FPC trends

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In spite of a lagging global economy, both private and public sectors appear to take responsibility when it comes to safety. The changing conditions also challenge our field of expertise.

Our main article shows how the government keeps investing in large infrastructure projects and that a modern approach to fire safety is very valuable here.

Also chemical plants and refineries that were built just after the recession in the early eighties, are up for revamping. The condition of fire water networks, the backbone of any industrial plant's safety system, then usually is critically evaluated. This requires capital expenditure.

One of the sectors that suffered least from the crisis is that of both renewable and traditional energy. Only recently FPC got awarded a large contract for a desalination power facility in Saudi Arabia. You will be interested to read about our activities in the Middle East, an increasingly important market to FPC.

The Eastern Europe market is slowly recovering and international organisations such as World Bank and EBRD are investing again in major projects in their region. During the due diligence process, not only business potential and finances are assessed but also safety policies adopted by the potential client.

In response to the economic crisis, companies adapted their organisations and they will continue to do so. From a safety perspective, the question then arises; how do we amend to this changing risk profile? You can read more about that in the SCE Times. SCE groups FPC's emergency management activities and advises public and private entities from an organisational perspective. Enjoy Reading!

Ralf Bruyninckx

Fire Safety at Large Infrastructure Projects

In the past recent years, a substantial number of infrastructure projects were initiated to relieve traffic congestion problems in many densely populated areas. In Belgium alone, examples such as the Liefkenshoektunnel for heavy-good railroad transport, the Diabolo connection between Mechelen and Brussels Airport and the extension of tram / premetro lines around Antwerp, can be given.

A couple of the many other projects worldwide that need being mentioned are: the newly planned metro lines in Paris, the new metro system in Dubai and the train tunnel on the line between Lyon and Turin.

In the same period, fire safety awareness for this kind of projects, increased considerably. The main reason for this was a series of fatal incidents in road and rail tunnels in Europe, during a relatively short period of time. This resulted in a European directive on minimum safety requirements for tunnels in the Trans-European Road Network. For rail and metro transport, no minimum requirements were imposed, but both operators and government started questioning the level of fire safety in their (often) old infrastructure.

The nature of the projects (often meaning mass transport combined with limited and controlled access to the infrastructure) leads to big challenges in life and fire safety design, certainly for existing infrastructure. Due to the fact that almost every project is unique, national building codes are

(see p. 2)

generally not applicable and specific codes are almost non-existent. Moreover, the application codes for retro-fit projects leads to enormous costs and is technically hardly feasible.

Therefore, the solution lies in the determination of the required fire safety level by performance-based methods. In order to obtain the best results, FPC believes that these methods are to be implemented in a general approach as presented on figure 1.

