Talk by Dr. Monideep Dey

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Working Toward an Enhanced and

Integrated Performance-Based

Regulatory Regime for Fire Safety

关于建立更加强大和全面的消防安全性能化法规制度

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Biography

Dr. Monideep Dey is President of Deytec, Inc., providing training and consulting services for fire safety engineering, and also audit and certification of fire safety programs. The services of Deytec, Inc. include sectors such as the built environment, tall buildings and iconic buildings, industrial facilities, warehouses, tunnels and nuclear power plants. The emphasis of Deytec, Inc. is on quality assurance to improve fire safety by preventing fires and minimizing its effects, if fires do occur.

戴伊（Monideep Dey）博士，美国 Deytec 公司总裁，公司负责消防安全工程领域培训和咨询，消防安全项目检查和认证。Deytec 公司服务涉及建筑环境，高层建筑，标志性建筑，工业建筑，仓库，隧道及核电站。Deytec 公司致力于通过消防安全的质量保障，尽量降低火灾造成的损害。

Dr. Dey has been involved in the International Organization of Standardization ISO TC 92, Fire Safety, since 2009. He is presently the Chairman (Convenor) of ISO TC 92 SC 4 WG 7 on verification and validation of fire calculation methods. In his work at ISO TC 92, he has developed standards to ensure reliability of calculation methods for fire safety engineering, taken initiatives to make ISO standards practical and usable, improved standards to address quality in fire safety programs.

戴伊（Monideep Dey）博士自 2009 年参与国际标准化组织 ISO /TC92（消防安全技术委员会）的工作。他目前担任 ISO/TC92/SC4/WG7 工作组召集人，主持火灾计算方法的验证和确认的标准项目。在其参与 TC92 活动期间，已负责起草相关标准确保消防安全工程计算方法的可靠性，积极助推 ISO 标准可操作和实用性，并提高标准中质量在消防安全项目的作用。

Dr. Dey has an in depth familiarity with ISO fire safety engineering standards and also the product fire performance standards of ISO. He recently has taken an initiative at ISO TC 92 to integrate all ISO fire safety standards, those for fire safety engineering and product performance.

戴伊（Monideep Dey）博士深谙消防安全工程及灭火性能 ISO 国际标准。他近期在 ISO/TC92 牵头负责整合 ISO 领域全部消防安全标准，包括消防安全工程和产品性能标准。

Dr. Dey has a PhD in nuclear engineering from the University of Michigan, USA.

戴伊（Monideep Dey）博士在美国密西根大学获得核能工程博士学位。

Talk

Thank you _____ for the introduction. It is my pleasure to be here at this conference and I thank TFRI for inviting me to give this talk to this esteemed audience. I hope you will find it useful for your work for fire safety in China.

讲稿

感谢_____的介绍。非常高兴能够参加这次研讨会，感谢主办方 TFRI 提供机会在这里和大家交流。希望能对您和中国消防安全工作有所帮助。

Slide 1

I will be talking about *working toward an enhanced and integrated performance-based regulatory regime for fire safety*. This talk is applicable to our fire safety industry in general but also for any specific country that wishes to improve its fire safety program. I have specifically designed the talk for fire safety in China.

幻灯 1

我要谈的是***关于建立更加强大和全面的消防安全性能化法规制度***。这个话题适用于消防安全整个领域，也适用于希望提高其消防安全制度的国家。针对中国消防安全情况我特别准备了下面的内容。

Slide 2

The aim of my presentation is firstly to present current practices for fire safety worldwide. Then I will discuss developments and the status of performance-based fire safety design, specifically the enhancements that are needed for performance-based fire safety design. I will also discuss the need for integration of prescriptive fire performance standards with performance-based design. The ultimate goal is to improve quality of fire safety programs and thus fire safety in China.

幻灯 2

我讲座的第一部分是介绍目前国际上消防安全领域普遍管理做法，然后再谈一下性能化消防安全设计的发展和现状，重点介绍性能化消防安全设计需要增强的内容。我还会讨论一下规格式消防性能标准和性能化设计整合的必要性。最后会探索提高中国消防安全项目的质量水平从而提高中国消防安全的方法。

Slide 3

Let me now discuss the current practices in fire safety.

Fire safety design is presently done with the prescriptive product performance fire standards for combustibility and flammability, resistance to fire, for determining the effects of fire effluents and tenability conditions. The organizations that publish prescriptive product standards are the

International Organization of Standardization, or ISO, the American Society for Standards and Materials, or ASTM, the National Fire Protection Association, etc.

幻灯 3

我首先先谈一下消防安全领域的惯例。

目前，消防安全设计通用做法是使用描述性产品性能化标准中的可燃性、易燃性、耐火性能来判断火灾产生的燃烧产物和耐受程度。目前已发布关于描述性产品标准的标准化组织包括 ISO，国际标准化组织，美国材料与试验协会 ASTM 和美国消防协会 NFPA 等等。

Slide 4

In contrast performance-based, or (P-B) standards, also known as fire safety engineering – FSE – standards, one defines, safety objectives, functional requirements, and performance criteria first. From now on I will use the term fire safety engineering and performance-based interchangeably as meaning the same. Then the standards require the most important step which is to define fire loads in building or facility for which the fire safety plan is being developed. Then one conducts engineering calculations to determine if performance criteria are met which were set in the first step. Examples of performance criteria are tenability for the life safety objective, or heat flux or smoke density if equipment performance in a fire is the objective.

幻灯 4

在性能化基础（P-B）标准，也就是消防安全工程（FSE）标准中，会首先定义安全目标，功能要求和性能指标。接下来我会交替使用消防安全工程和性能化基础两个术语表示同一个意思。标准中规定的最重要的步骤是定义在消防安全计划中建筑和设备火灾载荷。然后进行工程计算确定是否性能化标准是否符合第一步骤要求。性能化要求可以包括生命安全目标的可维持性或热通量或烟浓度（若在火灾中设备性能是一个设定目标）

Slide 5

This slide shows the fire safety engineering design process for a fire safety plan. The figure is taken from ISO 23932 which contain the general requirements and procedures for a fire safety engineering design. Initially, the scope of the project must be defined, what safety objectives are of concern and is fire safety in the whole building or facility being analyzed, or just part of it.

