RESOURCE PROTECTION INTERNATIONAL

Fire and Explosion Hazard Management Specialists

Statement of Capability
Introduction

Resource Protection International is an independent consultancy specialising in Fire and Explosion Hazard Management of oil and petrochemical facilities and other high risk industries. Fire and Explosion Hazard Management (FEHM) is a vital part of any company’s Risk Management Policy. Every facility has special specific needs, which must be reviewed, updated and maintained as business conditions change.

The optimum cost-effective FEHM policy will involve a unique combination of measures including security, fire prevention, incident detection, process control and fire protection / firefighting systems.

In order to develop the optimum strategy for any particular facility a comprehensive knowledge of each aspect of FEHM is required. Resource Protection International, established in 1989 by specialists with unique international experience, has the team of talent necessary to propose and implement practical, pragmatic solutions to all FEHM problems.

This document provides an overview of the wide range of services offered by Resource Protection International, along with details of the companies we serve and the methodologies we have developed working with our customers to provide site specific, justified, auditable, cost-effective and relevant Fire and Explosion Hazard Management strategies.

"Resource Protection International  - a team of talent providing a unique range of services to assist their clients in developing and implementing cost -effective and relevant Fire and Explosion Hazard Management strategies."
Scenario Based Fire and Explosion Hazard Management

Working with their clients worldwide, Resource Protection International has developed a methodology by which a facility’s fire and explosion hazard management strategy can be developed in an auditable way so that it is relevant, justified and cost effective. The technique involves a scenario based evaluation of credible incidents, an assessment of their potential consequences and quantification and implementation of the resources required to respond to them.

Meeting legislation alone is not enough because this will primarily be aimed at life safety and protection of the environment. It is vital, particularly in today’s business climate, to also assess incident consequences to business interruption, asset value and public image. The Resource Protection International methodology considers these factors and the various options to mitigate them and so results in a policy, which is specific to a given facility.

Scenario worksheets are used during the analysis and these can be used to develop Preplans – the final link required in a planned incident response policy.

The technique has now been used at a variety of facilities on a worldwide basis and has consequently become accepted as a valuable tool in a company’s Risk Management Strategy.

Resource Protection International provides an integrated package of Fire and Explosion Hazard Management. The concept of FEHM recognises the input to fire risk reduction from a wide range of issues. It results in cost-effective site specific strategies which are directly relevant to real needs. Resource Protection International has the in-house experienced–based expertise to provide assistance in all aspects of FEHM, from Risk Assessment through to implementation. Resource Protection International has been at the forefront of FEHM’s development and implementation in high risk industries.

Further information regarding the concept of FEHM is included at the end of this document in the form of a presentation summarising the main points.

Scope of services

- Fire and Explosion Hazard Management Strategy Development
- Risk Assessment
- Scenario Based Fire Protection Reviews
- HAZOP Studies
- Fire Detection/Protection System Specification
- Fire Vehicle and Mobile/Portable Equipment Specification
- Factory and On-Site Inspection/Testing of Equipment
- System Commissioning
- Development of System Operation and Maintenance Documentation
- Fire Brigade Management and Development
- Halon Removal and Replacement Analysis
- Fire Response Preplanning
- Major Incident Emergency Response Planning
- Response Training
- Fire and Explosion Hazard Management Seminars
- Incident Response Exercise Management.
Expertise and experience

Resource Protection International has a unique team with experience and expertise encompassing all aspects of Fire and Explosion Hazard Management.

- Hands-on Emergency Incident Experience
- Fire Brigade Management
- Fire Science Knowledge
- Fire Systems Operational Experience
- Fire Systems Engineering
- International Standards Authority Committee Members
- Qualified Trainers
- International Experience
- Fire Effects Modelling
- Comprehensive Applications Expertise
- Process Knowledge
- HAZOP Studies
- AutoCad Capability
- Hydraulic Calculations
- Quantitative Risk Assessment

RPI have unrivalled experience of fire protection systems worldwide.

Jet Fire From Vertical Release From 2” Diameter Pipe @ 18bar

Vertical Section through Origin

Heat Flux

- 6.3 kW/m²
- 12.5 kW/m²
- 25 kW/m²
- 37.5 kW/m²
- FLAME

Down Wind
0 m/s

Resource Protection International use comprehensive Fire and Explosion Consequence Modelling programs.
Resource Protection International work in all high hazard industries, but the majority of their work is in the oil and petrochemical sector where the combination of fire science, engineering and operational skills is seen as unique and essential to practicable solutions to Fire and Explosion Hazard Management problems.

Breakdown of RPI FEHM Project Involvement
## Clientbase

Resource Protection International have a client base that encompasses all the world’s major oil and petrochemical companies as well as a wide range of smaller companies, thus emphasising RPI’s adaptability and versatility to meet the needs of all companies.

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Clients outside the oil and petrochemical sector include NATIONAL GRID, POWERGEN, GOLDEN VALE and the BRITISH LIBRARY.
Resource Protection International have truly international experience at oil related facilities ranging from production stations to distribution depots, and is consequently fully familiar with the special needs of different operating environments around the world.

Resource Protection International has worked in the following countries, thus showing their knowledge of different operating environments and conditions.
Resource Protection International’s experience demonstrates a working knowledge of international standards and Codes of Practice. Resource Protection International is represented on code writing committees where their independent status balances supplier input.

RPI carry out consultancy in the most demanding of environments
Project applications – From Wellhead to Distribution, Onshore and Offshore.

- Offshore Oil/Gas Production Platforms
- Offshore Accommodation Facilities
- Onshore Production Stations
- Tankers
- Storage/Pipeline Installations
- Floating Storage Units
- Marine Loading Facilities
- Refineries
- Distribution Depots
- Petrochemical Production Facilities
- Power Generation Facilities
- Airports
- Helidecks
- General
- Commercial/Industrial Facilities

Project Applications are both Onshore and Offshore
Call-Off contracts

Several major companies have recognised Resource Protection International’s unique, integrated and comprehensive FEHM capability, awarding ‘call–off’ contracts encompassing all aspects of FEHM and allowing fast response through simplified contractual agreements.

Call-Off Contracts held for more than 6 years
Typical FEHM experience within one Call-Off Contract

SHELL SARAWAK
SHELL SALYM
BAPETCO EGYPT
SHELL GABON
AL-FURAT SYRIA
HOCOL COLOMBIA
NAM NETHERLANDS

SHELL THAILAND
SPDC NIGERIA
BRUNEI SHELL
SHELL VENEZUELA
SHELL MALAYSIA
PET. DEV. OMAN
SHELL TEMIR

The range of services provided to one major international oil company under such an agreement clearly shows Resource Protection International’s breadth of capability.

