RISK ENGINEERING CONSIDERATIONS IN THE DESIGN AND CONSTRUCTION OF NEW BUILDING PROJECTS

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INTRODUCTION

One of the key considerations in the design and construction of a new building or facility is the level of physical protection which will need to be incorporated into the project. Most organisations including project managers, architects and design engineers will normally address this issue from a building regulatory compliance point of view usually adopting only the minimum protection requirements specified by the building regulations. Compliance with the building regulations and related design standards is obviously an essential part of the design and construction process but is this approach effective from a business risk management perspective?

This paper discusses some of the common pitfalls of a principally compliance driven approach and offers some practical guidance on how risk and insurance managers can assist the organisation and the project team in ensuring the key physical risks are satisfactorily addressed by using a “catastrophe risk engineering” approach to the design decision making process for the project.

This paper also explores possible property insurance implications in the design decision making process and the importance of integrating any identified asset protection requirements (particularly the fire protection requirements) with the fire safety requirements of the new building or facility. This paper does not consider those risks (project risks) arising from the actual design and construction of a proposed new building or facility.

CONCEPTUAL DESIGN PHASE

Risk and Insurance Management Involvement

Early risk and insurance management involvement in the conceptual design phase of the project is critical as building codes such as the Building Code of Australia (BCA) are principally focused on life safety matters and are not concerned about the protection of the assets and the impact of potential business interruption and other consequential losses. Additionally, most project teams tend to only focus on those risks which are considered to have a medium to high probability of occurrence, often completely ignoring the potential impact of other more extreme risks (catastrophe risks)\(^1\) where the probability is expected to be low.

For large organisations the risk or insurance manager can play an important role in a new building project to assist with:

1. Developing the overall business risk management objectives for the project.
2. Identifying key physical risks associated with the project and opportunities to eliminate or mitigate those risks by recognising that it is prudent from a business risk management perspective to not only consider the probability of a potential risk but also its possibility (in other words a risk should not automatically be excluded because its probability is considered too low).

\(^1\) For the purpose of this paper “catastrophe risk” is defined as any reasonably foreseeable natural or man-made risk which has the potential to cause catastrophic damage to assets and or significant consequential losses.
3. The early appointment of risk engineering expertise, particularly in regards to the interpretation and application of “best practice” asset protection standards such as Factory Mutual (FM) Global Data Sheets and National Fire Protection Association (NFPA) Standards.

4. Identifying any potentially significant property insurance issues or implications including any pre-existing corporate risk management standards or practices which may need to be incorporated into the project.

5. Building the business case for any proposed risk improvements which are likely to exceed the requirements of the building code or the project’s initial budgeted costs for the physical protection systems.

For those organisations which do not employ a fulltime risk or insurance manager, a suitably experienced business or operations manager should be appointed to fulfil the role outlined above.

Building Code Compliance

One important development in recent years has been the ability for fire safety specialists to utilise “alternative fire safety engineering solutions” to the prescriptive requirements of the BCA, particularly for large projects. In simple terms this approach involves simulating the development of the fire within the building (principally the development and spread of smoke) and the time taken for the building occupants to safely exit the building or facility using mathematical models based on fire safety research. Fire safety engineers use the outcomes from these analyses, which are principally computer driven, to determine the most cost effective protection scheme that ensures the safe evacuation of the occupants from the building.

Depending on the circumstances, a fire safety engineering approach can result in active and passive fire protection trade-offs such as the reduction in fire resistance levels (FRLs) of major structural elements and the elimination of major fire walls and fire sprinkler systems within a building or facility where such protection would otherwise be mandated under the prescriptive requirements of the BCA. This does not necessarily mean the level of fire safety has been compromised however the reduction in the level and reliability of the physical protection systems is usually not desirable from an asset protection and an overall business risk management perspective.

The other main difficulty is that even when a seemingly more conservative prescriptive code compliance approach is adopted, the protection systems for the building or facility may still not provide any material benefit from a business risk perspective because the minimum prescribed design standards for the protection systems have not kept pace with the latest developments in asset protection.

