Risktec
risk management and assessment for business

RISKworld

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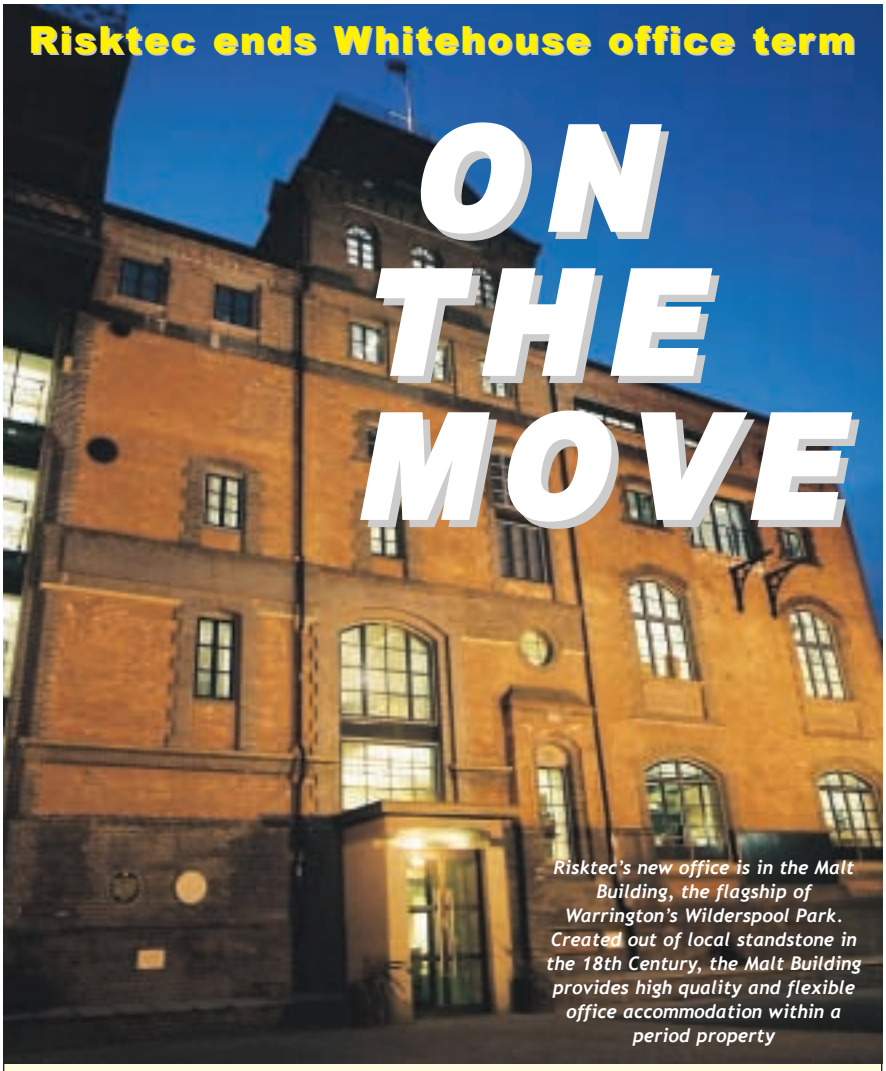
Risktec ends Whitehouse office term

ON THE MOVE



Risktec's new office is in the Malt Building, the flagship of Warrington's Wilderspool Park. Created out of local standstone in the 18th Century, the Malt Building provides high quality and flexible office accommodation within a period property

Risktec Solutions has moved on in many respects since it was formed a year ago.

The company has established itself internationally as a respected specialist in assessing and mitigating risks for major industrial and commercial enterprises.

Now, it has left its formative home at the Whitehouse Business Centre, in Stockton Heath, Warrington, and moved into new accommodation on the same Wilderspool business park site.

Similarly, Risktec has also outgrown its initial home in Aberdeen and moved to an office suite in the city centre.

Risktec, part of Nutec Global, one of the world's largest providers of safety and emergency response training and consultancy services to the offshore, maritime and industrial sectors, has grown at a spectacular rate since it was established in September last year, and now has 25 staff in Warrington.

Its continued commitment to the North-West as a base from which to serve an international client portfolio is illustrated by the fact it has taken a ten-year lease in the Malt Building.

Nick Eckersley, who coordinated the move, said: "The Malt Building, which was once part of the Greenall's brewing operation, has been converted into modern office accommodation, which is well-suited to the needs of a modern consulting business.

