MARSH

LOSS CONTROL NEWSLETTER

2012 – EDITION 1

LEADERSHIP, KNOWLEDGE, SOLUTIONS...WORLDWIDE.

MARSH & McLENNAN COMPANIES

CONTENTS

FOREWORD

These are certainly interesting times we are living in. Oil prices dropped more than 20 percent in the second quarter of 2012; this is the largest single three-month fall since the financial crisis began in 2008. Even the European Union and US sanctions on crude oil from Iran, issued on 1 July failed to have a significant impact on the fall. So where does that leave companies trying to assess their exposures? Ultimately, the key will be in knowing where your company's exposures lie and having comprehensive plans in place to mitigate them.

Marsh hopes that this edition of the Loss Control Newsletter will highlight some key lessons you can draw upon to help reduce the likelihood of major accidents within the industry. Unfortunately, as May's tragic incident at Bangkok Synthetics Co in Map Ta Phut illustrated, the industry has to keep reminding itself of the consequences of failing to sufficiently manage the risks it faces everyday.

As always, your comments are welcomed. Please contact us at LCN.editor@marsh.com.

INSIDE THIS ISSUE

In addition to the articles referenced below we also include, amongst other things, a summary of major and interesting incidents and losses that have occurred throughout the industry in recent months.

SAFETY NEWS FROM AROUND THE WORLD

Latest safety news.

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It has been some time since a single energy industry topic has attracted so much attention in the world's media, but shale gas has been doing just that over the last couple of years. The media has been filled with puns on "fracking", and documentaries claim environmental damage and flaming water taps all across shale gas operations in the United States. But what is the reality and why has this topic caused so much interest? Nigel Cairns, a Risk Engineer in Marsh's Energy Practice, provides feedback from a Shell-led workshop on fracking.

DO LUBE OIL FIRES REALLY HAPPEN?

Adrian Louis, one of our Dubai-based engineers, explores the phenomenon of lubricating oil fires within lube oil skids. Can they really occur when the oils are handled below their flash points?

AIR FRANCE FLIGHT 447 – LESSONS FOR THE ENERGY INDUSTRY

Chris Price-Kuehne, a Risk Engineer within Marsh's Energy Practice, provides some potential lessons from the Air France Flight 447 flying from Rio de Janeiro to Paris in 2009, which crashed into the Atlantic Ocean killing all passengers and crew; these lessons may also be applicable to those in the process industries.

CHIBA REFINERY

Paul Talbot, a Risk Engineer based in Marsh's London office, reviews the Chiba Refinery incident in Japan focusing on what lessons can be learned, particularly for Liquefied Petroleum Gas (LPG) installations in areas susceptible to natural catastrophes.

FROM THE ARCHIVES: HIGH-VOLTAGE POWER TRANSMISSION SYSTEMS AND PIPELINE RISKS

While oil, gas and product pipelines have their own operation-related risks, including those arising from mal-operation, poor design, corrosion initiated failure, excavation or even terrorism-related hazards in some parts of the world, those near to high-voltage (HV) power transmission facilities have their own unique risks which are often overlooked. This edition's archive item was written by Dick Barton, a Construction Risk Engineer within Marsh's Energy Practice, and assesses the hazards associated with HV power lines when designing and operating pipelines.

MARSH SHARING KNOWLEDGE IN ASIA

YueFeng Chen, leader of Marsh's Energy Practice's Global Energy Risk Engineering in Asia, was recently invited to represent the insurance profession at the Industry Process Safety Management session of the 14th Asia Pacific Confederation of Chemical Engineering (APCChE) Conference.

MARSH NEWS

The latest updates on Marsh's Energy team.

LOSS REPORT

A summary of incidents of interest from recent months.