Latest technology reviews
Corporate FHM training
Fire Protection Analyses
Fire vehicle specification
In-house standards / Codes
Fire / gas detection specification
Fire & Explosion Risk Management
Policy Development
Fire training
MSDS Sheets
Emergency Exercises
HAZOP / HAZAN / QRAs
Halon Replacement Studies
Competence Assessment
Fire Brigade Management
System Commissioning / Testing / Inspection

Typical projects within Call-Off Contract
Management team

Resource Protection International has a management team of full time consultants comprising individuals with complementary expertise. The team’s experience and knowledge includes fire science, fire detection/protection systems engineering, process engineering, fire protection/safety systems auditing, hazard assessment, major incident fire fighting, system commissioning and training. The expertise in the Management Team is supplemented by other in-house consultants and by the use of associated consultants in specialist areas such as insurance or security issues. Thus Resource Protection International can provide a balanced, independent analysis of all fire hazard management problems and offer practical solutions based on hands-on experience.

Brief details of Resource Protection International’s management team are given below. Full C.Vs are available along with those of other Resource Protection International consultants if required.

Dr Niall Ramsden  Director

Niall Ramsden joined the loss prevention industry in 1976 after having graduated in physics and in mechanical engineering. He has been involved in all aspects of active and passive fire protection and detection systems to international standards including conceptual studies, detailed design and system commissioning. He has carried out training and consultancy projects for major oil/petrochemical companies around the world including fire/safety audits, process safety studies, scenario based emergency resource evaluations and in-house seminars. He is a Chartered Engineer, a Chartered Physicist and a member of the National Fire Protection Association (USA) Foam Systems Committee.

Typical project involvement includes:
- Fire and Explosion Hazard Management
- Conceptual Detection/Protection System Design
- Corporate Standard Development
- Scenario based incident analysis
- Seminars
- Fire Modelling
- System Training
Dr. Barbara Chisholm  Project Manager

Dr. Barbara Chisholm has over 25 years experience in civil, fire, environmental, water and wastewater projects as both a designer and contractor in a variety of roles working in or leading multi-disciplinary teams. Barbara joined Resource Protection International to take on an overall project management role with particular involvement in the specification, testing and assurance of water based systems.

Typical experience includes:-

- Structural Design Engineering
- Site Manager
- Project Manager
- Fire Risk Assessment
- Fire Hazard Management Philosophy Development
- Detail design and specification of fire systems

Peter Spinks  Engineering Manager

Peter Spinks has worked in the Fire Industry for over 25 years primarily engaged in the Design of Engineered systems for Foam Deluge Sprinkler and Gaseous Systems including integration with detection and control. During his career he has held managerial positions with three major Fire Protection Companies responsible for the Design, Project Management, Production, Installation and Commissioning of systems in the UK, offshore and worldwide.

Typical experience includes:-

- Fire Protection Audits
- System Design and Specifications
- Project Management
- Implementation of and Audits to ISO 9001
- Training on Deluge, Sprinkler & Foam system design
- Training on the operational and maintenance of Deluge and Foam Equipment
- System Testing and verification of equipment

Paul Watkins  Fire Engineer / Hazard Analyst

Paul Watkins is a graduate of Fire Science from the University of Leeds in the United Kingdom. During his studies he was heavily involved in the use and validation of fire and explosion modelling techniques and the application of risk assessment procedures. With Resource Protection International he has delivered seminars on a wide range of fire engineering topics at venues including the Fire Service College in the U.K. and at the Loss Prevention Council. He is responsible for carrying out fire modelling and Quantitative Risk Assessments (QRA) including environmental / loss of containment reviews. As part of an internal project involving 16 oil companies (‘LASTFIRE’) which reviewed the fire related risks of large atmospheric storage tanks, he has assisted in developing a methodology which allows site-specific quantification of the potential reduction in risk that can be achieved with different risk mitigation options.

Typical project involvement includes:-

- Development / delivery of training
- Fire protection reviews
- Risk Assessment, fire modelling and fire science
- Fire protection system witness testing
- Building protection
- System training
- HAZOPS
**Other in-house and associated consultants**

**Richard Johnstone Systems Engineer**

Richard Johnstone has over 25 years experience in electrical design, detection and alarms systems for commercial and industrial installations. His career includes working as a Design Engineer for international fire protection/detection system suppliers prior to joining Resource Protection International. His responsibilities include design, specification preparation, testing and commissioning of fire and gas detection/alarm systems and active fire protection systems. He is also a qualified Breathing Apparatus maintenance engineer.

Typical project involvement includes:

- Design and commissioning of fire/gas detection systems
- Preparation of detail systems drawings on Autocad
- Preparation of Operating and Maintenance Manuals
- Factory inspection/witness testing.
- BA Maintenance and Inspection

**Jeremy Minahan Emergency Response Specialist**

Jeremy has worked in the Fire and Safety sectors of high hazard industries culminating in leading the Fire Department at a refinery of a major international oil company. Prior to this he worked in specialist training roles developing and presenting packages and competency assessment tools for Occupational Health and Safety. Thus he has unique expertise bringing together extensive Emergency Response experience with the day to day Operational aspects of running and managing a Professional Industrial Fire Department. He holds formal qualifications in Fire fighting, Fire Technology, Fire Science, Training and Emergency Communications.

Typical project involvement includes:

- Fire and Emergency Response Philosophy Development
- Site Audits
- Portable/mobile equipment specification
- Scenario based incident analysis
- Incident Pre-planning and Response
- Fire Risk Assessment
- Training Delivery/Development
- Fire Instructor

**Luke Haines Project Design Engineer**

With Resource Protection International Luke Haines is involved in the design, testing and commissioning of passive fire protection and detection systems to International Standards. Luke is also heavily involved in implementing site specific FSIA procedures for passive fire protection and detection equipment. He has carried out on-site systems training and system assurance testing including full systems discharge and flow verification measurement at several international hydrocarbon processing and storage facilities.

Typical project involvement includes:

- Fire protection system design and specification
- Fire/safety systems O & M manuals,
- Fire protection systems testing/verification
- Foam system/foam concentrate testing
- Fire protection systems training
- Fire protection maintenance training
- Fire pump testing
- Onsite servicing and maintenance of fire system components
- Fire water system flow verification
Robert Joel **Project Design Engineer**

Robert Joel is a Project Engineer / Systems’ Designer with Resource Protection International, designing fire detection and protection systems.

Typical project involvement includes:-

- Autocad work
- Hydraulic Analysis
- Fire protection system design and specification
- Fire/safety systems O & M manuals
- Fire protection systems testing/verification
- Foam system/foam concentrate testing
- Fire protection systems training
- Fire protection maintenance training
- Fire pump testing
- Onsite servicing and maintenance of fire system components
- Fire water system flow verification

Fred Tucker

Fred Tucker has worked in the oil industry for over 25 years, initially with design contractors, then, for more than 11 years, with a major oil company at their refineries in Africa and the Middle East. As a senior project engineer he was responsible for handling the mechanical design for improvement and replacement in process units and storage tank areas. For more than 10 years he has specialised in the design and specification of fire protection systems.

Typical project involvement includes:-

- Halon replacement studies
- Offshore fire protection reviews
- Scenario based fire protection reviews
- Fire vehicle specifications and witness testing
- Foam system witness testing
- Detail design of fire and gas detection/protection systems.
A full set of project references is included in this document. Additional detailed information is provided on a small selection of projects, in order to provide a more graphic demonstration of how Resource Protection International work with their clients on all aspects of Fire and Explosion Hazard Management not only to develop policies and procedures but also to facilitate implementation of them.