Despite the difficulties, our experience has shown that alternative or prescriptive fire safety and catastrophe risk engineering approaches can in practice be complimentary to each other, resulting in protection solutions which are highly effective from both a life safety and business risk management perspective, provided there is early risk and insurance management engagement in the new construction project and a strong commitment on the part of the organisation to “better protect” both its people and its assets.
Expected Maximum Loss (EML) Analysis

Fire Risks

One way of developing the business risk management objectives for the project is to conduct a “high level” Expected Maximum Loss (EML) analysis of the original design proposal. The outcomes from the analysis should help the organisation and the project team to identify whether or not there are any opportunities to eliminate or mitigate potentially significant physical and business interruption risks.

The process and the definitions outlined below focus on the risk of fire as this is invariably a key design consideration for most new building projects:

1. The first step is to quantify the potential losses arising from three distinctly different scenarios, preferably in dollar terms, as outlined in the three fire risk scenario definitions Maximum Foreseeable Loss, Probable Maximum Loss and Normal Loss Expectancy (MFL, PML and NLE) below. This will usually require the examination of a number of potential fire events initiating in various parts of the new building or facility including; major storage areas, key production facilities or hazardous processes, building service equipment areas etc. to determine the maximum property damage and business interruption loss for each of the three scenarios. This analysis allows the project team to gain a good understanding of the “fire risk EML profile” of the current design. A flat to slightly stepped declining fire loss estimate profile indicates (see Figure 1 – before asset risk improvement strategies) that the resilience of the current asset protection design proposal is poor. Whereas a steeply stepped declining loss estimate profile (see Figure 1 - after asset risk improvement strategies) indicates that the building or facility is well protected with a number of contingencies built into the design of the facility and its fire protection systems. In the example below the Total Insurable Value (TIV) for the site is also shown. The TIV and the three loss estimates include the values of the physical assets (building replacement values, plant and equipment values, removal of debris costs etc.) as well as the expected insurable business interruption values (gross profits, wages, extra expense etc.).

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EML analysis can be especially useful if there are no clearly defined corporate asset protection objectives or standards in place.

Historically these definitions have been developed by Highly Protected Risk (HPR) insurers to manage their underwriting risk exposures (principally fire) however this methodology is also useful to organisations in better understanding their risk exposures even though a large proportion of the risk is normally transferred to the organisation’s insurers. The definitions will also need to be modified for other types of physical risks.
2. In stage two the EML analysis is expanded or refined as necessary to assist in the detailed development of the risk mitigation strategies such as improvements to the building’s active and passive fire protection systems, the selection of suitable building materials, the protection of special hazards etc.

3. Stage 3 typically involves the costing and if necessary the development of a detailed business case for the proposed improvements.

The improved fire risk EML profile depicted in Figure 1 is typical of an HPR facility however the organisation and the project team may choose to adopt the current fire protection strategy or a strategy which is somewhere in between depending on the risk appetite of the organisation and the expected cost and scope of the property insurance programme once the project is completed.

EML Analysis

Natural Hazards and Other Physical Risks

A similar approach⁴ can be taken for the EML analysis of other physical risks such as explosion, mechanical and electrical breakdown, arson and malicious damage and natural hazards such as flood, earthquake, windstorm, bushfire etc. For example, if the new building project is potentially flood exposed, the impact of various flood events ranging from high frequency events up to the maximum foreseeable flood event should be considered by the project team, not just the 1 in 100 year flood event. A good understanding of the flood risk EML profile should enable the project team to make more informed decisions about eliminating the risk entirely (choosing another site), mitigating the total exposure through various design and management approaches (for example, elevating flood affected equipment) and transferring all or part of the risk to the future property insurers.

⁴ The loss scenario definitions outlined below will need to be modified to match the type of risk and the available systems to control or mitigate the risk.
Maximum Foreseeable Loss (MFL) Scenario

The MFL (Maximum Foreseeable Loss) scenario is by definition the “worst case” loss scenario which considers the potential damage caused by a fire starting in the most vulnerable area within a building or facility with all its active fire systems impaired or unavailable at the time of the incident. This scenario considers the significant fire hazards within the building, particularly the expected level and continuity of combustibles throughout the building, the presence of fire rated barriers and separation distances between combustibles within and between buildings. This scenario does not contemplate any manual firefighting response by site employees or the fire brigade. In other words the scenario assumes a “free-burn” until all combustible material throughout the fire area is consumed. This scenario also typically considers the potential business interruption loss exposure however other potential consequential losses (such as the impact on operations upstream and downstream of the new building or facility, environmental pollution arising from the fire etc.) could also be considered by the design team.