"The Malt Building location in Warrington is ideal because it is in the heart of an area offering a great wealth of expertise in the field of risk management. So far, there has been excellent response from industry," he added.

The short distance of the move means all contact details remain the same.

In Aberdeen, Risktec simply outgrew its office space within the Nutec Centre for Safety, at Dyce, and has moved into an office suite in the newly-opened Riverside House, in Riverside Drive, Aberdeen.

New contact details for Risktec's Aberdeen office are Telephone 01224 224454 and Fax 01224 224455.

Safeguarding against fire and explosions

As a member of the Fire and Blast Information Group (FABIG), Risktec is pleased to enclose with this issue of RISKworld a leaflet providing more information about FABIG. Established in 1992, FABIG, in partnership with the oil and gas industry, has carried out research projects, produced technical notes and held regular meetings to disseminate information for all hazardous industries to safeguard against fires and explosions. Current work includes the development of simplified methods for the analysis of structures subjected to blast loading.

Information about future open meetings and other activities may be obtained from the FABIG website, at http://www.fabig.com

Training for hazards

Risktec successfully delivered a hazard management course for key managers and supervisors in Shell Nigeria.

More than 40 staff received training in the process of identifying, assessing and managing hazards. The course included the application of the "bow-tie" diagram (described in RISKworld, Issue 1), a user-friendly, graphical illustration of how hazards are controlled.

Risktec consultant Andy Lidstone said: "A lot of countries are expecting consultants to not only conduct technical assignments but also to transfer knowledge, rather than merely leaving a report behind. By providing training, the intention is that, in future, organisations will be able to carry out the studies themselves.

"Risktec is committed to developing long-term sustainable relationships with our clients and training is an important part of that commitment."

Training for incidents

Risktec successfully provided training to over 20 key managers and supervisors at Shell Cameroon in incident investigation and analysis.

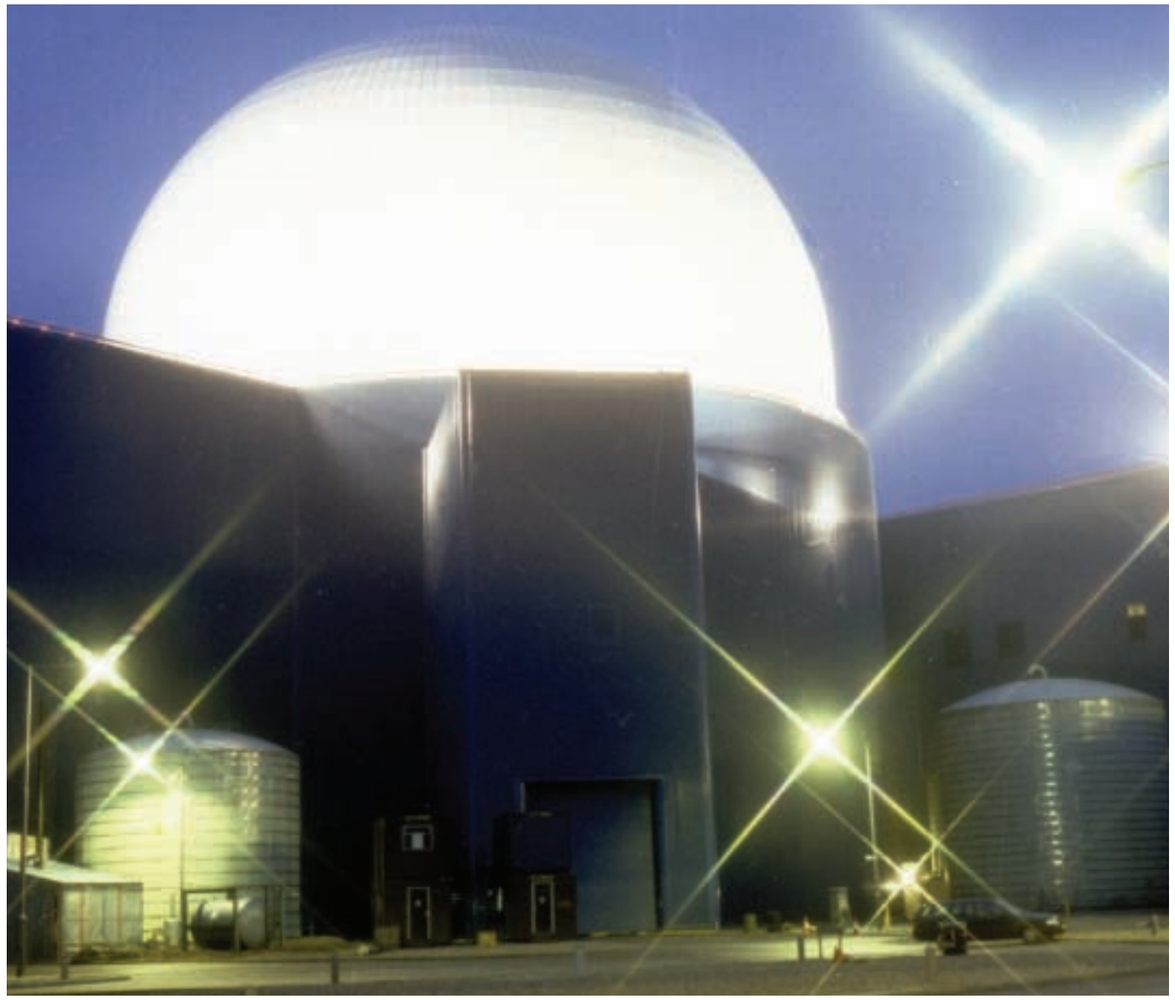
Personnel received training in how to investigate incidents, analyse root causes and make recommendations for lasting improvements in business performance. The training was based on the Tripod Theory of accident causation (introduced in RISKworld, Issue 1) and focused on the principle that identifying measures to prevent "latent", or hidden, structural or organisational weaknesses is likely to have the greatest beneficial impact in accident prevention.