RPI have provided consultancy in the oil industry from Wellhead to Distribution
Project example 1

Scenario Based Fire Hazard Management Study For Major Far Eastern Oil Company

Resource Protection International was commissioned for an initial study of all company owned onshore facilities. Phase 1 was carried out by our firefighting and fire engineering consultants with the Fire Hazard Management technique of scenario worksheets serving as the foundation of the study. The resultant report included recommendations regarding enhanced Fire Hazard Management options.

RPI were then retained for input into Phase 2 where the company fire protection philosophy was developed. As a result of the philosophy adopted in Phase 2 - that of a stand-alone mobile response - attention turned to fire brigade enhancement requirements.

Phase 3 therefore concentrated on the development of the brigade in terms of structure, manning, competencies and training. Further Phase 3 work involved RPI developing basic designs for a new fire station and a fire training facility as well as detailed design of an aircraft live fire simulator.

RPI was then retained for Phase 4 detailing fire vehicle specifications. This involved a fleet of 8 specialist industrial and aviation crash rescue vehicles. RPI prepared the specifications and assisted with the technical reviews of potential suppliers. Further testing, commissioning and training in the vehicles was carried out over a two year period by our project engineering, fire engineering and firefighting specialists.

As a result of the work on the fire vehicles, RPI was engaged for Phase 5 to prepare ambulance specifications.

Following this work, RPI was also requested to review offshore living quarters fire protection standards and prepare a comprehensive Fire Hazard Management specification for the facilities.

This initial study was part of Phase 6. RPI fire engineering, project engineering and fire systems design engineering consultants prepared the specifications which incorporated all aspects of Fire Hazard Management including procedural response issues as well as both passive and active mitigation measures.

Later Phase 6 work involved the development and delivery of offshore fire team member, fire team leader and self-contained breathing apparatus "search and rescue" training courses which our fire training personnel successfully produced and held for trainees. The final part of Phase 3, company personnel basic fire training was conducted at the same time as the offshore fire training.

RPI maintained a close working relationship with the client for the 4 years time scale of the project and took great satisfaction from the client’s recognition of RPI’s comprehensive expertise in several fields of Fire Hazard Management as witnessed by client’s willingness to continue with RPI consultancy services. Following the development work, RPI was retained for regular ongoing competency assessment of fire responders.

Key Aspects:

- SCENARIO BASED FEHM REVIEW
- FIRE SYSTEM SPECIFICATION
- FIRE VEHICLE SPECIFICATION
- FIRE BRIGADE RESOURCE SPECIFICATION
- FIRE TRAINING
- COMPETENCY ASSESSMENT
Scenario Based Fire Hazard Management Study For South American National Oil and Petrochemical Company

Resource Protection International was originally commissioned for an initial fire protection study of one of the smaller refineries operated by the state owned oil company. The scenario based study was carried out by our firefighting and fire engineering consultants which established a fire protection philosophy and identified areas for improvement. RPI were then requested to develop enhancements to the fire brigade and emergency planning. This second phase concentrated on the development of the fire brigade re-organisation in terms of structure, manning levels and job competencies. It also included a study of existing emergency plans and procedures and methods to improve the overall response. To further complement the Fire Brigade a live fire training ground design was developed and specifications for the purchase of new fire vehicles and portable equipment were produced. Acceptance tests of the fire vehicles at the supplier’s works were also undertaken.

Subsequently, RPI were contracted to provide a scenario based study of the country’s major oil refinery and petrochemical complex operated by the company. This produced a series of recommendations and lead to additional studies that included:

- a] Hydraulic analysis of the firewater network
- b] HAZOP study and fire protection analysis for a new FCC unit
- c] Fire incident investigations
- d] Basic engineering for detection and protection systems.
- e] Development of a Fire Hazard Management Philosophy

The next phase of the work was for the oil distribution department, which operates the oil pipeline and pumping stations for distribution of petroleum products and propane throughout the country. A scenario based fire protection study and analysis of fire response capability was undertaken at 30 sites ranging from single pump stations to large crude and propane storage stations, some with marine loading facilities. During the study fire incident investigations were carried out at incidents on three sites. The next phases of this work led to the development of fire protection guidelines and recommendations for improvements to detection and protection systems.

Key Aspects:

- SCENARIO BASED FEHM REVIEW
- FIRE SYSTEM SPECIFICATION
- FIRE INCIDENT INVESTIGATIONS
- HAZOP REVIEWS
- HYDRAULIC ANALYSIS
- FIRE BRIGADE RESTRUCTURE
- FIRE VEHICLE SPECIFICATIONS
Major Service Agreement Based Contract With European Oil Exploration Company

Resource Protection International have a service agreement ‘call off’ contract to provide consultancy services to the corporate headquarters of a European based international oil exploration company for all aspects of Fire and Explosion Hazard Management studies associated with onshore and offshore installations.

The onshore projects have involved the RPI firefighting and fire engineering consultants in studies for a crude oil/gas process plant, crude oil gathering station and LPG rail loading facility and crude oil sea terminal. The studies included quantification and fire modelling of credible fire scenarios and preparation of pre-fire plans for emergency response.

The offshore projects have involved the RPI firefighting and fire engineering consultants in studies of fixed foam systems to assess their performance and suitability and reviews of the criticality of halon systems with recommendations for replacement with alternative agents. An analysis of the fire protection requirements for living quarters was carried out on several platforms with recommendations for improvements on materials, operation of existing fire protection systems and the provision of additional systems. The RPI firefighting consultants also produced guidelines for firefighting equipment and protective clothing on helidecks as well as preparing detailed purchasing specifications and procedures for firefighting foam concentrates for use in helicopter incidents.

Key Aspects:

- FIRE AND EXPLOSION HAZARD MANAGEMENT
- SCENARIO BASED FIRE MODELLING AND QUANTIFICATION
- FIRE PROTECTION ANALYSIS OF OFFSHORE LIVING QUARTERS AND DIVING SUPPORT VESSEL
- STUDY OF OFFSHORE FOAM AND HALON SYSTEMS
- HELIDECK FIREFIGHTING GUIDELINES AND FOAM SYSTEM TESTING
- FOAM CONCENTRATE PURCHASING SPECIFICATIONS
Project example 4

Fire Brigade Management

Shell Gabon, an operating unit of Shell International Exploration and Production, recognised the need for an integrated approach to FEHM. Having had poor service from a manpower service agency, Shell Gabon awarded Resource Protection International a contract to provide and manage a Fire Department and integrate the maintenance and inspection of fire detection and protection systems into the package.

**Scope of Contract**

- Provision of Station Officers
- Provision of Fire Crews
  - Maintenance of Breathing Apparatus
  - Maintenance of Extinguishers
- Development of Fire Training Ground
  - Fire Training
- Foam System Maintenance
- Detection Systems Inspection and Maintenance
  - Fire Vehicle Maintenance
  - Equipment Procurement

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**Main Operating Areas**
**With Fire Brigade Cover**

- Gabon
- Gamba
- Rabi
Project example 5

LASTFIRE Project

On behalf of a consortium of 16 oil companies, RPI carried out a project to review the risks associated with large diameter (greater than 40m) open-top floating roof storage tanks. The project was known as the LASTFIRE project. (Large Atmospheric Storage Tanks).