Whilst the probability of a MFL scenario is considered to be very low, this scenario is still possible and is one of the key factors which govern an insurance company’s ability to underwrite “the risk” and the amount insurance coverage which will need to be put in place once the building or facility has been completed.

From a business risk perspective it is important the organisation fully understands its maximum potential loss exposure as it will also provide some insight to potential exposures which are not covered by insurance, for example, unforeseen delays in reinstating the damaged building or facility, permanent loss of customers or market share, lost new business opportunities etc.

An understanding of the MFL can also highlight the potential need for physical protection strategies (such as the installation of fire barriers, separation distances between buildings, the use of non-combustible or “limited combustible” construction materials etc.) to reduce the maximum loss potential to the organisation and the importance of various management controls which will need to be put in place once the new building of facility has been completed (fire equipment maintenance programmes, fire emergency response procedures, business continuity plans etc.)

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5 This is the area of the building or facility which is likely to result in the greatest level of physical damage and or consequential loss in the event of a fire.
**Probable Maximum Loss (PML) Scenario**

The PML (Probable Maximum Loss) scenario is by definition the “most probable” maximum loss scenario and is usually based on a fire starting in the most vulnerable area of a building or facility with a single impairment to the most critical active fire system protecting this area of the building or facility (such as a shut valve on a sprinkler system, an isolated smoke detection system or fire water supply tank). This scenario also considers the significant fire hazards within the building particularly the level and continuity of combustibles throughout the building, the presence of fire rated barriers and separation distances between combustibles within buildings and between buildings.

Unlike the MFL scenario, the PML scenario considers the capabilities of the responding fire brigade and the manual firefighting systems (particularly the hydrant system) in limiting the spread of fire, however, the response by site personnel and the fire brigade is also assumed to be delayed (usually due to a critical fire system impairment) and the fire is assumed to reach its full development stage by the time manual firefighting commences. This scenario also typically considers the potential business interruption loss exposure however other potential consequential losses could also be considered and quantified by the project team.

Like the MFL, the largest PML is a key factor in the level of risk the underwriter is prepared to assume and the amount of property insurance which will ultimately need to be purchased by the organisation for the new building or facility. Understanding the PML can also highlight any further opportunities for improving the level of passive fire protection, improvements to the manual firefighting systems and the importance of the future management controls for the new building or facility.

**Normal Loss Expectancy (NLE) Scenario**

The NLE (Normal Loss Expectancy) by definition is the “most likely” loss scenario and like the MFL and PML scenarios is based on a fire starting within the most vulnerable area of the facility, however, the NLE scenario assumes all available fire systems are in service at the time of the fire. The size of the NLE relative to the PML or MFL is a good indicator of how well the building or facility or a specific area of the building or facility is protected and can be used to highlight the potential advantages of employing active fire protection measures such as automatic fire alarms, automatic sprinkler protection and special extinguishing systems (gaseous extinguishing systems, water spray systems, foam extinguishing systems etc.) in reducing the level of risk.

The largest NLE can also be an important underwriting risk factor however this factor is usually only a significant consideration for HPR underwriters.

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* It should be noted that smoke and thermal detection systems will generally have a very limited impact on reducing the NLE compared to automatic fire sprinkler systems which will not only detect the fire but are also designed to control or suppress the fire (particularly a rapidly developing fire).
Developing the Risk Mitigation Strategies

If the conclusions drawn from the initial EML analyses indicate the risk profiles for the original design concept are tolerable then no further input is considered necessary from a business risk management perspective. The project should then proceed as originally planned, provided any identified property insurance protection or prescriptive corporate standards and practices are considered and incorporated into the specifications as necessary.

If however the organisation and the project team has determined that additional asset risk improvements will be necessary then the project team will need to consider the most effective strategies for reducing the risks to match the risk appetite of the organisation, including any best practice design and installation standards which need to be included in the specifications for the project. As discussed previously, this process should ideally involve completing additional EML analyses demonstrating the likely impact of various strategies in reducing the EML estimates for the original design proposal.