幻灯 5

这张幻灯片展示的是一个消防安全方案中消防安全工程设计过程。图片是摘自 ISO 23932,包括消防安全工程设计的总体要求和步骤。首先，必须界定项目范围，安全目标是什么，是关于整栋建筑的消防安全还是只是分析部分设备。

Then as I have described before, the safety objectives, functional requirements, and performance criteria are developed, followed by the most important step to define fire loads in building or facility for which the fire safety plan is being developed. Based on these fire loads, one has to develop a preliminary fire protection plan which one believes will provide a level of fire protection so the performance criteria will be met. Then a set of design fire scenarios and design fires are developed for which one conducts engineering calculations to determine if performance criteria are met. If they are not met, then one has to modify the fire safety plan until the performance criteria are met.

然后像我刚才提到的，设定安全目标，功能要求和性能指标。下一步是最关键的步骤，设定消防安全方案中的主要对象，建筑或设备的火灾载荷。在已有火灾载荷基础上，制定一个可以满足性能指标的消防方案初步设计。然后设计系列不同火灾场景，可以通过工程计算确定是否符合性能指标要求。若不符合要求，需要修改消防安全方案直至符合性能指标要求。

Shown on the right side of the figure is the most important part of fire safety engineering, that is to document the initial plan and implement it, but also to establish a fire safety management and audit program to continual monitor changes in the fire loads and to determine if the fire safety plan needs to be modified. At ISO TC 92 SC 4, Fire Safety Engineering, we are currently emphasizing this part of fire safety engineering in the ISO standards.

投影右侧的图表是消防安全工程最重要的部分，撰写初步设计方案并实施，并建立一套消防安全管理和检查程序，持续监控消防载荷的变化，从而判断消防安全计划是否需要修改。在 ISOTC92SC4 消防安全工程委员会，我们目前的工作重点就是这项内容的国际标准项目。

Slide 6

In ISO, we have developed a set of ISO fire safety engineering standards which we call the Global Fire Safety Engineering Analysis and Information System. This set of standards include general procedures and requirements, and procedures to develop design fire scenarios and design fires, fire loads. There is a very important standard for verification and validation of fire calculation methods which has recently been improved to ensure reliability and quality in fire safety engineering. There are also standards for structural failure calculations, fire detection and suppression, and evacuation modeling.

幻灯片 6

在 ISO，我们致力于一整套 ISO 消防安全工程标准，我们叫做全球消防安全工程分析和信息系统。这套标准包括总体步骤和要求，开发火灾场景的步骤 和设计火和火灾载荷。我们有一部非常重要的标准，关于火灾计算方法的验证和确认，提高了消防安全工程领域的质量和可靠性。我们还有一些标准是关于建筑损坏计算，火灾监测和灭火和疏散模型。

Slide 7

This slide shows a schematic of the Global Fire Safety Engineering Information System in another format. At the left you have the prescribed parameters given by the architect, the building or facility size, number of rooms, type of materials in the rooms, fire loads etc. On the top you have first the design scenarios which is the basis of you fire protection system design. The fire phenomenon are analyzed for these scenarios, the initiation and development of fire and fire effluents, movement of the fire effluents, structural response and propagation of the fire beyond the enclosure of origin, and finally detection and suppression of the fire. It is important to understand the interrelationships between these phenomena in fire safety engineering.

幻灯 7

这里介绍的是关于另外一个版本的全球消防安全工程和信息系统图解。左边可以看见一个建筑师提供的描述性参数，建筑或设备的尺寸，房间数量，房间内材料材质，火灾载荷等等。最上方是设计场景，这是灭火系统设计的基础。通过这些设计场景分析火灾现象，火灾的最初和发展情况及火灾燃烧物，燃烧物的运动情况，结构响应，火灾在火源封闭空间以外的传播，及火灾最后的监测和灭火。在消防安全工程领域，理解这些现象的内部联系是非常重要的。

At the bottom you have the possible safety objectives for the fire safety design, life safety, property loss, business interruption, contamination of environment, and destruction of heritage. The functional requirements and performance criteria are set based on the safety objective and evaluated for the design scenarios as shown in the block on the right hand side. The ISO standards for each of these blocks is also shown in the schematic.

在图片下方是消防安全设计中可能实现的目标，关于消防安全设计，生命安全，财产损失，营运中断，环境污染和文物的破坏。功能性要求和性能指标是在设定安全目标基础上制定的，并根据右侧的设计场景进行评价。ISO 标准在不同模块有相应标准提示

Slide 8

The advantages of the global approach is that it provides awareness of the interrelationships between fire evaluations when using ISO or other fire safety engineering standards, and it provides logical means to organize analysis and data needed for the safety design. Computer models cover several subsystems and can become a “black box” if awareness of interactions not maintained. Also, “Quick Calculation Methods” for the fire phenomena shown in the schematic in the last slide has an important role in fire safety engineering because it facilitates understanding of fire safety engineering and can check for errors from more complex computer codes.

幻灯 8

全局理论的优势就是在使用 ISO 或其他消防安全工程标准时关注火灾评估的内在关系，在安全设计中为分析数据提供逻辑方法。计算机模型包括若干分系统，如果内部联系没有达到就会变成一个“黑匣子”。同时，在上一张幻灯中展示的关于火灾现象的图表“快速计算方法”在消防安全工程中起到非常重要的作用，因为他有利于理解消防安全工程并从更复杂的计算机数据中查错。

Slide 9

This slide lists the ISO standards available for fire safety engineering. The column on the left side lists the Chapters in ISO 23932 which contain the general requirements and procedures for fire safety engineering. The middle column lists the ISO standards available for implementing the requirements and procedures in those chapters. I won’t go through the list in detail here. They are provided to you for future reference in your work.