The project was initiated due to the oil and petrochemical industries’ recognition that the fire hazards associated with large diameter, open top floating roof tanks were insufficiently understood to be able to develop fully justified site-specific fire response and risk reduction policies.

A true Fire Hazard Management (FHM) approach to reducing the fire associated risk to as low as is reasonably practicable was adopted during the project. This is in line with current regulatory trends towards preparation of “Safety Cases” whereby all aspects of risk mitigation including incident prevention are reviewed.

Under the direction of RPI, a Working Group comprising RPI, BP, and Shell worked closely with the project sponsors to investigate these risks and to disseminate the findings of the review in the form of a comprehensive 300-page document comprising the following parts:

- Incident Frequency Survey
- Review of Escalation Mechanisms
- Risk Reduction Options
- Review of Foam Properties
- Risk Workbook
- Lightning Issues Review

The LASTFIRE Project provided an independent and comprehensive assessment of fire-related risk in large, open-top floating roof storage tanks resulting in a methodology by which site-specific Fire Hazard Management policies can be developed and implemented. It therefore represents a major advance in the knowledge of this risk.

Project Working Group

- AGIP
- BP
- Conoco
- DEA
- ELF
- Exxon
- MOL
- Mobil
- OMV
- Petrofina
- Repsol
- Saudi Aramco
- Shell
- Total
- Veba
- W.R.G.
Training and seminars

Resource Protection International carry their consultancy work right through to implementation. This includes hands-on training of operators to use the equipment and systems correctly and the development of specialist courses as required.

In addition, Resource Protection International run seminars, at worldwide locations, on many topics related to Fire and Explosion Hazard Management of oil and petrochemical facilities. These can also be held in-house and tailored to meet specific customer requirements.

Courses are also run on behalf of the UK based but internationally recognised Loss Prevention Council on Sprinkler Systems, Automatic Fire and Gas Detection Systems, Special Hazards Fire Hazard Management, etc.

Resource Protection International also develop and market CD based training packages.

A selection of RPI CD-ROM training packages is shown above. Titles currently available include:

- Risk Assessment Techniques
- Foam Concentrate and Foam System Testing
- Forum for Fire Hazard Management and Firefighting in the Oil, Gas and Chemical Industries 1999
- LASTFIRE Project Findings
- LASTFIRE Risk Workbook
- Recommended Practice For Fire Protective Clothing for BP Personnel (A package developed for BP but now made available by BP to other companies)

In addition, Resource Protection International has produced training videos, amongst which is the highly informative ‘Fighting Floating Roof Tank Rimseal Fires’. This film, made by firefighters for firefighters, contains appropriate response strategies for rimseal fire scenarios and is an ideal supplement to the LASTFIRE project.
Typical Hands-on training

- Basic Firefighters
- Fire Team Leader
- B.A. User
- Use of Hydraulic Rescue Equipment
- Use of Foam Systems
- Testing Foam Systems
- Storage Tank Fire Fighting

Typical Seminars

- Fire and Explosion Hazard Management of Oil, Petrochemical and other High Risk Industries
- Fire Fighting Foam and Foam Systems
- Vehicle Road Accident Casualty Extrication
- Testing Foam and Waterspray Systems
- Fire and Gas Detection Systems
- Smoke Control Systems
- Gaseous Extinguishing Agents - System Design and Testing
- Foam System Selection and Design Criteria
- Replacement and Alternatives for Fixed Fire Suppression Systems and Portable Equipment
- Preventing Explosions and Major Fire Hazards
- Emergency Preparedness Strategies
- Fire Hazard Management of Flammable Liquid Storage Tanks
- HAZOP and HAZAN Studies
- Risk Analysis Techniques
- Preplanning for Major Incidents

The Forum for Fire Hazard Management in the Oil, Gas and Chemical Industries 1999, held at the Fire Service College in the UK is a good example of the type of seminars and conferences that RPI can offer. The event was a success, attended by delegates from over 20 countries around the world – all with one aim – to learn about the latest developments in Fire and Explosion Hazard Management. All lecturers on the 1999 Forum were either acknowledged independent experts in their field, firefighters, or speakers from oil and chemical companies - each with valuable lessons learnt and new technologies or systems to discuss. (A selection, but not all, of typical lectures is shown below.)

An important feature of the event was that the proceedings were not influenced by suppliers (who had an opportunity, separate from the Forum sessions, to demonstrate their latest equipment).

Delegates also had the opportunity to attend two Workshops ‘Specifying and Testing Foam Systems’ and ‘Risk Assessment Techniques’, CD ROM training packages including guidance and proformas to facilitate record keeping were provided to delegates as a permanent training and operational aid.

- Developments In Fire Detection
- Fire and Explosion Modelling - An Overview of Techniques, Application and Accuracy
- FOAMSPEX - Large Scale Foam Application - Modelling of Foam Spread and Extinguishment
- Full-Circumference Rim-Seal Fire Case Study
- Full Surface Fixed System Application to Large Floating Roof Storage Tanks
- Pre Incident Planning For the Oil, Gas and Chemical Industries
- Incident Report / Lessons Learnt – Full Surface Fires, Singapore Refining Co. October 1988
- The Regulators View of Risk Based Legislation For Major Hazard Sites
- LASTFIRE – Large Atmospheric Storage Tank Fires
- Contracting Out a Petrochemical Fire Brigade
FORUM FOR

FIRE HAZARD MANAGEMENT AND FIRE-FIGHTING IN THE OIL, GAS AND CHEMICAL INDUSTRIES

JUNE 15th, 16th and 17th 1999
Organised by Resource Protection International and Publishing and Exhibition Services

CONFERENCE THEME
The benefit of close co-operation between risk analysts, process engineers, fire system engineers and firefighters is now clearly recognised as a major contributor to good Fire Hazard Management.

With an emphasis on practical issues this conference provides an opportunity for personnel responsible for any aspect of Fire Hazard Management at oil and chemical handling facilities to update on the latest techniques for assessing and reducing risk. The forum is not influenced by suppliers. All lecturers come from oil and chemical companies or are acknowledged independent experts in their field. Delegates will hear the lessons learnt from actual incidents - from the people who had to handle them and from the application of new technology and systems - from the people who have had to use them. (Suppliers will have an opportunity, separate from the forum sessions, to demonstrate their latest equipment.)

There will also be two 1/2 day workshops on 14th June and 18th June, with the themes "Specifying and Testing Foam Systems" on the Monday and "Risk Assessment Techniques" on the Friday.

SUPPORTING ORGANISATIONS
The Fire Protection Association (FPA)
Joint Oil and Industry Fire Forum (JOIFF)
I. Chem. E. Safety and Loss Prevention Subject Group

LECTURE CONTRIBUTIONS FROM
BP - Elf - HSE - OMV
Mobil - MOL - Nerefco - Sunoco
Shell - Texaco

THE VENUE
The Fire Service College
Moreton-in-Marsh, Gloucestershire, UK

The Fire Service College provides excellent conference facilities and accommodation. It also provides the opportunity to stage practical demonstrations and scenarios of equipment in their petrochemical fire training complex.