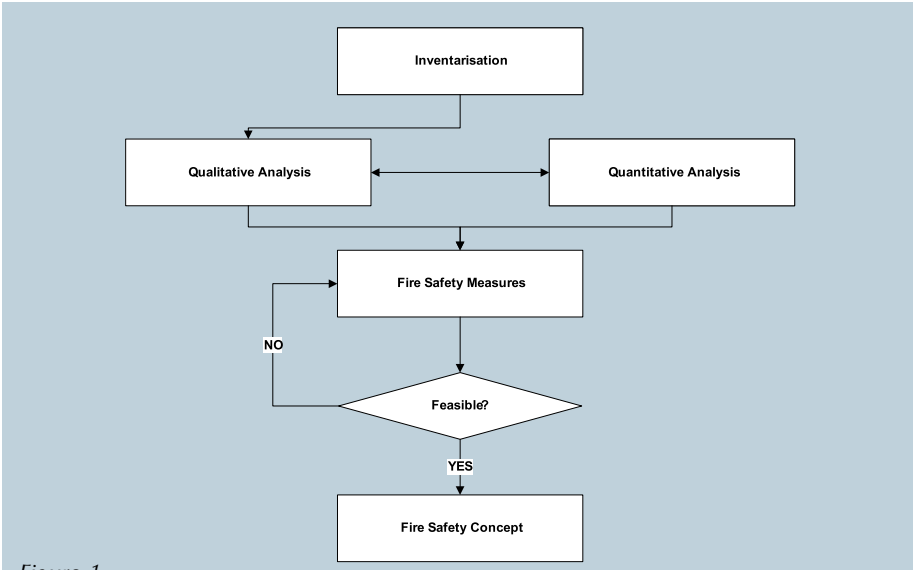

Figure 1:
Performance Based Approach

All the steps in the process are equally important in order to obtain a sound and cost-efficient fire safety concept. The steps are briefly outlined below:

1. Inventarisation

Each infrastructure project is unique in various ways:

- Level of accessibility
- Specific risks
- Operational
- Equipment
- Commercial
- Emergency response strategy

During this phase, all relevant information on the project is gathered, in order to obtain a complete overview on life & fire safety related aspects.

2. Qualitative analysis

Next, the infrastructure project is assessed in a qualitative way. Compliance to the scarcely available codes, benchmarking with other similar projects and literature review on specific items are specific techniques for identifying the typical risks and risk reduction measures.

In this stage , some of the risks can already be mitigated by relatively easy techniques. Compartmentation of public areas from non-public rooms is just one of the techniques to mitigate the public risk from fires in technical areas.

This step is executed in parallel with the quantitative analysis.

3. Quantitative analysis

In some areas, a simple qualitative analysis is not sufficient to identify the real risk and to feel comfortable with the proposed life and fire safety solution. The reasons can be manifold:

- The proposed qualitative solution is technically not feasible
- A code compliant solution will lead to exuberant costs
- A qualitative analysis is insufficiënt to understand the risk

The impact of the risk reduction technique needs to be simulated.

In these cases, a quantitative analysis is executed. It gives all stakeholders a better understanding of the risk and will lead to performance-based, specific solutions.

However, a performance-based analysis requires significant professional experience. Roughly, the process can be divided in the following steps:

- Definition of the goals of the analysis. It is of utmost importance that all stakeholders in the project agree with the levels of fire safety that should be attained by the analysis. These goals will be translated in fire safety criteria for life safety, property protection and business continuity
- Data collection. Since the analysis can become quite detailed, a lot of input parameters need being defined. The data collection not only encompasses the