幻灯 9

这张幻灯片列出了现有 ISO 国际标准化组织关于消防安全工程的国际标准。左侧列出的是 ISO 23932 系列标准，包括消防安全工程的总体要求和步骤。中间栏列出相关标准的具体实施要求和步骤。在这里我不再详细介绍标准的具体细节。这些资料仅供在日后工作参考。

Slide 10

This slide lists the ISO standards that compose what ISO now has named the Global Fire Safety Engineering and Analysis System. The list is contained in the paper I wrote for this conference and is provided to you for future reference in your work.

幻灯 10

这张幻灯片列出 ISO 中所有被称为“全球消防安全工程和分析系统”的标准。我为这次研讨会撰写的报告中有这个列表的详细内容供大家日后参考。

Slide 11

Let me now mention the other standards by other organizations that are available for fire safety engineering. The Society of Fire Protection Engineering (SFPE) has published Performance-Based Guidelines, the American Society of Testing & Materials (ASTM) has some standards for fire safety engineering and is now going through the process of national adoption of ISO fire safety engineering standards in the US. British Standards Institute (BSI) and Standards Australia were active in the early formulation of ISO standards and now have developed that information into their own national standards which are used around the world. Those by BSI in the gulf states mostly, and standards of Standards Australia are used in Indonesia, Malaysia, and countries in that region.

幻灯 11

下面我介绍一下其他标准化组织中现有消防安全工程领域的标准。消防安全工程协会（SFPE）出版了一部性能化导则，美国材料与试验协会 ASTM 也有一些关于消防安全工程的标准，目前正在进行将 ISO 标准采纳为美国国家标准的阶段。英国标准化协会（BSI）和澳大利亚标准化协会（SA）在 ISO 标准制定初期也积极参与标准项目工作，目前也将 ISO 标准内容引入到本国用于全球使用的标准内容中，比如 BSI 英国标准化协会用于大部分海湾国家，澳大利亚标准化协会用于印尼，马来西亚及该地区的其他国家。

Slide 12

I would like to now summarize for you the evolution and experience in fire safety engineering around the world. New Zealand has been a pioneer in this effort and published a Verification Method: Framework for Fire Safety Design also known as C/VM2. The fire safety requirements in the New Zealand building code is totally performance-based and I will discuss this more later. The Nordic Countries have also moved along similar lines and published, Fire Safety Engineering — Verification of fire safety design in buildings - prINSTA TS 950. Australia is embarking on a similar path as New Zealand with an optional verification method. The European standards body, CEN, has recently initiated fire safety engineering standards development and would like to adopt ISO standards as much as possible.

幻灯 12

我现在简要介绍一下国际上消防安全工程领域的发展历程。新西兰是该领域的开拓者并发布了一个验证方法：消防安全设计的框架（俗称 C/VM2）。在新西兰的建筑规范中，消防安全要求全部是性能化为基础的，我稍后会详细说明。北欧国家也沿着类似的路线发布了消防安全工程-建筑中消防安全设计的验证-prINSTA TS950.澳大利亚是和新西兰相同的路线并提供一个可选的验证方法。欧盟（CEN）最近着手制定消防安全工程标准并希望尽量多的采用 ISO 标准中内容。

Slide 13

So why do I emphasize ISO standards at this conference for you. I have been involved in ISO since 2009 because I believe ISO fire safety standards will become dominant in the future. I believe China with representation by SAC in TC 92 concurs with this statement. ISO standards are developed by member national standards bodies such as SAC and the American National Standards Institute - ANSI, and not individuals. ISO and the UN are promoting the use of ISO standards around the globe, specifically in developing countries. They are hosting a conference and training in November 2015, in Geneva, Switzerland on the topic of “Using and referencing ISO and IEC standards to support public policy and

regulation." This will be a very important initiative for ISO and the UN and I plan to attend this conference and will report on it later.

Slide 13

So why do I emphasize ISO standards at this conference for you.

那么，为什么这次会议我强调国际标准化组织的标准。

I have been involved in ISO since 2009 because I believe ISO fire safety standards will become dominant in the future.

从 2009 年我就参加国际标准化组织的工作，我深信国际标准化组织的消防安全标准将发挥主导作用

I believe China with representation by SAC in TC 92 concurs with this statement.

我相信参加 92 工作组的中国标准化协会的专家也同意该观点。

ISO standards are developed by member national standards bodies such as SAC and the American National Standards Institute - ANSI, and not individuals.

国际标准化组织标准由包括中国、美国国家标准研究院等制定国家标准的机构编制，而非个人。

ISO and the UN are promoting the use of ISO standards around the globe, specifically in developing countries.

国际标准化组织以及联合国在全球推广国际标准化组织标准，特别是在发展中国家。

They are hosting a conference and training in November 2015, in Geneva, Switzerland on the topic of "Using and referencing ISO and IEC standards to support public policy and regulation."

2015 年 11 月将在瑞士日内瓦召开主题为"使用或参照国际标准化组织以及国际电工委员会标准以支持公共政策和标准"研讨会

This will be a very important initiative for ISO and the UN and I plan to attend this conference and will report on it later.

这对国际标准化组织和联合国来说是非常重要的开始，我也将参加该会议并作报告

Slide 14

Now let me turn to the topic of improvements needed in the fire safety engineering standards.

下面让我们转到消防安全工程标准哪些方面需要改进的主题上来

Although we currently have a good set of standards, there is a need for improvement both for the standards themselves but more importantly in the implementation.

虽然现在我们已经有了一套好的标准，但对于标准本身，更重要的是对于标准的实施都需要改进

Generally, performance-based approaches are used when prescriptive requirements cannot be met.