The college is situated in the Cotswolds, one of the most beautiful parts of England.

Resource Protection International organise and run international forums on FEHM subjects.
The following is a selection of projects where Resource Protection International has supplied consultancy services.

**ONSHORE – OIL/CHEMICAL INDUSTRIES**

**Shell, S.I.P.M.**  
In-house seminar on fire fighting systems and fire protection analysis for safety engineers from worldwide locations.

**Continental Engineering, Netherlands**  
Military aircraft hangar fire protection system design for Middle East client. (Royal Saudi Air Force).

**Shell, S.I.P.M.**  
Completion of Safe Handling of Chemicals (SHOC) cards.

**Loss Prevention Council, U.K.**  
Consultancy on fire fighting foam testing.

**Getty Oil, Kuwait**  
Acceptance testing of fire vehicles.

**Azzawiya Refinery Co., Libya**  
Site inspection, loss prevention philosophy study and contingency plan preparation for refinery.

**Agoco, Libya**  
Project engineering of firewater system upgrade.

**Saudi Civil Defence**  
Major Incident Control investigation and Emergency Response capability evaluation for refineries.

**Mobil Oil, U.K.**  
Survey of onshore Halon systems and proposals for alternative protection methods.

**Arco, U.K.**  
Literature search for data on waterspray application rates for different fire scenarios.

**Shell, Egypt**  
Fire protection audit of oil production facility.

**Zadco, Abu Dhabi**  
Analysis of firewater and foam protection systems for oil storage and processing facility.

**Mobil Oil, U.K.**  
Review of fire fighting vehicle specifications for oil terminal.

**Shell, Brunei**  
Preparation of fire protection philosophy for oil export terminal, production facilities, refinery, offices, warehouses and housing. Analysis method included preparation of fire scenarios for each facility and assessment of fire protection/fire fighting equipment requirements.

**Shell, U.K.**  
Marine loading terminal fire protection system philosophy preparation.

**Hocol, Colombia**  
Fire protection analysis and HAZOP of onshore production stations.

**BP, Switzerland**  
Crisis management exercise for storage facility major fire incident.

**Shell Marketing, Middle East Oman**  
Assessment of fire protection systems at distribution depot.

**Petroleum Development, Oman**  
Fire/explosion protection audit of terminal and production facilities.

**Esso, U.K.**  
Review of fire protection and fire fighting arrangement at distribution depot.

**Shell, Brunei**  
Detailed specification of industrial and municipal fire vehicle fleet.
<table>
<thead>
<tr>
<th>Company</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell, Brunei</td>
<td>Development of structure, training requirements and training programme for Industrial Fire Department.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Fire protection analysis of refinery, terminals and jetties (LPG and flammable liquids).</td>
</tr>
<tr>
<td>BP Chemicals, U.K.</td>
<td>Emergency response organisation and planning review.</td>
</tr>
<tr>
<td>Seychelles Petroleum</td>
<td>Specification of fire protection systems for distribution depot and marine terminal from scenario based analysis.</td>
</tr>
<tr>
<td>BP Aviation</td>
<td>Evaluation of fire emergency response capability of aviation fuel depot at major international airport.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Hydraulic analysis of refinery and terminal firewater ring main.</td>
</tr>
<tr>
<td>Shell, Brunei</td>
<td>Preparation and provision of an &quot;Offshore Fire Fighting&quot; training course and masterfile.</td>
</tr>
<tr>
<td>Shell, Brunei</td>
<td>Preparation and provision of a &quot;BA for Search and Rescue&quot; training course and masterfile.</td>
</tr>
<tr>
<td>BP, Middle East Oman</td>
<td>Fire protection and Emergency Response audit of hydrocarbon product distribution depot.</td>
</tr>
<tr>
<td>BP, Middle East, U.A.E.</td>
<td>Fire protection and Emergency Response audit of hydrocarbon product distribution depots and marine loading facility.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>HAZOP study of new Fluidised Catalytic Cracker (FCC) unit at final design stage with process licensor and project contractor.</td>
</tr>
<tr>
<td>BP Chemicals, U.S.A.</td>
<td>Review of fire protection systems fire response capability at petrochemical process and storage facility.</td>
</tr>
<tr>
<td>BP Refinery, U.S.A.</td>
<td>Fire protection and Emergency Response audit of refinery.</td>
</tr>
<tr>
<td>Seychelles Petroleum</td>
<td>Fire protection system design for airport fuel storage and distribution depot.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Design of fire training ground for refinery fire brigade use.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Development of new fire brigade structure, including responsibilities and job descriptions for refinery Fire Brigade.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Detailed specification and bid evaluation of fire fighting vehicles for refinery usage.</td>
</tr>
<tr>
<td>S.I.P.M., Netherlands</td>
<td>Development of new code of practice for fire fighting operations at exploration and production facilities.</td>
</tr>
<tr>
<td>S.I.P.M., Netherlands</td>
<td>Review and modification of new design code of practice for fire fighting vehicles.</td>
</tr>
<tr>
<td>BP Oil, U.K.</td>
<td>Independent evaluation of foam concentrate samples.</td>
</tr>
<tr>
<td>S.I.P.M., Netherlands</td>
<td>Review of fire detection systems for inclusion in company code of practice.</td>
</tr>
</tbody>
</table>
BP Chemicals, Belgium
Audit of fire response capability and Fire Hazard Management policy at petrochemical plant.

BP Oil, U.K.
Audit of fire response capability and Fire Hazard Management policy at refinery.

BP U.K.
Preparation of Fire Response Preplanning Workbook for international use at all types of BP installations. (Production Stations, Offshore Platforms, Storage Depots, Refineries, Distribution Depots and Petrochemical Plants.)

Shell, Brunei
Design, specification and provision of fabrication drawings for helicopter crash fire simulator training module.

S.I.P.M., Netherlands
Preparation of lecture material for in-house presentations on Introduction to Fire Protection; Hazard Management Procedures; High Sensitivity Smoke Detection; Halon Recovery, Recycling and Banking; Replacement Gaseous Extinguishants; Alternatives to Extinguishing Agents; Storage Tank Fire Extinguishing Systems; Turbine and Enclosed Space Protection; Special Risks.

Shell, Nigeria
Health, Safety and Environment Audit of Headquarters office building complex.

Unocal, Thailand
Preparation of policy for isolation and marking of energy sources as part of International Safety Rating System audit review.

Fluor Daniel, Netherlands
Fire Hazard Management review and Fire Protection Analysis of underground gas storage reservoir and associated production and injection facilities.

Lindsey Oil Refinery, U.K.
In-house seminar on fire protection systems.

EGPC, U.A.E.
Specification of fire protection systems at tank farm and marine loading facility including hydraulic analysis of fire water system.

Shell, Nigeria
Technical Fire Audit of Administration and Support facilities.