Risktec's Andy Lidstone explained: "Simply identifying what happened and blaming the person at the sharp end is not good enough. The analysis should focus on the 'why' – and that means working back from the final failed defence to identify failures deeper within the business. Very often these arise from the decisions of top management, designers and line managers."

The inside story A personal view on the future of nuclear energy

Letter from Vienna: The future of nuclear energy

Ian Facer, a former Risktec Solutions consultant, now employed by the International Atomic Energy Agency in Vienna, gives a personal view of the way ahead for the nuclear energy industry



A hopeful beginning

In 1954, the first nuclear power reactor provided 5MW of electricity to the national grid in Russia. This was rapidly followed by Calder Hall in the UK providing 50MW. This initial trend continued and, subsequently, the development has been for the power output to increase, from 300MW through to 600MW to 1000MW and even up to 1500MW. This growth in size was intended to achieve the economics of scale, but conversely it has had the effect of limiting the number of countries and electricity systems that could consider using nuclear generation.

Today, only a handful of countries are still constructing nuclear power stations. New construction starts, since 1990, have only been in China, Japan, Korea and India.

Although the nuclear industry claimed that it would bring economic benefit and cheap power, many countries are now rejecting nuclear power for the future and other countries that have a growing need for energy cannot afford the investment or to develop the infrastructure that is needed to support a nuclear industry.

The need for electricity production, desalination schemes, process heat and district heating is growing in many countries. Nuclear power can meet these needs effectively and safely, so why is there not a surge in demand for new nuclear facilities?

One major factor is economics. New nuclear plants are capital intensive, take a long time to build and are subject to significant regulatory and political interference. The financial risk resulting from technical or regulatory delays can be seen as too great.

The counter arguments are that nuclear has a fuel price stability that will lead to an improving economic position in the future, that nuclear provides energy without the carbon emissions and pollution of fossil fuels, and that nuclear does not have the environmental damage of large dams and hydro schemes. But these arguments do not yet have sufficient influence to change the minds of decision makers except in countries that have already recognised that the need is overwhelming.

Licence extension

Today, there are 32 countries worldwide operating 438 nuclear power plants with 30 units under construction. The operating units have an installed capacity of about 357GW. Within 20 years these will have reduced by 150GW unless efforts to extend the operating life of existing plants are successful. There are only about 50GW of the currently installed capacity with a design life beyond 2030, and most of these are in Asia-Pacific region or in France.

In the short-term the effort to justify the continued operation of economically efficient plants is a major challenge for the industry

My old colleagues at Risktec, along with the rest of the European nuclear industry, are mainly occupied with short-term efforts to justify the continued licensed operation of economically efficient plants or the safe decommissioning of older reactors. It is worth noting that the nuclear industry worldwide has increased both the amount and the percentage of electricity provided, due mainly to improved availability factors.