一般而言，性能化的方法主要用于常规的规范要求难以实现的情况

So authorities question when P-B design is used to justify a design when the design does not meet requirements.

因此，对于权威机构而言，其疑问在于设计在什么情况下不符合规范要求，才能应用性能化的方法

The reason for this doubt is because currently the fire safety engineering standards are not connected and integrated with prescriptive product fire performance standards.

之所以出现该疑问，是因为现行的消防安全工程标准与常规的消防标准没有联系

We need to integrate performance-based with prescriptive standards.

我们需要将性能化及常规的规范整合在一起。

Slide 15

Before we get to the topic of integration which I will address later, let's discuss the pros and cons of prescriptive versus performance-based standards.

在讨论如何整合之前，我们先讨论一下常规的规范与性能化的标准的优缺点

Standardized fire test methods give information on performance of a material or assembly "in the test" but this may not be related to the most likely real fire scenarios.

标准的火灾试验方法提供了材料或者构件的耐火性能，但这种测试条件并不能代表大部分的真实火灾场景

The standardized tests are valuable for ranking materials or assemblies under standard fire exposure and play important role in prescriptive regulations.

在传统的规范中，标准的测试方法对于在标准受火条件下区别材料或构件的耐火性能非常有用

They are good for ranking but do not reflect performance in real world or are suitable for supporting performance-based design.

他们对于分级非常好用，但并不反映真实的性能，也不适应性能化的设计。

Slide 16

For performance-based standards, the requirements are not easily understood.

对于性能化的标准，其要求不容易理解

The standards for performance-based design that will allow uniform conformity assessment are not currently available.

目前性能化的标准还不能进行一致性的评价

Therefore, there is lack of uniformity of application across the industry.

因此，在工业领域的应用还缺少一致性

But, P-B standards allow fire safety designs to be based on real fire scenarios and effects.

但性能化的标准允许消防安全设计按照真实的火灾场景和危害进行设计。

The establishments of and monitoring of fire loads is the biggest advantage of the fire safety engineering approach.

确定并且保持相应的火灾荷载是消防安全工程最有利的方法

Slide 17

Now let's talk about the improvements needed for fire safety engineering standards.

下面，涉及到消防安全工程标准的改进

First, the general improvements that are needed are that they must be practical and easily understood by practicing engineers as a cohesive set of standards.

首先，总体而言该标准对于使用的工程师而言，作为一个整体必须易于使用和理解

They must be able to be adopted by national authorities and form the basis of conformity assessment with minimal judgments.

该标准必须得到国家权威机构的认可，并作为合规判定的基础，当然要易于判定

We need to decrease the present uncertainty in use of fire safety engineering and the variability in the results for fire safety systems design.

我们需要减少目前使用消防安全工程方法时的不确定性以及消防安全系统设计结果的可变性。

We need to improve the quality of implementation of fire safety engineering.

同时，需要改进使用消防安全工程方法的质量

Slide 18

The specific improvements that are needed are that quantifiable performance measures of safety objectives must be developed for applications.

需要特别改进的是，消防安全目标的确定必须量化

We need to establish specific design scenarios and design fires and specific input data and assumptions that cover a broad range of fire scenarios.

我们需要建立特定的场景，设计火灾，输入参数和假定条件，这涉及到各种各样的火灾场景

Requirements to address uncertainty and safety factors as part of quality assurance for performance-based design should be developed.

作为安全保障的不确定性及安全系数也应确定相应要求

All this leads to an important point that I will make in this presentation, that we need to develop application guides for different sectors.

我要强调的是我们需要针对不同的部分制定相应的指南

I will discuss this more later.

我们随后讨论这部分内容

Slide 19

Let me present to you what we are doing at ISO TC 92 SC 4 to address these needed improvements which I have just presented.

下面介绍我们在国际标准组织 92 委员会 4 分委会针对上述内容所做的工作

SC 4 has recently developed a strategic plan with a goal that standards should be simple, usable and practical for use worldwide.

4 工作组最近确定了工作目标，即标准应在全球范围内简洁、可操作和适用。

SC 4 will link the standards to make them a package, the Global Fire Safety Engineering Analysis and Information System.

工作组 4 将协调这些标准作为一个整体，即“全球消防安全工程分析和信息系统”

ISO has recently in August 2015 published a new standard, ISO 16730-1, for the verification and validation of fire calculation methods.

国际标准组织在今年 8 月发布了一个新的标准，ISO 16730-1,主要关于火灾模拟计算方法的验证和确认

This work was initiated in the working group I chair (convene).

该工作由工作组 1 发起

I highly recommend this standard to you.

我向大家推荐该标准。

SC 4 has also in initiated development of a standard for Quick Calculation Methods, and also is examining development of a standard for assessing input data for fire safety engineering which is an important source of uncertainty.

4 分委会同时也在制定关于快速计算方法的标准，以及对输入数据进行评价的标准，这也是消防安全工程的不确定性非常一部分内容

Slide 20

Now let me dis cuss an important topic, the need to develop application guidelines.

下面我们讨论有关应用指南这一重要内容。

ISO standards apply generally to all industrial sectors, it is very difficult to make these standards specific for a range of applications.

国际标准组织的标准应用于所有的场所，因此很难针对一组特定的场所进行规定

There is a need to develop application guidelines for specific “applications” and country.

因此对于特定的场所及国家需要制定相应的指南

These guides will depend on the fire protection practices of a particular country.

这些指南将给予特定国家的消防安全实践

We need to develop application guidelines for tall buildings, tunnels, warehouses, industrial facilities and also nuclear power plants to make the best use of the advantages of fire safety engineering.

同时为了共好的发挥消防安全工程的长处，我们将针对高层建筑、隧道、仓库、厂房和核电厂等制定相应的指南

Slide 21

The guidelines will make standards more practical and helpful for engineers, but still have the “ISO” quality brand name.

这些指南将使工程师能更好的使用国际标准组织的标准

They will be specific to each sector and will provide uniformity of application across China, and increase fire safety across China.