SAFETY NEWS FROM AROUND THE WORLD

US: API AND JOINT INDUSTRY TASK FORCE RELEASE REPORTS ON OFFSHORE SAFETY CHANGES

In response to the Macondo Gulf of Mexico (GOM) incident, the US oil and natural gas industry launched a comprehensive review of offshore safety. Four Joint Industry Task Forces (JITFs) were assembled to focus on critical areas of GOM offshore activity. Whilst the JITFs were not involved in the review of the incident, their objective was to bring together industry experts to identify best practices in offshore drilling operations and oil spill response, with the definitive aim of enhancing safety and environmental protection.

The JITFs worked with, and continue to work with, the federal agencies involved in regulating offshore activities as they considered the GOM incident and potential changes in industry oversight. These federal agencies include the independent presidential commission (National Commission), the Chemical Safety Board (CSB), the National Academy of Engineering (NAE), members of Congress and others.

This builds upon previous task forces' recommendations to the Department of the Interior on industry operating procedures and equipment in 2010. Upon these recommendations several new API standards are being developed and revised in relation to blowout preventers (BOP) deepwater well design and cementing operations. Similarly, recommendations on the prevention and enhanced oil spill response have been made. More information can be found here.

COLOMBIA: HELICOPTER INCIDENT

Helicopter travel has its inherent hazards and there have been a number of incidents in recent years affecting those travelling offshore. However, for onshore downstream facilities the risk of an incident involving a helicopter is considered much lower. Despite this perception, there was a lucky escape earlier this year when a military helicopter made an emergency landing in a refinery in Barrancabermeja, Colombia. A rotor failure in the Colombian Air Force helicopter forced the pilot to make a crash landing and he managed to avoid process units and major flammable inventories by landing on a satellite control room. A small fire ensued and, whilst there were injuries, fortunately no fatalities occurred.

Whilst this is a rare event, it does raise the question "why would an aircraft need to be flying over industrial facilities?"

UK: ICHEME HAZARDS ARCHIVE

For more than fifty years, a series of symposia within the Institution of Chemical Engineers (IChemE) have been held to present the latest developments in loss prevention within the process industries. Previously, the papers from these conferences have been reserved for the members of the IChemE and those who subscribe. However, at the suggestion of the Safety and Loss Prevention Special Interest Group committee, papers more than five years old are being made available for free download. The archive includes articles with a multitude of topics such as inherently safer design, safety management systems, risk assessments and analyses, and the human behavioral aspects of safety in the process industry. More information and free downloads of the symposia up to Hazards 19 can be found here.

PROCESS INDUSTRIES' LOSS INCIDENTS

There is a multitude of internet sources for global loss incidents. One that has recently come to our attention is that of ASM, the Abnormal Situation Management Consortium, who are a group of companies and universities with an interest in the process industries. As part of their work to improve process safety awareness, they also report on the latest incidents within the process industries. Click here for more information.

CYBER SECURITY INCIDENTS

In the last edition of the Loss Control Newsletter we reported on an interesting example of an apparent breach of cyber security; in what is being perceived as an ever-growing exposure to the process industries. To help track the frequency and severity of such events a database has been compiled to track industrial incidents. The Repository of Industrial Security Incidents (RISI) provides basic online access for free, or an enhanced service for a fee. For more information click here.

US: FOAM PARTY

Whilst this air hangar could be mistakenly perceived as floating in the clouds, it is actually the result of a welder's spark triggering the fire suppression foam in a US aircraft hangar. According to *The Aviationist* website the 90,000 square feet (8,400 m^2) hangar was filled with high expansion foam within two minutes – sufficient to submerge most of the F-15s, F-16s and A-10 within the hangar.

Such systems are commonplace, as airplanes tend to be kept fully fuelled to prevent water contamination of the fuel tanks. Fire protection systems, therefore, need to be able to respond in seconds to prevent millions of dollars' worth of damage and will also need under-wing foam protection for those areas shielded from any overhead foam pourers.

Source via youmustvotenato/Reddit

THE SHALE GAS REVOLUTION

Nigel Cairns, a Marsh Energy Practice Risk Engineer based in London provides feedback from a Shell-led workshop on fracking.