Increased availability provides greater impetus to efforts to prolong the life of plants and to maximise the economic returns on plant that has been paid for many years ago. In the longer term, even with improved conservation of energy, what will Europe and North America use for electricity production after 2030?

Imported oil and gas will become much more expensive, and while concerns for the security of nuclear plants must be treated rigorously, the vulnerability of pipelines to terrorist attack may leave Europe with little security of energy supply.

It is remarkable to note that Finland is leading the way in Europe with decisions to approve a repository for spent fuel, and the decision "in principle" on the proposal to build a new nuclear reactor. It is disappointing that there is not the same positive recognition of the need for action in other European countries.

In the US, there is formal approval for the Yucca Mountain high-level waste repository, and there is an initiative by the Government to work with industry with the goal of a new nuclear power plant operating in the US by 2010.

Future developments

Here at the IAEA, we continue to look forward with a remit to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

In addition to the analysis of the contribution of nuclear energy to sustainable development and environmental improvement, the IAEA is coordinating the International Project on Innovative Reactors and Fuel Cycles (INPRO). This project is identifying the needs for innovative reactor designs for the future and the requirements that will allow the designs to be built.

In presentations to the ICONE 10 Conference in the US, information from the INPRO project suggests new designs must achieve lower capital costs, be more flexible and easier and quicker to construct, and must include a range of sizes to allow countries with smaller electricity grids to install and operate the plants successfully.

Nuclear energy must compete economically with alternatives to have a future in the short-term. The primary challenge that INPRO is identifying for Governments is not technical, but to identify how national regulation, international licensing or certification can be structured to gain investor confidence.

A further challenge for the industry is the requirement to develop economic designs and fuel cycles that will allow the application of new nuclear facilities without the need for excessive infrastructure surrounding the facility.

Public acceptance

Whatever the technical, financial and political progress, the overriding obstacle is worldwide public acceptance. Eventually I believe that the public will come to accept that the risk from not having a nuclear energy source is greater than the risk of using nuclear power.

Hopefully, this will occur before Europe's nuclear expertise has diminished and the experience of the past has been lost.

**This article presents personal views and is not submitted on behalf of IAEA*

DID YOU KNOW? Some facts about Risktec Solutions

- Risktec Solutions started operations in the UK in September 2001.
- Risktec has undertaken over 90 projects with over 40 clients, mainly major blue-chip companies such as British Energy, BNFL, Railtrack, Rolls-Royce, Shell, Agip and Safeway.
- Risktec operates a quality assurance system that has been certified to ISO 9001:2000.
- Risktec's clients span the main hazardous and commercial sectors, from nuclear and defence, through oil and gas and chemical, to rail and manufacturing.
- Risktec has over 30 professional consultants.
- Risktec consultants have travelled to more than 15 different countries to undertake assignments for clients.
- Risktec is part of the Nutec Global group, a leading provider of safety and emergency response training to industries worldwide.
- Risktec's sister companies include Risktec Consulting BV (previously called Advi-Safe) based in The Netherlands, and Nutec Crisis Management in Norway, each providing operational safety management and crisis management services on an international scale.

Project review

Good planning will offer rail benefits

Risktec Solutions is fulfilling a key role in the exciting development of a new radio communications system, which will be implemented over Great Britain's railway network within the next few years.

Railtrack is undertaking a major project to upgrade and replace its existing operational voice radio communications systems – Cab Secure Radio (CSR) and National Radio Network (NRN) – with a modern system based on GSM digital radio technology.

Railtrack's National GSM-R (Global System for Mobile Communications – Rail) radio system will comply with UIC-developed EIRENE specifications. Thirty-two European railway companies have already adopted GSM-R as the new international standard for railway telecommunications and, in addition to Britain, GSM-R systems will shortly enter service in Sweden, the Netherlands, Switzerland and Germany.

Although standards have been developed to ensure interoperability of railway traffic throughout Europe, Britain's railway operating practices differ from those in other countries in continental Europe. As such, one of the first activities to be conducted was the development of a Safety Assurance Strategy, which defines the process by which Railtrack will demonstrate that the GSM-R Radio System is 'fit for purpose' and safe for use specifically within Great Britain's railway environment.