这些指南将针对具体的情况，同时在中国提供统一的指导，促进中国的消防安全

Slide 22

As I mentioned before, there is a need to integrate prescriptive requirements with performance-based requirements.

如前所述，需要整合传统的规范和性能化的要求

Not much has been done in this respect but I will note the set of design fire scenarios provides a possible means to integrate performance-based with prescriptive requirements.

这方面目前还没有什么进展，但我在设计火灾场景时将进行标注，以将这两种方法整合

We need to identify when prescriptive requirements are necessary in an overall approach for the total fire safety design.

我们需要区分在整体消防安全设计中什么时候传统的要求是必须的。

New Zealand has taken such an approach in verification method (C/VM2) I had mentioned earlier.

前面已经提到，在新西兰在验证方法中，已经采取了这种做法。

10 design fire scenarios were used to encompass most fire safety requirements.

10 种设计火灾场景被用于概括大部分的消防安全要求

Slide 23-25

This slide presents the 10 design fire scenarios in the New Zealand verification document.

这就是新西兰验证文件中提供的 10 中设计火灾场景

I won’t read them all but note that ASET/RSET analysis is used for many of the fire scenarios.

我不一一介绍，但可用疏散时间和需要疏散时间的分析是许多火灾场景都涉及到的

For some scenarios such as fire spread in internal linings, horizontal fire spread to other buildings, and external vertical fire spread, prescriptive requirements are used to address the fire scenarios.

对于火灾在建筑内部蔓延、火灾蔓延到其他建筑以及火灾在建筑外部竖向蔓延等场景，可采用传统的方法

Slide 26

As I mentioned earlier, there is a need to develop an infrastructure for fire safety requirements.

如前所述，需要制定消防安全规定的基础性要求

In 2004, ISO TC 92 developed and published a Framework of Standards for Fire Safety (FSFS).

2004 年，国际标准组织 92 委员会发布了消防安全标准体系

This document provides an interesting approach to the integration of prescriptive and performance standards, but unfortunately it was never implemented.

该文件提供了传统的和性能化的标准整合的一种途径，但遗憾的是没有完成

I have recently taken an initiative at ICO TC 92 to update the document and start implementation of the framework.

我最近重启了该工作，对该文件和体系进行完善

This effort will require national standards bodies to be interested and involved.

该工作需要各国标准化组织的支持和参与

I suggest China and SAC support this effort and be involved in the development of this framework.

我建议中国标准化协会支持这一努力，并参与制定这一体系

Once the framework is developed at ISO, it can be modified and adapted for use in China.

一旦基于国际标准组织的体系完成，可以修改后在中使用

Slide 27

This schematic is taken from the ISO document I just mentioned.

这是刚才我所说的框架

I won’t go through it in detail here, but the top part shows the current practice of conducting fire test methods to support prescriptive requirements.

同样不一一介绍，顶部展示的是目前支撑传统要求的火灾测试方法

The bottom part shows the “real world” and fires to which the materials and assemblies will actually be exposed.

下部是材料和构件实际遇到的受火情况

This is the domain of fire safety engineering.

这是消防安全工程的关键

The middle part and the schematic attempts to show a connection between the traditional fire tests, prescriptive requirements, and the need for test data and performance-based requirements.

中间部分试图建立上下两部分的关系

Slide 28

Before I conclude my talk, I would like to mention something about other general areas of fire safety that require standardization.

在结束前，我还想介绍一下其他消防安全领域需要标准化的情况

The relationship between fire safety design and the construction process is important and this process needs more requirements.

消防安全设计与建造过程之间的关系非常重要，需要作出更多的规定

Fire safety management is of utmost importance and needs to be standardized to take advantage of the main benefits of fire safety engineering to identify the real fire hazards and loads, and to continually modify the fire protection program based on this monitoring.

还有更重要的是消防安全管理，也需要标准化以发挥消防安全工程的优势。主要包括监管实际火灾危险和火灾荷载，并根据实际情况对消防管理进行完善

Standards for fire safety training and education must be developed.

消防安全培训和交易也需要标准化

As I mentioned before, standards themselves are not useful unless the regulatory structure for successful implementation of the standards is in place.

如前所述，标准要发挥作用，必须得到有效的贯彻

ISO realizes that safety regulation is important and as I mentioned before has begun initiatives for the use of ISO standards for public policy and regulation.

国际标准组织已经认识到安全标准的重要性，并开始启动相应国际标准对公共政策和标准的支持

Slide 29

In conclusion, I recommend that fire safety can be increased through use of fire safety engineering.

最后，我建议通过消防安全工程方法以提高消防安全水平

The major benefit of fire safety engineering is the determination of fire hazards and developing fire protection based on those fire hazards and fire loads.

消防安全工程的主要优势在于通过确定火灾危险，根据这些火灾危险和火灾荷载，制定相应的防火保护措施。

Safety management is an important part of fire safety engineering to monitor changes in hazards and protection in the building and facility.

消防安全管理是消防安全工程的重要环节，主要监控火灾危险的变化，以保护建筑和设施

Slide 30

It is necessary that we improve improve fire safety engineering technology, standards, and regulation to implement fire safety engineering successfully in our countries.

当然我们需要改进消防安全工程的技术、标准、法规，以更好的在各国运用消防安全工程。

There is a need to develop application guidelines for specific applications in different sectors because standards themselves cannot contain all the details necessary for successful implementation.

这就需要针对不同情况制定相应的指南，以更好的使用标准，因为标准本身不能包括所有内容

It is also necessary to integrate the prescriptive and fire safety engineering standards so P-B is not used to only to justify the design when prescriptive requirements cannot be met.

还需要整合传统的和消防安全工程的标准，这样性能化的方法就不仅仅运用于传统的方法不能满足的清开了

I recommend to you to follow the ISO initiatives for standards implementation through regulation and conformity assessment.