Shell, Nigeria
In-house fire protection training seminars for operating divisions. (Hazard Management Process, Fire and Gas Detection, Passive Protection, Active Protection Systems.)

Shell, Brunei
Fire vehicle pre-build meeting at supplier facilities to finalise detailed specifications and define quality control procedures and tests.

Nerefco, Netherlands
Fire/Emergency Response Capability study of refinery and associated hazards.

BP Distribution, Switzerland
Fire/Emergency Response Capability Study and Emergency Exercises for distribution depot.

NAM, Netherlands
In-house Fire Protection Training Seminars (see Shell Nigeria above for subject matters).

NAM, Netherlands
Fire Protection Analysis of gas production facilities.

Ecopetrol, Colombia
Fire vehicle pre-build and final inspection meetings at supplier facilities to finalise detailed specifications and define quality control procedures and tests.

SIPM, Netherlands
Provision of fire protection consultancy services on call-off basis.

Shell, Thailand
In-house fire protection training seminars (see Shell Nigeria above for subject matter).

Shell, Sarawak
In-house fire protection training seminars (see Shell Nigeria above for subject matter).
<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell, Brunei</td>
<td>Fire investigation of facility incident.</td>
</tr>
<tr>
<td>BP Oil, Grangemouth, U.K.</td>
<td>Scenario based fire risk assessment of oil terminal and preparation of fire response pre-plans.</td>
</tr>
<tr>
<td>Lindsey Oil Refinery, U.K.</td>
<td>Scenario based review of crude and refined spirit tankage.</td>
</tr>
<tr>
<td>Shell, Gabon</td>
<td>General consultancy services and development of operation and maintenance dossiers on all safety related equipment.</td>
</tr>
<tr>
<td>BP Gas, U.K.</td>
<td>Fire protection audit of LPG handling facility.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Investigation of fire incident at main oil line pumping station.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Process safety study and HAZOP review of process plant at refinery.</td>
</tr>
<tr>
<td>NAM, Netherlands</td>
<td>Hazard analysis for Safety Case of flammable liquid storage and transport facility.</td>
</tr>
<tr>
<td>BP Distribution, U.K.</td>
<td>Fire protection review of styrene storage tanks.</td>
</tr>
<tr>
<td>Shell Gabon</td>
<td>Scenario based review of Emergency Response resources for oil production and export terminals.</td>
</tr>
<tr>
<td>Shell Gabon</td>
<td>Specification of fire vehicles for onshore terminal.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>Review of fire response resources for pipeline pumping stations.</td>
</tr>
<tr>
<td>BP Oil, UK</td>
<td>Distribution depot audits.</td>
</tr>
<tr>
<td>Consortium RFM, Colombia</td>
<td>Refinery fire detection and foam system design.</td>
</tr>
<tr>
<td>Ecopetrol, Colombia</td>
<td>HAZOP of LPG facility at refinery.</td>
</tr>
<tr>
<td>BP Exploration, UK</td>
<td>Wyth Farm Production Facilities – Scenario evaluation preparation and FHM study emergency response plan.</td>
</tr>
<tr>
<td>BP Oil, UK</td>
<td>Review of Fire Protection Facilities at Belfast Distribution Depot and Jetty.</td>
</tr>
<tr>
<td>Canadian Occidental, Yemen</td>
<td>Site review of fire protection facilities for crude processing plant.</td>
</tr>
<tr>
<td></td>
<td>Preparation of O &amp; M manuals for systems.</td>
</tr>
<tr>
<td>Shell Troll, Norway</td>
<td>Review of adequacy of Fire Water System for onshore gas handling terminal.</td>
</tr>
<tr>
<td>Ecopetrol CIB, Colombia</td>
<td>Risk Analysis study of polyethylene storage.</td>
</tr>
<tr>
<td>Ecopetrol CIB, Colombia</td>
<td>Development of FHM philosophy document for refinery and storage facilities.</td>
</tr>
<tr>
<td>Mobil, UK</td>
<td>Bulk Terminal FHM review.</td>
</tr>
<tr>
<td>BP Sunbury, UK</td>
<td>Refinery firewater system upgrade review.</td>
</tr>
<tr>
<td>Ecopetrol DOL, Colombia</td>
<td>Development of Fire Hazard Management policy document for pipeline and pumping stations.</td>
</tr>
<tr>
<td>Organization</td>
<td>Services/Project Description</td>
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</tr>
<tr>
<td>SODM, Denmark</td>
<td>Fire response preplanning workshop.</td>
</tr>
<tr>
<td>Costain, UK</td>
<td>Consultancy services for QGPC – Fire protection of crude oil storage tanks.</td>
</tr>
<tr>
<td>Foster Wheeler/BPOGRL, UK</td>
<td>Review of FHM of Kinneil MOL pumps.</td>
</tr>
<tr>
<td>EQE International, Malaysia</td>
<td>Hydraulic analysis of firewater system for LPG Plant, Singapore.</td>
</tr>
<tr>
<td>BP Grangemouth, UK</td>
<td>Oil and Gas Jetties FHM review and development of pre-fire plans.</td>
</tr>
<tr>
<td>PDO, Oman</td>
<td>Fire protection study of crude handling facilities and development of risk based Fire and Explosion Strategy.</td>
</tr>
<tr>
<td>Ecopetrol CIB, Colombia</td>
<td>Preparation of basic engineering drawings, specifications and equipment data sheets for fire detection and protection of petrochemical refineries and storage plants.</td>
</tr>
<tr>
<td>BP Chemicals, UK</td>
<td>Development of fire scenarios and pre-fire plans at major chemical facility.</td>
</tr>
<tr>
<td>Arabian Ind. Fiber Co. Ltd</td>
<td>PTA and Aromatics Project – FHM Consultancy to review turnkey design.</td>
</tr>
<tr>
<td>Petronas Carigali, Malaysia</td>
<td>Fire protection review of Crude Oil Terminal.</td>
</tr>
<tr>
<td>Mott MacDonald, UK</td>
<td>HAZID/FIREPRAN for SPDC Nigeria gas plant.</td>
</tr>
<tr>
<td>BP Dalmeny, UK</td>
<td>Fire protection studies of onshore crude oil reception facility.</td>
</tr>
<tr>
<td>Technipetrol, Italy</td>
<td>HAZOP Study for FCCU at Ecopetrol Colombia.</td>
</tr>
<tr>
<td>BP, UK</td>
<td>Preparation of FHM guidance note for polyethylene pellet warehouses.</td>
</tr>
<tr>
<td>Canoxy, Yemen</td>
<td>CPF Foam System Improvements – conceptual design and preparation of drawings, specifications and purchase requirements.</td>
</tr>
<tr>
<td>Shell, Gabon</td>
<td>Review of critical communications facilities - design and installation of incipient fire detection and inert gas suppression systems.</td>
</tr>
<tr>
<td>SIEP, The Netherlands</td>
<td>Review of engineering standard for fire pumps.</td>
</tr>
<tr>
<td>PDO, Oman</td>
<td>Fire systems review of upstream LNG facilities.</td>
</tr>
<tr>
<td>BP Bitumen, UK</td>
<td>Fire incident investigation.</td>
</tr>
<tr>
<td>PT Penni/BPC</td>
<td>On site review of fire response equipment at polyethylene plant.</td>
</tr>
<tr>
<td>PDO, Oman</td>
<td>Fire and Explosion Risk Management Facility Plans – Scenario based review of crude oil facilities to determine fire and explosion strategy. Preparation of pre-fire plans and fire responder capabilities.</td>
</tr>
<tr>
<td>Asco Oil, UK</td>
<td>Fire Risk Assessment and Audit of storage tank terminal, road tanker gantry and quayside vessel unloading/loading facilities.</td>
</tr>
<tr>
<td>LASTFIRE Group</td>
<td>Development of foam test standard for storage tank application.</td>
</tr>
<tr>
<td>BP International, UK</td>
<td>Fire Risk Assessment of Computer Rooms.</td>
</tr>
<tr>
<td>Shell, Brunei</td>
<td>Fire Brigade competency standards development.</td>
</tr>
<tr>
<td>BP, Sunbury, UK</td>
<td>Development of CD based guidance document on personal protective clothing.</td>
</tr>
<tr>
<td>Company</td>
<td>Project Details</td>
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<tr>
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</tr>
<tr>
<td>Elf, UK</td>
<td>Development and management of Emergency Exercises at refinery and corporate Head Office.</td>
</tr>
<tr>
<td>Distral, Colombia</td>
<td>HAZOP Studies for new alkylation plant.</td>
</tr>
<tr>
<td>BP Chemicals, Grangemouth, UK</td>
<td>Ethylene plant FHM review.</td>
</tr>
<tr>
<td>Ecopetrol CIB, Colombia</td>
<td>HAZOP study for aromatics complex project.</td>
</tr>
<tr>
<td>ABB, Colombia</td>
<td>HAZOP Study for refinery process units.</td>
</tr>
<tr>
<td>SIEP, The Netherlands</td>
<td>Nigeria Bonny Terminal FIREPRAN to determine hazards and fire response requirements.</td>
</tr>
<tr>
<td>Siemens, Mexico</td>
<td>Review of Risk Analysis for Caderayta refinery project.</td>
</tr>
<tr>
<td>Shell Temir, Kazakhstan</td>
<td>Fire fighting audit of well site, storage facilities camp and offices.</td>
</tr>
<tr>
<td>Enron, Teeside, UK</td>
<td>Emergency response assessment of private emergency response group for petrochemical complex.</td>
</tr>
<tr>
<td>Canoxy, Yemen</td>
<td>Fire protection improvements specification for Power Generation Building.</td>
</tr>
<tr>
<td>SPDC, Nigeria</td>
<td>Development of Emergency Response Package for fire incidents</td>
</tr>
<tr>
<td>BP Amoco, Trinidad</td>
<td>Specifications for fire protection upgrades and development and delivery of site specific tank FEHM Workshop and Firefighting exercises.</td>
</tr>
</tbody>
</table>
OFFSHORE