The appointed risk engineer is best placed to assist the organisation and the project team in the development of the risk improvement strategies which should take into consideration the reliability of the proposed protection systems as well as any important practical considerations in respect to the installation and ongoing operation and maintenance of these systems.

By way of example, if an automatic sprinkler system is one of the mitigation strategies, the organisation and the project team will need to develop a clear understanding of the design parameters which are critical to the successful operation of the system, in order to fully realise the benefits of this investment over the life of the building or facility.

First and foremost, the project team will need to ensure that all expected occupancy hazards (including future changes in occupancy hazard) in the new building or facility are properly analysed and catered for in the design of the sprinkler system. For example, the increasing use of plastic materials in everyday manufactured products (from automobile parts to food products) can significantly increase the fire hazard associated with the storage of raw materials and finished products over time which could place severe restrictions on future storage heights or at worst could lead to the catastrophic failure of the sprinkler system if the issue is not identified in the future. The potential presence of ignitable liquids (flammable liquids) and large numbers of idle wooden and plastic pallets in storage and manufacturing areas are also commonly overlooked problems. Ignitable liquids, particularly in plastic containers, can easily defeat the effective operation of a sprinkler system, particularly in a warehouse. Likewise, a fire involving idle pallets can rapidly overcome the capabilities of a sprinkler system if the hazard associated with this storage is not properly catered for in the design.

Another important issue in the design and installation of a sprinkler system is the interfacing of the system with other building services, building structural elements etc. to ensure the sprinklers are not obstructed. This issue is particularly important for
ESFR (Early Suppression Fast Response) sprinklers since relatively minor obstructions to the discharge pattern of these storage sprinklers could lead to the catastrophic failure of the system. Other common problems, particularly in storage areas, include the need to maintain a minimum 1 m clear space between the ceiling sprinklers and the top of the storage and the use of solid shelving. These issues can be difficult and costly to fix after the building or facility has been completed and are best resolved during the conceptual design phase of the project.

The appointed risk engineer will also need to work closely with the fire safety engineer and/or the building certifier for the project to resolve all potential asset protection/fire safety compliance design conflicts. The most common potential asset protection/fire safety design conflict arises when the installation of automatic sprinklers is also required for compliance purposes. This is because the BCA references AS 2118.1 –1999 “Automatic Fire Sprinkler Systems” as the applicable sprinkler system design and installation standard. Unfortunately, AS 2118.1 -1999⁷ has not kept pace with the latest developments in asset protection and the application of this standard could result in a suboptimal design from an asset protection and business risk management perspective. The appointed risk engineer should assist the project team with resolving any potential sprinkler protection design conflicts and incorporating, as necessary, any additional best practice design performance requirements into the specifications for the new building project.

Other potential asset protection/fire safety compliance design conflicts include; the specification of various building materials, fire rated walls, hose stream allowances for the design of the hydrant system and the design of the fire water supply systems where the requirements of the BCA and Australia Standards may fall short of best practice in some areas. Again, the appointed risk engineer is best placed to assist the team with resolving the design conflicts and incorporating any additional best practice requirements into the specifications.

Finally, whilst the main focus of the catastrophe risk engineering process is reducing the severity of losses, the importance of reducing the frequency of losses should not be overlooked. The appointed risk engineer should work closely with the project team to ensure all significant hazards are identified and minimised as far as practical through the design process and/or through various operational management controls which may need to be introduced once the building or facility is completed.

FIGURE 3 - OBSTRUCTED ESFR SPRINKLER

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⁷ It also important to note that FM Global Data Sheets 2-2 “Installation Guidelines for Automatic Sprinklers” and 8-9 “Storage of Class 1, 2, 3, 4 and Plastic Commodities” are referenced in AS 2118.1-1999 in clause 2.3.3 “Special sprinkler systems” in relation to the design and installation of ESFR (Early Suppression Fast Response) sprinkler systems only. There is little correlation between the occupancy hazard and storage commodity classifications in AS 2118.1 and FM Global/NFPA standards particularly in regards to the protection of high hazard occupancies and “high challenge” storage risks using standard sprinklers.
Business Case Analysis

Depending on the circumstances the organisation may require a business case analysis to be carried out before making a final decision on the mitigation strategies to be adopted by the project team. Given the uncertainties, a simple cost-benefit analysis is suggested. The business case analysis should consider the risk reduction benefits in terms of the potential uninsured losses averted as well as the possible premium savings over the life of the new building or facility. Whilst the uncertainties associated with calculating the risk reduction benefits and the premium savings can be significant it should be possible to determine whether or not the investment in risk reduction is likely to be worthwhile by undertaking a sensitivity analysis on each of the key assumptions.