我建议你们追踪国际标准组织有关在法规和一致性评价方面的标准贯彻的活动

Slide 31

That concludes my presentation.

这就是我所要介绍给大家的内容

I invite any comments or questions on what I have said now or any time later. My e-mail and contact information is given in this slide.

现在我接受任何问题，或后续提出的问题都行。

我的电子邮件和联系方式如下

I will take any questions at this time.

任何问题

Thank you.

谢谢

Working Toward an Enhanced and Integrated Performance-Based Regulatory Regime for Fire Safety

Dr. Monideep Dey

Deytec, Inc.

Quality Fire Safety Management

Presented at the 2015 International Symposium on Fire Science & Fire Protection Engineering Technology, October 18-20, 2015, Tianjin, China

Aim of Presentation

- Present current practices for fire safety world wide
- Developments & status of performance-based fire safety design
- Enhancements needed for performance-based fire safety design
- Need for integration of prescriptive fire performance standards with performance-based design
- Ultimate goal is to <u>improve quality & thus fire safety</u>

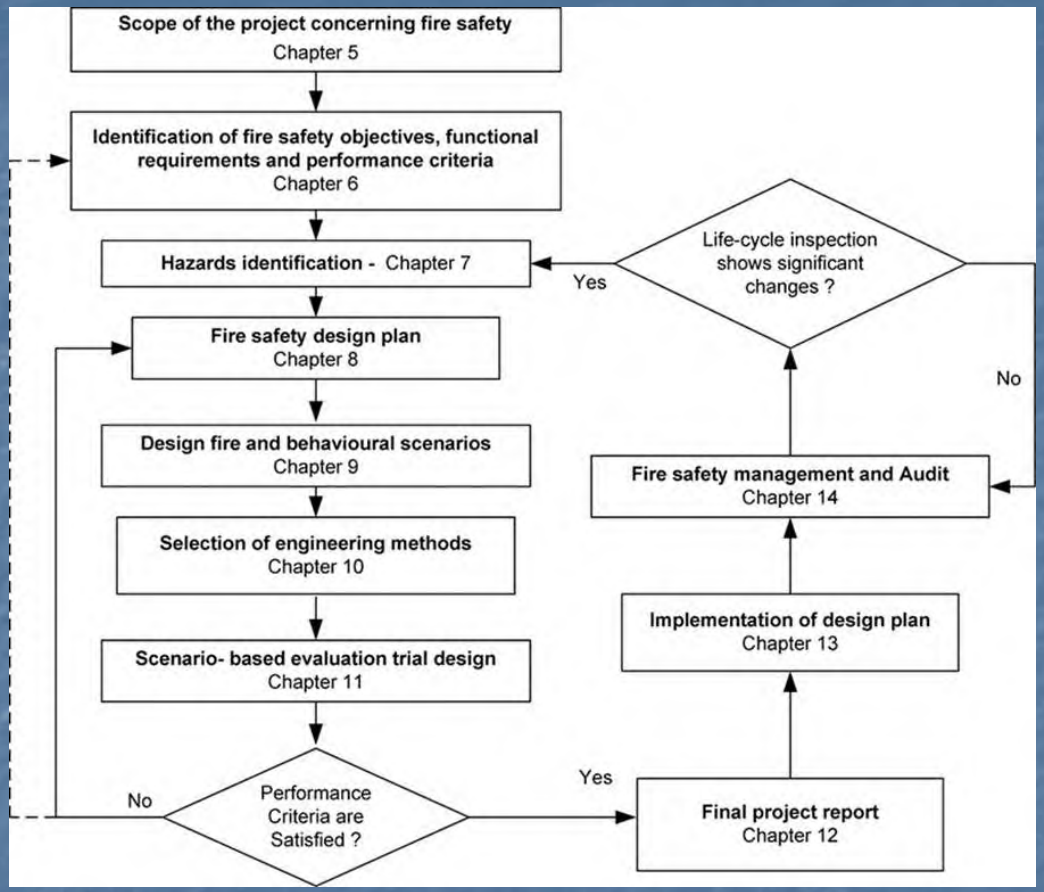
Current Practices of Fire Safety

- Product performance fire standards
  - Combustibility/Flammability
  - Resistance to fire
  - Effects of fire effluents/tenability
- Organizations that publish prescriptive product standards
  - ISO, ASTM, NFPA, etc.

Current Practices – Cont'd

- Performance-Based(P-B)/Fire safety engineering (FSE):
  - Define, safety objectives, functional requirements, & performance criteria
  - Define fire loads in building/facility
  - Conduct engineering calculations to determine if performance criteria are met
    - Tenability for life safety objectives
    - Heat flux or smoke density for equipment performance