Shell Expro, U.K.  Reliability study of fire protection systems on offshore production facility.

Petrofina, U.K.  Fire systems audit of offshore drilling rig.

Conoco  Feasibility study of foam systems for offshore production platform production.

Offshore Petroleum Institute Training Board, U.K.  In-house seminar on foam and foam equipment.

Mobil Oil North Sea, U.K.  Offshore survey of Halon systems proposals for alternative protection methods.


Conoco, U.K.  Fire system survey and scenario based system philosophy development for offshore gas platform, Southern Northern Sea, involving waterspray, foam, gaseous extinguishing agents, fire pumps, detection and sprinkler systems.

Unocal, Thailand  Fire/explosion protection system philosophy for floating storage facility.

BP Exploration, U.K.  Study of Halon protected areas including assessment of system effectiveness. Study also includes categorisation of essential and non-essential uses of Halon in line with BP and UKOOA guidelines. (Also to be used as part of Safety Case preparation.)

Mobil North Sea, U.K.  Assessment of sprinkler/deluge systems for drilling rig of offshore production platform.

NAM, Netherlands  Fire/explosion protection review for offshore production and accommodation platforms. (Part of Safety Case preparation).

Shell, Brunei  Preparation of specifications for offshore platform accommodation areas.


Mobil North Sea, U.K.  Development of performance specifications including personnel safety measures for CO₂ and foam fire protection systems for offshore switchgear room, turbine packages, emergency generators and crude export pump enclosures.

Ecopetrol, Colombia  Scenario based fire protection and emergency response analysis of Sea Island loading facility.

BP Exploration, U.K.  Scenario based analysis of fire protection measures and fire fighting response capability for living quarters of offshore platform. (Study included smoke migration effects, emergency lighting, active systems, personnel response, portable equipment, passive fire protection measures, etc.)

BP Exploration, U.K.  Preparation of guidelines and specifications for offshore helideck fire fighting equipment and personnel protective clothing.
<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom Offshore</td>
<td>Development of design guidelines for fire protection systems on offshore platforms.</td>
</tr>
<tr>
<td>Operators Association</td>
<td></td>
</tr>
<tr>
<td>BP Exploration, Norway</td>
<td>Fire protection systems and fire response capability audit of offshore production platform.</td>
</tr>
<tr>
<td>BP Exploration, U.K.</td>
<td>Scenario based analysis of fire protection measures in accommodation areas of offshore support vessel.</td>
</tr>
<tr>
<td>Shell Expro, U.K.</td>
<td>Development of new &quot;Goal Setting Objectives&quot; style standard for offshore waterspray and other water based systems.</td>
</tr>
<tr>
<td>Shell Expro, U.K.</td>
<td>Investigation and review of fine mist waterspray technology and its application to offshore hazards.</td>
</tr>
<tr>
<td>Unocal, Thailand</td>
<td>Scenario based assessment of Fire Hazard Management policy for offshore Gas Production complexes.</td>
</tr>
<tr>
<td>BP Exploration, U.K.</td>
<td>Risk assessment and review of deluge system design and operation on production platform.</td>
</tr>
<tr>
<td>AGIP, U.K.</td>
<td>Provision of process safety and fire protection consultant for offshore production platform.</td>
</tr>
<tr>
<td>Elf Enterprise, U.K.</td>
<td>Review of fire protection systems for crude process areas on offshore platform.</td>
</tr>
<tr>
<td>BP Exploration, U.K.</td>
<td>Development of alternative protection policy to Halon systems for offshore production platform.</td>
</tr>
<tr>
<td>BP Exploration, UK</td>
<td>Buchan Alpha platform – On site review of mini-deluge systems to assess role and performance of existing systems.</td>
</tr>
<tr>
<td>BP Exploration, UK</td>
<td>On site assessment of Halon protected areas.</td>
</tr>
<tr>
<td>Shell Expro, UK</td>
<td>Development of a new Firewater design standard document.</td>
</tr>
<tr>
<td>Shell Expro, UK</td>
<td>Witnessing of trials of Water Mist Systems for turbine enclosures.</td>
</tr>
<tr>
<td>Shell, Venezuela</td>
<td>FIREPRAN and F &amp; G Philosophy review of offshore facilities.</td>
</tr>
<tr>
<td>BP Forties, UK</td>
<td>Foam concentrate fire performance tests.</td>
</tr>
<tr>
<td>BP Forties, UK</td>
<td>Review of helideck foam systems and foam concentrate purchasing specifications.</td>
</tr>
<tr>
<td>Shell, Venezuela</td>
<td>Development of pre-fire plan for offshore platform and onshore dehydration facilities.</td>
</tr>
<tr>
<td>BP Exploration, UK</td>
<td>Halon replacement study for offshore platforms.</td>
</tr>
<tr>
<td>Mossgas, S.A.</td>
<td>Halon Phase-Out review for offshore facilities.</td>
</tr>
<tr>
<td>Zadco, U.A.E.</td>
<td>Halon Replacement Study for offshore platforms and islands.</td>
</tr>
<tr>
<td>BP/ETAP, UK</td>
<td>On site performance tests of helideck foam system.</td>
</tr>
<tr>
<td>Unocal, Thailand</td>
<td>Assessment of potential impact on control room and lifeboat stations from fire or gas release or explosion incidents.</td>
</tr>
<tr>
<td>SPDC/Mott MacDonald</td>
<td>FIREPRAN for Offshore Facilities in Nigeria.</td>
</tr>
<tr>
<td>BP Exploration – ETAP</td>
<td>Review of pneumatic detection systems.</td>
</tr>
<tr>
<td>BP, Venezuela</td>
<td>Fire hazard assessment of accommodation barge.</td>
</tr>
<tr>
<td>M.P. Girassol</td>
<td>Muster Integrity analysis for FPSO platform and loading buoy.</td>
</tr>
</tbody>
</table>
NON OIL/PETROCHEMICAL PROJECTS