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It has been some time since a single energy industry topic has attracted so much attention in the world's media, but shale gas has been doing just that over the last couple of years. The media has been filled with puns on "fracking" and documentaries claim environmental damage and flaming water taps all across shale gas operations in the United States. But what is the reality and why has this topic caused so much interest?

As part of Marsh's Energy Practice team I recently attended a Shell-led workshop in China. This took place in the wake of Shell's announcement regarding its first ever production sharing contract for shale gas in China with state-owned China National Petroleum Corporation.

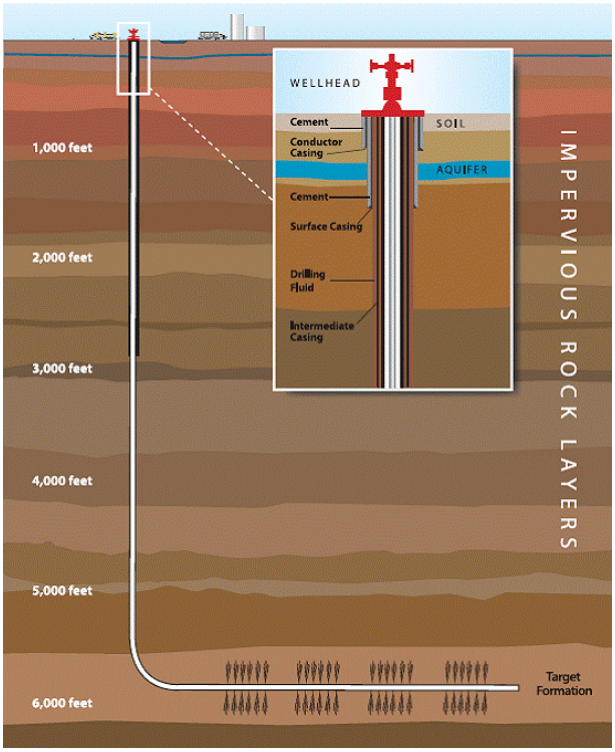
Shale gas is one of a number of so-called "unconventional" sources of natural gas, typically found two to three kilometers underground in ancient shale formations. The shale rock itself is impervious, making conventional drilling and gas collection techniques ineffective. However, recent advances in shale gas extraction technology have suddenly made previous uneconomic gas reserves accessible. Once brought to the surface, the natural gas is collected and processed in much the same way as other conventional natural gas forms.

The United States has been the most vigorous pursuer of this technology with the Marcellus Basin, across Pennsylvania and West Virginia, currently an area of particularly high activity. Only China (with approximately 1,400 trillion cubic feet of recoverable reserves) is thought to have greater shale gas reserves than the US, with Argentina, Mexico, South Africa and Australia also having significant reserves. In Europe, although France, Poland and Norway are thought to have around 200 trillion cubic feet of recoverable reserves each, most activity amongst the major European oil and gas companies has been in buying into the US shale interests.

Significantly, as the world's large energy consumers have relied on countries like Russia and Iran in recent years for supplies of conventional natural gas, shale gas finds are causing a change in the energy balance of power across the world, particularly as countries such as Russia, Iran, Iraq, Saudi Arabia and Venezuela are not thought to have significant shale gas reserves of their own.

When looking at the risks associated with the liberation of shale gas, it should be noted that its uniqueness comes as a result of the hydraulic fracturing process used, known as "fracking". This physically disrupts the normally impervious shale gas formations to enable the trapped gas to be released to the surface for collection.

Whilst conventional gas extraction is dominated by the vertical drilling of wells, unconventional gas drilling is making increasing use of horizontal drilling to expand its effective catchment area. The initial vertical portion of the well, however, is still constructed very much like a conventional oil or gas well. The fracking process then involves high pressure water and its associated flow-enhancement chemicals (typically 1-2% by volume) being pumped down the bored well to disrupt the shale formations and release the gas which then flows back up the well for collection. There are a number of comparative risks for conventional and unconventional drilling. These include the danger of well blowout during the drilling phases and potential environmental risks associated with production. However, the risks with shale gas drilling extend beyond those normally expected during conventional drilling on account of the transportation, storage and use of significant quantities of water in addition to the potential effects on local aquifers from both fracking fluids and released gas.