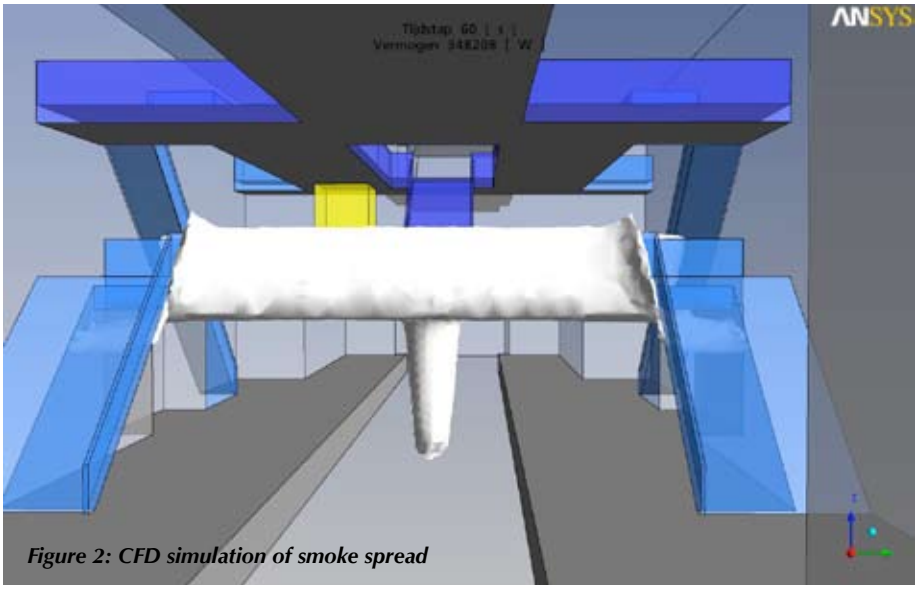

Figure 2: CFD simulation of smoke spread

collection of relevant plans and building characteristics, but also includes the determination of a design fire curve, population characteristics, location of the design fire, atmospheric conditions, etc… If these data are not available, the project team should define well-based assumptions. By doing this, a complete fire scenario is built up. The agreement of all stakeholders on the entire scenario is necessary for a successful completion of the analysis.

- Simulations. These kind of projects often require expert software to perform the simulations. Examples given are buildingEXODUS for evacuation simulations, and CFD packages like Ansys CFX for smoke and heat simulations (Figure 2).
- Post-processing. Since the simulations are often based on quite some assumptions, the results are to be analysed carefully before drawing any conclusions.

4. Fire Safety Measures

Based on the results of both the qualitative and quantitative analysis, fire safety measures shall be defined. Recommendations should be given for all aspects of life and fire safety:

- Building construction
- Compartmentation
- Detection and alarm
- Extinguishment
- Evacuation
- Prevention
- Emergency response

The determination of the fire safety measurements forms an iterative process. For every measure, technical feasibility and cost should be evaluated.

Alternative measures should be sought and evaluated if the measure cannot be implemented for one of these reasons.

5. Fire Safety Concept

The fire safety concept forms the summarising step of the complete process: it defines the life and fire safety goals and outlines how these goals are reached.

The process as described above has been successfully applied on an existing metro line in the Brussels Capital Region, where the combination of qualitative and quantitative analysis led to a series of cost effective recommendations, to be implemented in the stations. It combines the advantages of both types of analysis:

- Qualitative analysis is relatively straight forward, and leads to good results for typical, well-known risks in the infrastructure
- Quantitative analysis is time consuming and requires a lot of professional experience. It is therefore merely used for specific risks, where a qualitative analysis doesn't lead to satisfying results.

Conclusion

The implementation of a fire design concept in large infrastructure projects is often very challenging. Success is only possible if all stakeholders are closely involved in the complete process. In FPC's opinion, the proposed methodology is the only cost-effective way leading to economically and practically feasible fire safety solutions being supported by all stakeholders.

High value asset protection COST-BENEFIT analysis

It is common practice to protect high value assets against fire with some form of suppression agent; either foam, water mist, inert gasses or automatic sprinkler system based solutions.

All this however comes at a certain cost. What happens when the following factors come into play?

- Risks are reasonably low
- No incident history or any form of statistics is available from the past 100years whatsoever
- New technology and green building construction materials and techniques come together

The question immediately comes to mind: is the installation of such a system justified?

FPC became involved in the fire safety engineering of a proposed tram depot building in Brussels. The building and the operator form part of a coalition of 5 major European cities for the promotion of green sustainable cities, through public transport. The building is to be Brussels' contribution and image to this coalition. Due to the massive investment account for this building (total investment over €350million), the operator expressed concern about consequences of a potential fire to property, business continuity and revenue as well as reputation.

In other words, what if we don't have sufficient transportation means to serve the city?

FPC proposed to carry out a COST-BENEFIT analysis through an engineered risk analysis approach. The approach is based on LOPA (Layer Of Protection Analysis) and interviews with different parties involved at corporate and operational level.