One other important consideration (particularly if your organisation is a manufacturer) is the potential impact of a major incident on operations upstream and downstream of the new building or facility as well as the impact on the organisation’s customers or suppliers. In many instances the potential consequences are so significant and the benefits so obvious there is little need to quantify the cost-benefit of any proposed additional investment in the facility’s physical protection systems.

Property Insurance Considerations

It is important for the organisation and the project team to have some level of understanding of the minimum technical requirements of insurers and to also consider how operating conditions in the property insurance market can potentially influence the way organisations manage their risks.

Firstly, the local insurance industry is a competitive market place. There are no rules or regulations for setting property insurance premiums except in relation to government charges in each and every state for fire service levy and stamp duty. The premium component charged by underwriters is generally risk based (risk factors such as level of fire protection, construction and occupancy type etc. are taken into consideration) however the actual premium that is ultimately charged is also strongly influenced by market conditions including the cost and availability of reinsurance, industry loss experience and competition in the market place. As with most industries the market is cyclical and prices and insurance underwriting capacity can swing quite dramatically depending on the circumstances within the market place.

As a general observation most property insurers are normally comfortable with underwriting a building or facility which complies with the relevant building regulations and standards at the time building or facility was initially constructed. Underwriters will also typically focus on the site’s management of operational risks (housekeeping standards, equipment maintenance programmes, hot work procedures, smoking controls etc.) when underwriting a particular “risk”. Any unusual hazards or conditions are normally factored into the premium. However, as described previously the insurance market can be sensitive to any negative trends in industry loss experience, particularly major industrial fires and natural catastrophes such as, flood, earthquake and bushfires and the potential impact of such trends (such as increased premiums and restrictions to the scope and amount of cover) should be considered by the organisation and the project team.

In late 2002 many organisations involved in the food

* The EML analyses can also be utilised to determine the risk reduction benefits.
processing or cold storage logistics industries experienced significant difficulties with the placement and cost of their property insurance programmes within local and overseas insurance markets. These difficulties were primarily related to the “hardening” of the property insurance market at that time however the Fairfield NSW Tip Top Bakery Fire on the 2nd of June 2002 was probably the last straw in a long line of significant fires in Australia and New Zealand involving buildings constructed with highly combustible Expanded Polystyrene (EPS) insulated metal sandwich panelling. This fire also highlighted deficiencies in the design of the factory’s fire protection systems as well as the quality of its fire equipment maintenance programmes, emergency response procedures and its housekeeping standards.

Fire brigade investigators concluded the Tip Top Bakery Fire was most likely caused by a gas fired heater located directly above an oven located in a muffin-proving room in the north east corner of the main factory. Three brackets supporting the heater failed and the displaced heater probably ignited accumulations of polenta flour on top of the oven. Investigators also surmised that the build-up of polenta flour and vegetable oil residues in and around the production equipment within the muffin-proving room contributed to the initial development and spread of fire. It also appeared the fire spread quickly to EPS insulated panelling and other combustibles in the immediate area fracturing a 100 mm diameter copper internal overhead fire hydrant supply main in the same area (see Figure 5). The fractured main severely depleted the available water supply and rendered the hydrants on one side of the complex completely inoperable.

Thermal detectors were installed throughout the main factory however the system failed to adequately detect and transmit the alarm to the fire brigade. The first notification of the fire was to the Sydney Communications Centre however it took at least 45 minutes before an

* Fire & Rescue NSW (previously known as NSW Fire Brigades) (2002) estimated the total value of this loss at that time to be in excess of $100 m ($20 m building and contents plus business interruption).
emergency (000) call was made. It took a further 9 minutes before the first fire brigade appliance arrived on the scene. It quickly became apparent to the fire brigade that the available hydrant water supply had been compromised early during the fire, forcing the brigade to relay water from an adjoining industrial complex and take a defensive mode in fighting the fire instead of the initial offensive mode of attack.

