. It is recommended that all three players identified address the following two challenges as initial steps:

Establish Levels of Safety

All players must come to agreement as to what levels of safety are expected from fire safety engineering methodologies. This paper has offered one possibility, however, there has to be agreement. Parallel paths of prescriptive and performance regulations may be a possible solution. All parties must also agree on how to verify this level of safety and what fire safety objectives are to be measured.

Establish Levels of Competence

All players must address the issue of level of performance (competence) of fire safety engineering practitioners (both regulators and stakeholders). Levels of knowledge, types of knowledge and demonstrated experience are essential components as are licencing and continuing proof of competence throughout a career. Standards for establishing competence will need to be established.

Should these two challenges be successfully addressed and resolved, two of the greatest non-technical barriers to the acceptance of fire safety engineering methods in regulations will have been overcome. The other non-technical barriers, many of which have been addressed previously, can be handled more easily with these two issues out of the way.

Summary

To achieve the goal of global trade, many countries' regulations will have to be changed to become transparent and not be non-tariff trade barriers. Performance-based codes, supported by fire safety engineering methodologies, are considered to be the most appropriate means to achieve that goal. To gain acceptance of fire safety engineering methods in the regulatory system, changes are required for the three major players: the public policy developers/code writers, the regulators and the stakeholders. Major issues that must be addressed include: definitions of levels of safety, demonstration of technical competence, acceptance of licencing (certification) of all practitioners, cost effectiveness and increased risk-taking.

The two most important challenges that must first be addressed before progress can be made are defining the level of safety required by regulations and defining the level of competence required of practitioners. With those two issues addressed successfully, the path to gaining regulatory acceptance of fire safety engineering methods and performance-based codes may still be somewhat rocky, however, the major barriers will have been removed.

REFERENCES

1) Lucht, D.A., "Executive Summary," *Proceedings of the Conference on Firesafety Design in the 21st Century,* Worcester, MA, 1991, pp. 2-23.

2) Corbett, G.P., "Codes, Code Officials, and Firesafety Design in the 21st Century," *Proc. Conference on Firesafety Design in the 21st Century,* Worcester, MA, 1991, pp. 107-123.

3) Beck, V.R. and Yung, D., "A Cost-Effective Risk Assessment Model for Evaluating Fire Safety and Protection in Canadian Apartment Buildings," *Journal of Fire Protection Engineering,* Vol. 2, No. 3, 1990, pp. 65-74.

4) Hall, J.R., "Risk Based Design," *Proceedings of the International Fire Safety Engineering Conference,* Sydney, Australia, 1992.

5) Lucht, D., "International Developments in Building Code Concepts," *Proceedings of the SFPE Seminar on Issues in International Fire Protection Engineering Practice,* Society of Fire Protection Engineers, 1993.

6) Bukowski, R.W. and Tanaka, T., "Toward the Goal of a Performance Fire Code," *Fire and Materials,* Vol. 15, 1991, pp. 175-180.

7) Lucht, D., "The Enhancement of the Professional Quality of People," *Proc. Conference on Communications between the Fire Research Community and the Owner-Operators of Buildings,* National Research Council, 1984, pp. 121-128.

8) Jones, G.H., "Firesafety Design in the 21st Century—a Building Official's Perspective," *Proceedings of the Conference on Firesafety Design in the 21st Century,* Worcester, MA, 1991, pp. 224-227.