LOPA (see figure 1)

The LOPA analysis involves following steps:

- Identify, analyze and quantify fire scenarios
- Analyse and quantify damage and loss in monetary values
- Evaluate effect of a sprinkler system
- Introduce different layers of protection

Cost-benefit analysis (see figure 2)

The above results were coupled to additional study information that involved:

- capital investment costs for sprinklering the depot
- annual costs for maintenance and testing of a sprinkler system
- personnel training

In line with the above, as a final step the investment had to be judged and compared with solid numbers…

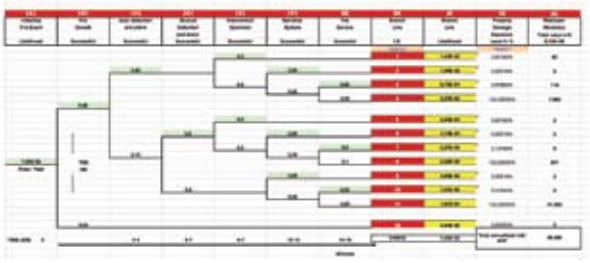

Figure 1: Event tree LOPA

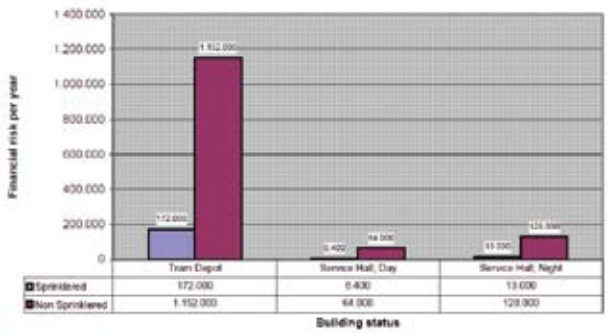

Figure 2: Cost-Benefit

CONCLUSION

Even though the ignition frequency of 0.07ignitions per year (once every 15 years) is considered low, the total risk was found unacceptable, due to the high consequential losses associated with the capital value of the trams.

The comparison between the sprinkler system capital investment/operational cost and the annual financial risk applicable to the depot with and without a sprinkler system, rendered the installation as a wise choice.

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Jubilee in Cyprus

2009 was a momentous year for FPC. This was the year of the company's 35th anniversary since its establishment in Belgium and the opening of an office in Antwerp. In addition, it is now 15 years ago that FPC started its activities in the Middle East by means of the incorporation of FPC ME in Cyprus.

To commemorate the joyful event of FPC's double anniversary, the entire FPC staff flew off for a 5 day celebration and team building event to Cyprus, the beautiful island of Aphrodite. The small country of Cyprus that is best known to us for its culture heritage and natural beauty with sunshine guaranteed.

After a good, but short night's sleep, the physical condition of all members was challenged. We spent most of the day hiking along a nature trail through the woods of the Troodos mountains, from its highest point down to the lowlands. We enjoyed lunch in one of the local restaurants. Late in the afternoon we visited a karting centre and organised a mini-tournament with go-karts . a nerve-wrecking experience for me!

The next morning we drove off to the marina of Aya Napa and boarded a ship for a gently relaxing cruise, taking us along the magnificent eastern coastline of the island with spectacular views of the rugged coast right up to the ghost town of Famagusta. There was ample time for swimming and snorkeling, lunch and beer.

The program for the following day consisted of a FPC seminar, combined with a visit to Nicosia. Purpose of the seminar was to familiarise our team members from Cyprus, Abu Dhabi and Belgium with FPC's international organisation and discuss future objectives. Once in the enchanted old town of Nicosia, we strolled along the narrow, cosy streets scattered with small shops, cafés and taverns, ending the day by enjoying an exquisite reception in FPC ME office.

During our stay in Cyprus, sports' activities included amongst others beach volley-ball, go-karting, having fun, riding a sea banana, bikini watching and swimming at night in the Mediterranean sea. Every evening we were able to dine outdoors and enjoy traditional Cypriot meze and wine accompanied by live music. .And yes. many of our colleagues are in fact extraordinary singers.

As you can see from some of the photographs, the team building event in Cyprus became one of the most splendid business/fun trips ever, organised by FPC.

We have come a long way indeed with FPC and on this occasion, I wish to express my appreciation and gratitude to the entire FPC staff and to our long time patrons.