The Tip Top Bakery Fire most likely prompted a dramatic retraction of insurance underwriting capacity in the local market and significant increases in insurance pricing for food processing risks and other businesses which utilised EPS insulated metal sandwich panels in the construction of their facilities. The previous poor EPS loss history and the prevailing insurance market conditions in the UK and Europe were also significant factors. At the time, most local insurers would not accept EPS construction without some form of automatic protection such as sprinklers or smoke detection systems. Some insurers also completely withdrew or significantly reduced their underwriting capacity on EPS risks which compounded market pressure to increase pricing on EPS exposed risks. This was despite the fact that the same insurers were very willing to underwrite these facilities with little or no protection 12 to 18 months earlier at premiums substantially below those demanded in the market place in late 2002. Most of these businesses suffered significant increases in their property insurance premiums and increased excesses even with a suitable level of protection in place. In some cases businesses faced the prospect of little or no insurance coverage if they were unable or unwilling to make any improvements to the level of protection of their facilities.

Although conditions in the current insurance market are not as severe as late 2002 and throughout 2003, the market’s fundamental concerns regarding EPS insulated panelling remain because of the continuing poor history of losses involving EPS construction and the failure of local building regulators to adequately address the use of EPS and the other combustible materials in the construction of buildings. The market could turn at any time in response to a similar loss which could be another unpleasant surprise for any organisation which has not appropriately addressed the potential risk.

The possible effects of climate change has also been a major concern of the insurance market for some time now because of the growing trend in the frequency and severity of weather related incidents (particularly flood and windstorm incidents) as well as bushfires (wildfires) which are strongly influenced by weather conditions. Research conducted on behalf of the Insurance Council of Australia (ICA) in 2001 indicated a 25 per cent increase in peak wind gust speed could result in a 650 per cent increase in building damage. The research also concluded that a 25 per cent increase in intensity of a 30 minute rainfall event could result in the return period of a subsequent 1 in 100 year ARI flood being reduced to 17 years. Furthermore, it shouldn’t be forgotten that the Sydney hailstorm in April 1999 is still the most costly natural disaster in the recent recorded history of natural catastrophes in Australia. Earthquakes can also have a major impact on both the local and worldwide insurance market impacting the cost and the availability of cover and therefore the potential impact of these natural hazards should also be taken into consideration in any new building project.

As discussed previously, building codes and regulations are principally focused on the life safety aspects of the design of a new building or facility and do not consider the protection of the assets and the mitigation of
consequential losses. Whilst it is not possible to completely avoid the effects of natural hazards the potential damage can usually be mitigated without necessarily incurring significant additional costs. Any steps taken to mitigate these risks are likely to be viewed positively by insurers and will at the very least reduce the organisation’s exposure to potential uninsured risks.

In summary, property insurance premiums and the availability of coverage can vary markedly from year to year depending on the overall risk profile of the organisation and conditions in the insurance market place. Those organisations which have a better than average risk profile and which can demonstrate a strong commitment to the management of their physical risks (particularly their catastrophe risks) are usually better placed to optimise the cost and structure of their property insurance programmes over the long term.

Property Insurance & Asset Protection Standards

Unfortunately there are no local insurance industry wide property protection standards and most local underwriters do not publish their own in-house standards which are primarily focussed on their capacity to underwrite the risk. Apart from the insurance industry concerns around EPS insulation materials and natural hazards, it is usually difficult or impossible to obtain more specific guidance on the technical requirements unless the underwriter has a suitably qualified and experienced risk engineer on staff that can provide more specific advice. In any case, this advice will probably differ from any subsequent advice which may be offered by competing underwriters.

The only comprehensive property insurance asset protection standards which are readily available are those published by FM Global which is a recognised international industry leader in HPR engineering standards and insurance. In recent years FM Global has made its standards (FM Global Data Sheets) available to all potential users instead of restricting the availability of these standards to its clients. This has been a particularly important development for those organisations which are interested in taking a best practice approach to the protection of their facilities or using these standards as a benchmark for the ongoing development of their asset protection and business risk management programmes.