Powergen, U.K. Fire protection systems audit of coal and oil loading jetties and terminals at power stations.


Akzo Coatings, U.K. Flammable liquid warehouse protection system design evaluation.

BBC Review of low pressure CO$_2$ system specifications for control rooms.

Reuters, Singapore Design of CO$_2$ system safety interlock mechanism.


Willis Corroon In-house seminar on foam systems.


The Snack Factory, UK Fire hazard survey of food processing plant.

Riyadh Cable Co, Saudi Arabia LPG vessel protection review.

Devonport Management Specification of inert gas systems for submarines.

British Library Review of inert gas protection systems for vaults and substations.

Golden Vale Food Products, UK FHM Review of food processing plant.

National Grid Co., UK Fire Hazard Management review of electrical distribution substations throughout UK.

Dublin Fire Brigade Assessment of fire protection facilities for Dublin Port.

National Engineering Laboratory, UK Fire Risk Assessment of Laboratories and Plant Rooms.

National Grid Co, UK Fire Tests on transformer oil to determine radiation levels and flame characteristics.

The BAT Co., UK Market Hall sprinkler system review.

Schlumberger, UK CO$_2$ System Review for seismic tape store.

Manx Electricity Authority, UK HAZARD management review of indoor substation.

Courtaulds, U.K. In-house seminar on foam enhancement of sprinkler systems.

CERN, Geneva Delivery of Flammable Gas Detection training.

MTM Agrochemicals Fire Hazard Management review.

OCTEL Fire Hazard Management review.

Fire and Explosion Hazard Management (FEHM)

The following extracts from a presentation given at an international oil and petrochemical safety conference illustrate the main concepts behind effective Fire and Explosion Hazard Management (FEHM):
A formalised approach to establish a SITE-SPECIFIC, RATIONALISED, RELEVANT and COST-EFFECTIVE policy to reduce potential fire and explosion consequences.

Why is it needed by the operator?

Fire and Explosion consequence reduction can be achieved in many ways:-

Fire prevention, fire detection, emergency shutdown, passive protection, active systems, salvage etc.

As every facility works in its own special environment, it is important to develop the optimum, cost-effective incident consequence reduction strategy/policy taking into account local conditions, the plant’s criticality and an incident’s potential effect on life safety, the environment, asset value, continued operations and company image.
Previously, fire protection practices used in high risk industries have been very prescriptive in approach and not based on the real needs of a particular facility. However, due to major incident experience, internationally recognised authorities such as NFPA (U.S.A.) and HSE (U.K.) have set a requirement for “goal setting” performance based standards within a “Safety Case”.

Consequently, it is now recommended that fire responders assess and justify requirements for cost effective fire protection resources based on credible major incident scenarios.
LEGISLATOR AND OPERATOR BOTH RISK BASED

NO CONFLICT!

HOWEVER!

Policies based on only meeting legislation are not necessarily appropriate or sufficient.
FIRE AND EXPLOSION HAZARD MANAGEMENT

**Legislator Concerns**
- Personnel Safety
- Societal Safety
- Environment
- National interests

**Additional Operator Concerns**
- Asset Loss
- Business Interruption
- Public image
The Solution: -

FIRE AND EXPLOSION HAZARD MANAGEMENT

Based on evaluation of credible scenarios

FIRE AND EXPLOSION HAZARD MANAGEMENT

Objective
To establish, in an auditable way, a formal, site-specific justified and cost effective fire and explosion damage mitigation policy appropriate to the criticality and overall needs of the facility

Methodology
Fire and Explosion Hazard Management using fire scenario analysis

Criticality factors
Life Safety
Environment
Continuity of Operations
Asset / Investment value
Public image
**FIRE AND EXPLOSION HAZARD MANAGEMENT**

*Identify fire hazards*

*Develop fire scenarios*

*Evaluate escalation consequences*

*Select scenarios for further analysis*

*Iterate*

*Develop provisional policy*

*Compare response options*

*Select cost-effective option*

*Finalise response policy / strategy*

*Provide response resources*

*Prepare to use resources*

*Test resources*

*Maintain resources*

*Review / update policy*

---

**FIRE AND EXPLOSION HAZARD MANAGEMENT**

- **Ignition Sources**
- **Hazardous Materials**
- **Incident Descriptions**

**Fire Scenario Analysis** → **Compare Risk Reduction Options** → **Define FHM Policy** → **Implement**

- **Evaluate Alternative Prevention, Protection & Mitigation Measures**
- **Formalisation Legislation**

- **Equipment Maintenance**
  - Preplanning
  - Exercises
  - Fire Training
  - Update

**POSSIBLE INPUT TOOLS**

- HAZOP
- QRA
- INCIDENT EXPERIENCE

- FIRE ENGINEERING
  - FIRE MODELLING
  - COST BENEFIT ANALYSIS

- DESIGN STANDARDS
- CODES OF PRACTICE
FEHM Scenario Based Review
Deliverables

Scenario Worksheets

Formalised, Cost-Effective and Justified Incident Response Policy

Pre-Fire Plans

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FIRE AND EXPLOSION HAZARD MANAGEMENT

Extreme cases :-

**Burndown Policy**
No damage mitigation measures.

**Total Protection**
Full automatic shutdown.
Comprehensive passive protection.
Sophisticated automatic fire and gas detection/protection systems.
Full portable/mobile equipment back-up.

In practice, most facilities will adopt a policy somewhere between the two extremes.
Contact details

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