Ed Bruyninckx

A selection

Latest projects

Fire Water Networks - Belgium & France

For the Total Refinery in Antwerp (Belgium) and the Total Petrochemicals sites in Gonfreville and Carling, both in France, FPC evaluated the condition and capabilities of the firewater supply systems, encompassing fire pumps and firewater distribution systems. Major parts of these systems have been installed over 30 years ago and Total management wanted to have the condition of system components evaluated and the hydraulic capabilities verified. Next to the aging aspect of the systems, process unit and infrastructure changes realized over the years have been taken into account. The testing of the systems was conducted in close corporation with the refinery fire brigades and by using an ultrasonic flow meter.

The scope of FPC involvement was therefore focused on following aspects:

- Define most demanding and credible fire incident scenarios
- Testing of fire pumps and firewater distribution piping (define condition – C-factor – of the piping)
- Hydraulic analysis of the firewater distribution network, based upon required firewater demands
- Presentation of findings of the testing / analysis and recommendations for upgrading of the system
- Priority listing and budget estimation for recommended upgrading

Off-shore production platforms – The North Sea

FPC's fire protection engineers have gained a lot of valuable practical experience in testing and commissioning deluge water spray systems on off-shore facilities over the last decade. They are accustomed to carry out site surveys with the highest level of expertise under extremely difficult circumstances.

Recently, commissioning of the upgraded fire water systems has been conducted on the Wintershall off-shore production platforms A6A, P6A, L8P4 and Q1B-Hoorn. As a result, the acceptance certificates were handed over. Thanks to a good mutual understanding and communication between Wintershall North Sea and FPC, the sequence for life testing and commissioning the fire water systems, was planned with a minimum of discomfort for both the platform operators and the environment.

Firesafety due dilligence - Projects in CIS Countries

The Commonwealth of Independent States (CIS) is an organisation whose participating countries are former Soviet Republics, formed during the breakup of the Soviet Union. They include countries such as Russia, Kazakhstan, Belarus, Azerbaijan, Ukraine, Georgia, etc.

For the past year, FPC has worked actively in all the above countries to assist IFC/World Bank and their clientele with major investments that take place in this Region. FPC's role in these projects is to provide assistance and advice on the application of international fire safety guidelines.

In general, the main project steps are :

- Conduct site visit
- Discussion with project sponsor(s) and local architect/contractor
- International code compliance analysis
- Development of corrective action plan
- Testing and commissioning of fire safety systems.

The projects range from large shopping malls to international hotels, hospitals and high rise office buildings.

New Project Announcements Around the World…

Umbrella Contract Amsterdam Airport Schiphol

Amsterdam Airport Schiphol (AAS) is amongst the largest airports in the world covering more than 260 destinations. Since 1995 FPC and AAS established a partnership in life & fire safety. Together with AAS, FPC has composed a fire safety concept for the entire Airport Terminal Building.

The terminal is one integrated building, which has been built in several stages during the last decades. It houses a railway station in the basement and three airport terminals, with a large office capacity. Due to its atypical format, fire risk assesment techniques are used to achieve equivalency with the Dutch building codes.

Recently AAS and FPC have renewed their partnership in order to further implement and follow-up on the established fire safety concept. The renewed legislative procedures regarding exploitation permits and ever continuing building changes will be forming a new challenge for the near future.

New Port House – Antwerp, Belgium

The new Antwerp Port House, designed by Zaha Hadid architects is quite a spectacular design. The concept is a free interpretation of a diamond-shaped volume raised above the existing building of the technical service department, which was partly used as a fire station. It is supported on three sculptured pillars housing the stairs and lifts. Two of the pillars are situated in the covered inner courtyard of the firehouse, while the third is located beside an external support point and consists of a panoramic lift shaft.

The concept imposes specific challenges to fire safety:

- Integration of the old classified building with the new modern building with different building codes that apply.
- Potential fire exposure from the existing building to the new building
- Limited number of safe locations available for fire brigade intervention
- Integration of the courtyard within the existing structure of the building
- Limited compartmentation in the existing classified building

FPC has been requested by the local project managers, Bureau Bouwtechniek, to provide consultancy services during the course of the project to ensure both a safe design and regulatory compliance.