Typical shale gas drilling operation

It is the perception of these risks within the media that has led to the great interest shown in shale gas and the ongoing debate as to whether the risks are acceptable. A number of these risks are discussed in greater depth below.

COSTS

Whilst technology risks are generally low, sharing many of the common risks with conventional oil and gas wells, the industry does have potentially significant risks from increasing costs – especially where regulations and environmental enforcements are tightened. However, it is expected that with economies of scale, costs will be reduced further as more major oil companies diversify into the shale gas market.

The costs associated with environmental licences and well permits also need to be considered, as do potential exposures as a result of damage to existing property during the construction and commissioning phase. This is when typically large numbers of contractors are on site with generally larger volumes of equipment than would be present for conventional gas operations.

However, the greatest potential exposures to operators are as a result of either well blowouts or, more likely, liability issues as a result of ground contamination during or after the operations phase of a project.

BLOWOUT RISKS

Well blowouts can happen in both conventional and shale gas developments, although shale gas wells have the incremental risk of potential failures caused by the high pressures of fracturing fluid. In both scenarios, blowouts can happen as a result of the failure of the integrity of the casing around the bore hole. At the surface this primarily creates a safety hazard to workers although there is also the risk of loss of containment of drilling fluids. Blowouts below the surface can, however, present additional environmental risks and if the blowout Preventer (BOP) closes to prevent flow from reaching the surface, the hydraulic fracking fluids and associated natural gas may exploit other strata weaknesses and escape into the surrounding formations. Industry experience thus far is that although blowouts are generally a rare occurrence, subsurface blowouts appear to be under-reported.

FRACKING FLUID RISKS

With the shear volume of water usage being a clear differentiating factor in shale gas extraction over conventional techniques, it is unsurprising perhaps that it is one of the areas of greatest concern for anti-shale gas campaigners and one of the largest potential liability areas for operators. A single well may require up to five million gallons of water to fracture the shale, with typically one to two percent of this figure being made up of proprietary "fracking fluids" which are designed to give improved flow characteristics. However, there is currently little state or federal regulation in the US regarding which chemicals need to be reported, putting the burden of regulation on the operator. The water used for fracturing must either be brought to site, giving increased transport risks (especially if it all has to be brought in by truck), or sourced locally from aquifers, which may create a conflict of priorities and risks to local area residences. The water then has to be managed and is typically sent to either a lined pit or a closed loop system using steel 'frack' tanks, though deep injection wells for disposal are also an option.

Clearly, any mis-management of the flow-back water (such as spills, leaks, faulty well construction or other exposure pathways) can result in the contamination of surrounding land and water resources. In addition, incomplete or faulty cementing of well casings can result in leak paths for the water into shallow aquifers that serve local communities. In this area thus far, whilst there is little industry evidence of direct groundwater contamination from fracking itself, there are documented cases of groundwater contamination related to above ground spills of fracking fluids, faulty cement jobs, failed well casings and poorly handled wastewater. It should be noted, however, that groundwater contamination issues such as these are not unique to the unconventional gas area and have been experienced in both conventional oil and gas operations.

Marcellus shale gas operation

NATURAL GAS MIGRATION

Another operational liability issue to hit shale gas extraction is the potential migration of natural gas along bedrock fractures (some of which may be existing) into aquifers and water courses, subsequently ending up in local drinking supplies. Whilst hydraulic fracturing represents one possible source of this problem, leaky well casings and abandoned wells are alternate sources, as is gas migration as a result of changes to the local strata's pressure characteristics. What is clear is that there is not currently a direct causal link to pin the blame on the shoulders of shale gas extraction. Indeed, groundwater saturated in methane has been found in a significant number of water wells overlying the Marcellus Shale and Barnett Shale areas in the USA, and in many cases has been known about for decades prior to shale gas drilling. Pennsylvania state regulators have also investigated around 70 "stray gas" incidents in the last 20 years, as well as a number of explosions – most of them distant from shale gas wells.