This strategy, along with a Concept Safety Case for the system, was used to support Railtrack's business case for the subsequent detailed design and implementation phases of the project.

Latterly, Risktec has augmented the strategy with a Safety Assurance Plan, which presents, in detail, the safety assurance and engineering safety management activities which are to be conducted over the remainder of the project's life-cycle.

Risktec's Systems Assurance Team Leader, Andy Reynolds, says: "Safety Planning is an important step in any project of this nature, as it provides all project stakeholders, including the approval authorities, with comprehensive details of the safety activities to be carried out, the deliverables to be provided and, not least, clarifies the safety roles and responsibilities of everyone involved in the project. By subjecting the project's intentions to an independent safety assessment by an external organisation, we can be confident that we are starting off on the right track and that an appropriate level of engineering safety management activities are being considered from the outset."

GSM-R Operational Handportable, for use by trackside personnel

Following endorsement of the GSM-R Safety Assurance Plan by Railtrack's Infrastructure Systems Review Panel (I-SRP) in August, Risktec is now assisting Railtrack in ensuring that the plan is followed and that all necessary safety activities are carried out.

Andy Reynolds added: "Railtrack follows a phased approach to safety approvals, which can be mapped to the conventional engineering 'V' life-cycle, and which minimises the risk of introducing a system into service which does not meet the needs of the modern railway. The next submission to I-SRP will seek approval of the system's safety requirements, followed by approval of the design and operating principles before the system is bought into service."

Risktec provides a wide range of services to the rail industry in strategic and operational risk management.

Risktec's sporting gesture

Risktec Solutions has helped kick-start an ambitious project to educate young people in the Aberdeen area about the benefits of sport - and the dangers of drugs.

Sponsorship from the company has enabled Aberdeenshire Rugby Club to appoint a full-time rugby community development officer.

Trying together: David Bonsall and Anthony Posa discuss the programme

Anthony Posa, a former Croatian international, will spearhead the club's outreach programme in conjunction with local police, delivering sports and drugs education to youngsters. He will work with PE departments in schools in the north of Aberdeen on a programme giving both boys and girls the opportunity to take part in rugby in school, after school and at weekends at the Aberdeenshire club.

Risktec, which recently expanded into bigger premises in Aberdeen's Riverside Drive, has enjoyed a good relationship with businesses in the city, notably those associated with the oil and gas and petrochemical industry.

Principal Consultant David Bonsall said: "Sponsoring the rugby club's education outreach programme is a worthwhile way in which we can put something back into the community. We recognise the serious effort being made by the club to offer youngsters the chance to take part in healthy activities."

Flameproofing ...

The prospect of a major fire onboard a nuclear submarine is almost unthinkable (see inset).

One approach to managing this potent hazard in multi-compartment spaces is to model the fire progression using computer codes based upon three dimensional computational fluid dynamics (CFD).

Unfortunately, this can be time consuming and expensive, and is only as good as the model definition. Moreover, the requirement to tie the fire modelling results into the safety justification for the reactor plant may be overshadowed by the effort associated with CFD. A more pragmatic and cost effective approach is outlined in **Figure 1**.

What if the unthinkable happened . . .

Petty Officer Kelly should have been asleep in his bunk. Instead, at 4am, he found himself rubbing tired eyes, staring at a relay lying in pieces in front of the adjacent switchboard cabinet.

The repair would take him another half-an-hour, he thought, cursing. Oh well, at least he could look forward to an early breakfast.

His meandering thoughts were interrupted by a quiet hiss, coming from behind. Turning, his eyes fixed on a plume of mist issuing from a small bore pipe, drifting towards the turbo-generator switchboard. In the next instant, the vapour cloud exploded, flinging him across the compartment.

Lying on the floor, struggling to breathe, his thoughts danced from his complaining body to the prospect of the engulfing fire. The complete loss of electrical power would be bad enough for the dived submarine.

Even now, he imagined, the well-trained crew would be driving the crippled vessel to the surface and readying a team to attack the fire. If they failed to rescue the compartment, there were worse prospects ahead.

Although the nuclear reactor was designed to shutdown automatically on loss of power, its long-term safety depended on restoring electrical systems . . .

Expert walkdown of compartments

The starting point for assessment is a physical or tabletop walkdown of compartments by suitably qualified and experienced operators, designers and fire experts. The initial purpose of this walkdown is:

- The creation of an equipment inventory
- The demarcation of each room or compartment into smaller zones (where necessary) to facilitate analysis of fire growth.