FSE Design Process



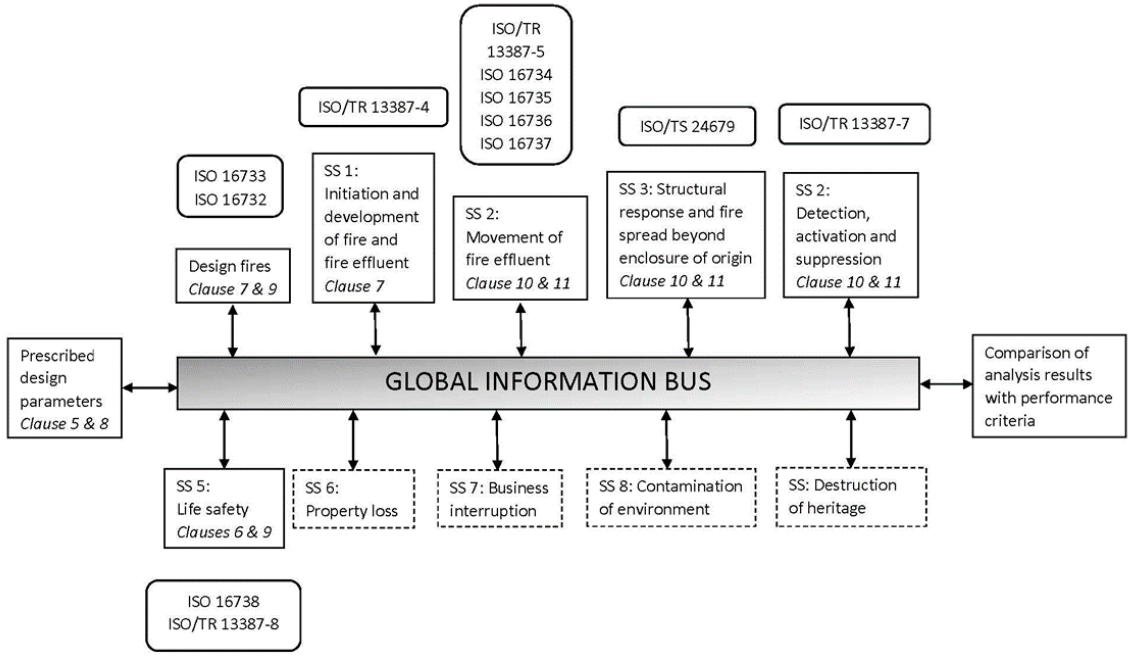
Deytec, Inc., 2015
- From ISO 23932

Presented at the 2015 International Symposium on Fire Science & Fire Protection Engineering Technology, October 18-20, 2015, Tianjin, China

Set of ISO FSE Standards- Global FSE Analysis & Information System

- General procedures & requirements
- Design fire scenarios/design fires and loads
- V&V of engineering calculation methods
- Structural failure calculations
- Fire detection & suppression
- Evacuation modeling

ISO FSE Global Information & Analysis System



Global Fire Safety Engineering Analysis and Information System

Advantages of Global Approach

- Provides awareness of interrelationships between fire evaluations when using ISO or other FSE standards
- Provides logical means to organize analysis & data needed for design
- Computer models cover several subsystems & become a "black box" if awareness of interactions not maintained
- "Quick Calculation Methods" has important role in FSE

ISO Core FSE Standards

Chapter in ISO 23932	List of standards available	Comments
Scope of the project concerning fire safety – Chapter 5	-	Provided by architect to fire safety engineer
Identification of fire safety objectives, functional requirements and performance criteria – Chapter 6	ISO 29761	The standards cover the life safety objective. Other safety objectives have not yet been elaborated.
Hazard Identification - Chapter 7 and Design scenarios – Chapter 9 -	ISO 16733-1, ISO 16732, ISO 29761	ISO 16733-1 covers design scenarios generically, ISO 16732 includes risk methods for scenario selection, and ISO 29761 covers the life safety objective.
Scenario based evaluation of trial design – Chapter 11 -	-	1. Covers fire plumes, smoke layers, ceiling jet flows, and vent flows, respectively.
1. Movement of fire effluents	ISO 16734, ISO 16735, ISO 16736, ISO 16737	
1. Structural response and fire beyond enclosure of origin	ISO/TS 24679	
1. Detection, activation, and suppression	ISO/TR 13387 -	
General to ISO 23932	ISO 16732-1, ISO 16730-1	ISO 16732-1 is used for a fire risk assessment approach. ISO 16730-1 is for verifying & validating methods used for Chapter 11.

ISO Global FSE System

- ISO 23932:2009, Fire Safety Engineering – General principles.
- ISO 16733-1:2015, Fire safety engineering -- Selection of design fire scenarios and design fires — Part 1: Selection of design fire scenarios.
- ISO 16732-1:2012, Fire safety engineering -- Fire risk assessment -- Part 1: General.
- ISO 16734:2006, Fire safety engineering -- Requirements governing algebraic equations -- Fire plumes.
- ISO 16735:2006, Fire safety engineering -- Requirements governing algebraic equations -- Smoke layers.
- ISO 16736:2006, Fire safety engineering -- Requirements governing algebraic equations -- Ceiling jet flows.
- ISO 16737:2012, Fire safety engineering -- Requirements governing algebraic equations -- Vent flows.
- ISO/TS 24679:2011, Fire safety engineering -- Performance of structures in fire.
- ISO 16730-1:2015, Fire safety engineering — Procedures and requirements for verification and validation of calculation methods – Part I: General
- ISO 29761:2015, Fire Safety Engineering -- Selection of design occupant behavioural scenarios and design behaviours

Other International FSE Standards

- Society of Fire Protection Engineering (SFPE)
  - Performance-based guidelines
- American Society of Testing & Materials (ASTM)
  - National adoption of ISO FSE standards
- British Standards Institute
- Standards Australia

Experience & Evolution of Fire Safety Engineering

- New Zealand, C/VM2, Verification Method: Framework for Fire Safety Design
- Nordic Countries, prINSTA TS 950, Fire Safety Engineering — Verification of fire safety design in buildings
- Australian verification method
- CEN initiatives

Why ISO Fire Standards

- ISO fire safety standards will become dominant in future
- ISO standards developed by member national standards bodies, not individuals
- ISO & UN promoting use of ISO standards around the globe, specifically in developing countries
- *"Using and referencing ISO and IEC standards to support public policy and regulation"*, Conference and Training, November 2015, Geneva, Switzerland

General Issues for Fire Standards

- Generally, performance-based approaches used when prescriptive requirements cannot be met
- Authorities question when P-B design is used to justify design when design does not meet requirements
- Currently, FSE standards are not connected & integrated with prescriptive product fire performance standards
- Need to integrate performance-based with prescriptive standards

Pros & Cons of Standard Fire Tests

- Standardized fire test methods give information on performance of a material or assembly *'in the test'*
- May not be related to the most likely real fire scenarios
- Valuable for ranking materials or assemblies under standard fire exposure
- Play important role in prescriptive regulations
- Good for ranking but not reflect performance in real world or suitable for supporting performance-based design