National Fire Protection Association (NFPA) standards are also another possible source of information. Even though these standards were originally developed for application in jurisdictions in the United States they are also widely recognised throughout the world. However, unlike FM standards, NFPA standards are industry wide consensus standards. NFPA standards can be very helpful in validating FM design requirements or identifying alternative design solutions which may not be available under FM datasheets or current Australian Standards.

The application of FM Global standards including any applicable NFPA standards (particularly NFPA 13) should be carefully considered by the organisation and the project team as part of the catastrophe risk engineering process however the standards can be difficult to interpret and their strict application may not suit every organisation’s particular circumstances.

Over time, organisations (particularly large organisations) develop their own asset protection standards or practices in response to any significant incidents which may have occurred or because of management concerns over known risks within the organisation’s facilities. In most cases the previously described catastrophe risk engineering process will address these risks however it is important that these standards and practices are identified early in the project to avoid any unnecessary duplication of effort. In some instances the previously described catastrophe risk engineering approach may not be essential if there is a comprehensive set of corporate asset protection standards and practices already in place.

Finally, it is also important to recognise the significant improvements that have been made to various Australian Standards from a best practice asset
protection perspective over the last ten years even though some of these standards may not be called up by the BCA. As discussed previously, the most effective approach is to reference the latest applicable Australia Standards (including the versions called up by the BCA) as the base design standards for the project.

Where necessary, the specific design performance requirements of NFPA and FM Global standards as well as any corporate in-house standards and property insurance requirements should then be integrated into the specifications for the project.

DETAILED DESIGN & CONSTRUCTION PHASES

Because of the unique design, operating and maintenance characteristics of asset protection systems the organisation and the project team should consider the benefits of the ongoing engagement of the risk engineering consultant to provide high level advice during the detailed design and construction phases of the project and attend the commissioning tests for the key protection systems. The role of the risk engineer during these phases of the project should be to:

1. Assist the project team as necessary with the development and review of the tender documentation to ensure it accurately reflects the organisation’s business risk management objectives and the proposed risk mitigation strategies.

2. Ensure all significant hazards have been identified and appropriate controls are specified in the tender documentation.

3. Work closely with contractors and the design consultants to ensure the final installation plans (including the hydraulic calculations) for the fire protection systems and various other asset protection systems are in accordance with the specifications.

4. Attend the commissioning tests for the installed fire systems and various other asset protection systems\(^\text{10}\) to assist with validating the installation and operating performance of these systems is in accordance with the specifications and the drawings.

5. Assist as necessary with resolving any significant design or installation issues.

6. Assist with the development of the asset protection systems operating and maintenance manuals and related documentation.

\(^{10}\) Such as the sprinkler fire pump commissioning tests, special extinguishing system tests including computer room door fan room integrity tests, foam-water and deluge system discharge tests etc.
CONCLUSION

Risk and insurance managers are uniquely placed to assist the organisation and the project team in the important decision making process in how to best protect a proposed new building or facility from a business risk management perspective.

The design decision making process should ideally be driven by a catastrophe risk engineering approach rather than a compliance driven approach which could otherwise result in lost opportunities to minimise the risks or expose the organisation to risks that it may never be able to recover from. Additionally, the organisation could miss opportunities to optimise the value of its investment in the physical protection systems which have been incorporated into the new building or facility, as well as, the cost and scope of the organisation's property insurance programme over the life of the new building or facility.

An effective catastrophe risk engineering approach will typically involve the following important steps:

1. Engage early with the project team to determine the scope of the project and the required input from a business risk management and risk engineering perspective.

2. Identify and quantify the key catastrophe risks associated with the project using EML analyses as necessary.

3. Use the results of the EML analyses and other input from the project design team to establish suitable risk mitigation strategies to reduce the level of risk in accordance with the risk appetite of the organisation.

4. Develop the risk mitigation strategies in close consultation with the project team, the appointed risk engineer, fire safety specialists and other consultants.

5. Ensure appropriate design performance requirements and standards for the proposed protection systems including all relevant corporate risk management and insurance requirements are incorporated into the specifications as well as the final installation plans for the project.

6. Validate the installation and commissioning of all key physical protection systems have been completed in accordance with the specifications and plans.

7. Ensure the design limitations of the installed physical protection systems are clearly documented and communicated to the facility’s operations and maintenance staff once the project is completed.

REFERENCE LIST


Lion. [Photographs] Australia: Author.


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