Identification of fire loading and ignition sources

At the same time, the walkdown identifies equipment with the potential to act as an ignition source or as fuel, adding necessary detail in slower time by reference to authoritative fire data.

Classification of fire type and frequency

The walkdown categorises potential fires according to both their likely size and type based on the sources of fuel and ignition present. An example of such a scheme is given in **Table 1**.

The likelihood of each fire is determined on a qualitative basis from which a quantitative value can be inferred (see, for example, **Table 2**).

Crucially, the results of this exercise are reviewed against relevant historical data to confirm their consistency with evidence available from operational experience.

Generation of fire growth sequences

A fire growth model can now be developed that takes account of the detection and fire fighting capability within each local zone and/or compartment, including:

- First aid firefighting
- Fixed firefighting systems
- Compartment re-entry.

The resulting fire growth model is again reviewed against historical data to ensure that it remains realistic.

Identification of design basis initiating events

From the validated fire growth model it is possible to identify those fire events that would lead to:

- A significant fire (eg type 1 or 2) where first aid fire fighting and fixed fire suppression systems fail, but the fire is ultimately brought under control by the re-entry team, hence restricting fire damage to a single local zone.
- A major fire where none of the fire suppression methods succeed and the compartment is lost.

In both instances, it is assumed the integrity of any equipment contained within the affected local zone (for significant fire) or compartment (for major fire) is challenged. By making reasonable assumptions about equipment loss any given fire can be linked to one or more initiating events in the Reactor Plant Safety Justification (RPSJ).

Assessment of sufficiency and adequacy of reactor protection

Having identified the relevant initiating events, the RPSJ's fault schedule may be used to determine which protective safeguards may potentially be claimed, discarding those substantially affected by fire.

Identification of design weaknesses and ALARP measures

Assessing the outcome against predefined design basis assessment criteria (such as the preferred number of safeguards, their degree of single failure tolerance) leads naturally to:

- Singling out potential design weaknesses with respect to fire
- Identifying where targeted use of detailed fire modelling such as CFD could be beneficial
- Deriving potential improvements for subsequent ALARP assessment, such as the removal or reduction of fire loading and ignition sources, introduction of automated fire suppression systems, the increasing of separation or segregation of vital safety systems.
- Determining fire-related safety functional requirements (e.g. fire withstand) and operating constraints.

In conclusion

Although the development of this technique has been pioneered on nuclear submarines, in principle it offers an economic, modern standards approach to the fire assessment of any multi-compartment facility.

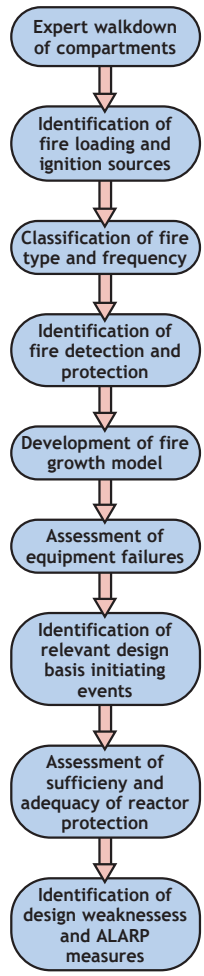


Figure 1

Table 1

Fire Type	Description
1	**Minor fire,** such as oily rags, solid materials, pools of lubricating oils, paper.
2	**Minor electrical fire,** such as spark generated, overheating components, insulation material.
3	**Major fire,** such as gas or hyraulic oil mist ignition, characterised by a rapidly moving flame front, or an escalation from a type 1 or 2 fire.
4	**Explosive fire,** occurring within compartments, or spaces, used for the stowage of conventional explosives or propellants.

Table 2

Fire Frequency Band	Occurrence During Life of the Facility	Fire Frequency (/yr)
Frequent	Likely to occur repeatedly	>1
Probable	Likely to occur from time to time	0.3
Occasional	Likely to occur once	3×10^{-2}
Remote	Unlikely to occur	3×10^{-3}
Improbable	Very unlikely to occur	3×10^{-4}
Highly Improbable	Extremely unlikely to occur	3×10^{-5}
Beyond Design Basis	Extremely unusual event and unlikely to occur	3×10^{-6}
Incredible		$<10^{-6}$

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