Oman Convention and Exhibition Centre

Planned to be an iconic development with a global profile, this development will be the first significant venture for Oman into the Meetings, Incentives, Conferences and Exhibition (MICE) market. The centre will act as a gateway to Muscat the capital of Oman and draw on Oman's strong cultural heritage, architectural traditions and natural beauty.

When completed, this phase of the OCEC shall have:

- Convention Hall for 3,000 tiered seats & Exhibition Hall of 23,000 sqm
- Banquet/Meetings rooms of 4,000 sqm & Retail Shops
- 4 star hotel of 400 keys complete with Banquet / meetings facility
- 3,000 cars in mixture of surface and covered/structured spaces.

FPC's involvement is over a period of 12 months and will cover, Concept, Schematic and Design development phases including NFPA compliance anlaysis, modeling of smoke management and evacuation strategies.

The World Largest Fire Training Center, Qatar

Ras Laffan Emergency & Safety College in Qatar is an initiative of Qatar Petroleum (QP), the largest oil and gas operator in Qatar.

The duration of the project is thirty months and the training center is expected to be fully operational in 2010. The construction of the Ras Laffan Emergency & Safety College will provide the ultimate in modern, realistic training facilities for the Middle East and North Africa and in particular, for the state of Qatar.

The training center will be built in Ras Laffan, the industrial town of Qatar. The site measuring approximately one hundred hectares (1 million m2), will contain 28 training situations and simulations (training props), including a petrochemical factory setting, an airplane and car crash, a ship accident and large (oil) fires.

The campus will house approximately 250 students and 150 staff. There will be a variety of study and residential facilities, such as a school building with teaching locations and offices, a faculty, hotel rooms, a mosque, schoolrooms and an auditorium.

Various buildings and installations will be constructed in the surrounding desert landscape, including a fire station, a water purification plant, a control tower, storage facilities, and additional classrooms.

FPC has been appointed to provide Fire Safety Engineering and Consultancy Services for the complete facility.

FPC scope of works covers:

- Development of the Fire Safety Philosophy to be utilised for the project, the Fire & Gas Detection System Philosophy, the Passive Fire Protection Philosophy and the Life Safety Philosophy
- Life Safety Report & Code Compliance
- Fire water supply systems (fire main, tanks, hydrants & monitors) for both the emergency fire water main and the training fire water main
- Design of all active fire protection and detection systems (site wide, buildings, fuel storage areas, substations, etc)
- Design of all safety and fire fighting equipment and life and fire safety signage to be provided for the facility

FPC has a dedicated team, consisting of engineers and consultants, based at the Abu Dhabi office to maintain day to day contact with Tebodin and other engineering disciplines. The team leader is Mr. Luc Feremans CEng., with over 30 years experience in fire safety engineering.

For further information on the project, contact Mr. Luc Feremans CEng – UAE Operations Manager (lferemans@fpcme.com) or FPC Middle Office at sdakessian@fpcme.com.

Fire Safety for PDO in Oman

Petroleum Development of Oman (PDO) is the foremost exploration and production company in the Sultanate. It accounts for more than 90% of the country's crude-oil production and nearly all of its natural-gas supply.

PDO's oil fields are spread throughout Oman where the oil reaches the surface, subsequently it travels along a flow line to gathering / production stations, where the water and gas are separated from the oil and then it is fed into the main oil line to the coast at Mina al-Fahal near Muscat for further processing and shipment.

FPC's involvement encompasses fire risk assessment / fire hazards evaluation, GAP analysis and evaluation of the active fire safety systems utilizing performance based engineering methods (heat radiation calculation for estimating the heat contours and their impact to adjacent areas and hydraulic calculations for estimating the existing systems capabilities) and the preparation of basic and detailed engineering design packages.