Pros and Cons of Performance-Based Design

- Requirements not easily understood
- Standards for performance-based design to allow uniform conformity assessment not available
- Lack of uniformity of application across the industry
- Allows fire safety designs to be based on real fire scenarios & effects
- Establishment & monitoring of fire loads biggest advantage

Improvements Needed for FSE Standards

- Must be practical & easily understood by practicing engineers as a cohesive set of standards
- Can be adopted by national authorities & form basis of conformity assessment with minimal judgments
- Decrease present uncertainty in use of FSE & variability in results for fire safety systems design
- Improve quality of implementation of FSE

Specific Improvements Needed for FSE

- Quantifiable performance measures of safety objectives
- Specific design scenarios and design fires
- Specific input data and assumptions that cover a broad range of fire scenarios
- Requirements to address uncertainty and safety factors as part of quality assurance for performance-based design
- Development of application guides

Activities at ISO TC 92 SC 4

- Strategic plan developed
- Standards should be simple, usable & practical for use world wide
- Link ISO standards as a package
  - Global FSE Analysis & Information System
- Publication of ISO 16730-1, V&V standard
- Quick calculation methods
- Input data for FSE

Need for Application Guidelines

- ISO standards apply generally to all industrial sectors, very difficult to make specific to application
- Need to develop application guidelines for specific "applications" and country
- Tall buildings
- Tunnels
- Warehouses
- Industrial facilities & nuclear power plants

Application Guidelines – Cont'd

- Guidelines will make standards more practical and helpful for engineers, but still have the "ISO" quality brand name
- Will be specific to each sector
- Will provide uniformity of application across China
- Increase fire safety across China

Need to Integrate Performance & Prescriptive Requirements

- Set of design fire scenarios provides possible means to integrate performance-based with prescriptive requirements
- Need to identify when prescriptive requirements necessary
- New Zealand approach in verification method (C/VM2)
- 10 design fire scenarios used to encompass most fire safety requirements

Design Fire Scenarios – Example from New Zealand Building Code

- Fire blocks exit
- Fire in normally unoccupied room threatens occupants in other rooms
  - ASET/RSET analysis or provide separation
- Fires in concealed spaces
  - Provide separation

Design Fire Scenarios – Example from New Zealand Building Code

- Smoldering fire
  - Provide automatic detection & alarm
- Fire spread in internal linings
  - Use suitable materials proven by tests
- Challenging fire for evacuation & life safety
  - ASET/RSET analysis

Design Fire Scenarios – Example from New Zealand Building Code

- Robustness check
  - ASET/RSET analysis assuming fire safety system unavailable
- Horizontal fire spread to other buildings
  - Radiation calculation
- External vertical fire spread
  - Use suitable materials proven by tests

Need to Develop a Fire Standards Infrastructure

- *Framework of Standards for Fire Safety (FSFS)* - ISO TC92/TG244 N10 – June 2004
- Document provides interesting approach to integration of prescriptive & performance standards, but was never implemented
- Initiative taken at ICO TC 92 to update document & start implementation
- Will require national standards bodies to be involved

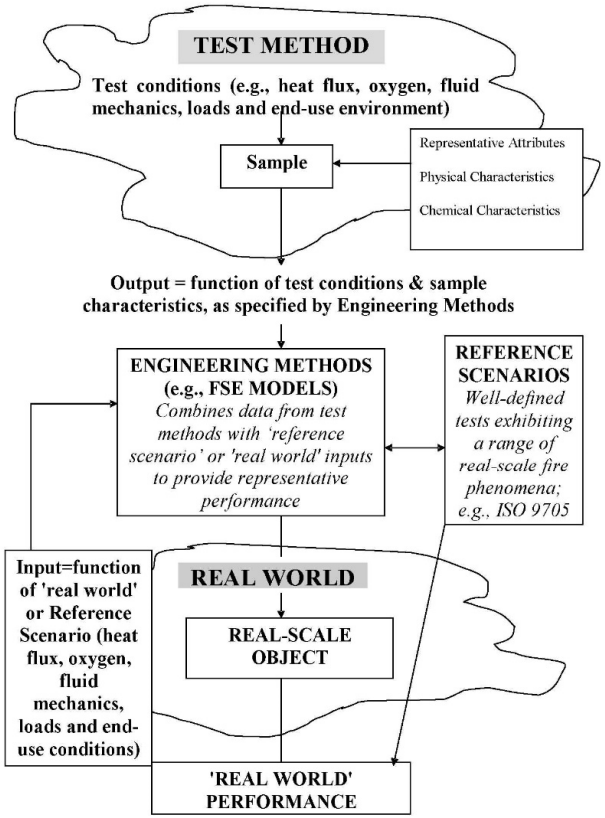


FIGURE 1 SCHEMATIC SHOWING PROPOSED ROLE OF TEST METHODS AND EENGINEERING METHODS IN A PERFORMANCE-BASED ANALYSIS

4

Presented at the 2015 International Symposium on Fire Science & Fire Protection Engineering Technology, October 18-20, 2015, Tianjin, China

Areas Needing Standardization

- Relationship between fire safety design & construction process
- Fire safety management
- Fire safety training/education
- Fire safety regulation (ISO initiatives in use of ISO standards for public policy and regulation, Geneva Conf.)

Conclusions & Recommendations

- Fire safety can be increased through use of fire safety engineering
- Major benefit of FSE is the determination of fire hazards
- Fire protection is based on hazard & fire loads
- Safety management is important part of FSE to monitor changes in hazards & protection in building/facility

Recommendations – Cont'd

- Necessary to improve technology, standards, & regulation to implement FSE successfully
- Need to develop application guidelines for specific applications in different sectors
- Necessary to integrate prescriptive & FSE standards
- Follow ISO initiatives for standards implementation through regulation & conformity assessment

Questions

- Comments and discussion
- Thank you

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