SEISMIC RISKS

There has been great interest, particularly in the UK, with what a number of media sources have reported as earthquakes occurring near to shale gas operations. The main interest stems from the Cuadrilla drilling project near Blackpool, England, where a seismic event of magnitude 2.3 was registered in April 2011. This followed similar experiences with drilling operations in Oklahoma, Arkansas and Ohio in recent years in the US.

Again, however, we need to put these reports into context and examine both the likelihood and degree of exposure that shale gas drilling operations can generate. Studies on seismic events near shale gas operations in the US have revealed that generally, such events have occurred at existing fault sites (rather than operations unilaterally generating tremors) that often other operations such as deep injection wells used for waste disposal have caused these events.

The UK Government's independent report into the Blackpool events suggested that whilst further seismic events were still possible, they were "not likely to cause significant damage". Indeed, typical fracking events have been measured at magnitudes of around -3.0 and whilst the magnitude 2.3 event in Blackpool was significantly greater than this, it still doesn't reach the experience of standing next to a passing truck, which is typically around magnitude 3.0.

LIFE CYCLE RISKS

Those risks discussed above cover the main operational risks associated with unconventional gas operations, but it must be highlighted that once an operation has ceased, there still lies the potential for liability if decommissioning and closure risks are not properly managed. This includes the making safe of abandoned wells and responsibly dealing with any residual waste water from the process.

DEVELOPING BEST PRACTICE

Thanks to the hive of media activity associated with shale gas drilling, the major operators are acutely aware of the public spotlight upon them and it is telling that a number are becoming more public about the good practices that they expect from their operating teams and contractors out in the field. In essence, this should be no surprise as what we would consider to be 'Good Practice' for other areas of the upstream industry is equally valid for unconventional drilling operations.

For example, we would expect the operator to have thoroughly researched the reservoir, not only to optimize the fracking process to maximise production, but also to ensure that drilling operations consider the environmental (and potential liability) issues. It is important that water usage is minimized as far as reasonably practicable and measures put in place to address gas migration and groundwater contamination.

To this end, 'Excellence in HSE' would include baseline environmental and geology studies to identify potential issues, with a clear framework for ongoing monitoring and reporting of any emissions and ground contamination. Ongoing operations should have a Water Management Plan utilizing good storage design, with a clear, defined and rehearsed emergency response plan if there are any losses of containment.

With the speed of legislation generally running slower than that of public reaction, operators need to ask themselves if mere compliance with existing regulations is sufficient in itself to demonstrate commitment to a responsible care philosophy, or whether they need to be constantly going beyond legislative compliance to maintain their license to operate with their community.

In conclusion, the comparatively recent boom in shale gas exploitation in the US and its export to other regions around the world, has the potential to revolutionise the politics of world energy supply and create a new sense of energy independence for many countries. There are, however, a number of associated risks and whilst a number of these are in common with existing conventional gas extraction technology, shale gas offers a number of unique risks which define the operation, yet which can be mitigated by following good practice.

The fracking process looks set to continue to be scrutinized by regulating authorities and presents one of the greatest challenges for the energy and insurance industries.

DO LUBE OIL FIRES REALLY HAPPEN?

Adrian Louis, a Risk Engineer in Marsh's Energy Practice based in Dubai, explores the phenomenon of lubricating oil fires within lube oil skids. Can they really occur when the oils are handled below their flash points?
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We have learned a lesson, albeit a very expensive one, from our colleagues in the power sector, of losses due to lubricating oil fires occurring at machinery lube oil consoles. In the last 15 years, there have been more than US$400 million in property losses alone (Source: FM Global) due to lubricating oil fires.

It is not uncommon for fires originating at the consoles to then escalate to surrounding equipment and typically, the associated main machine – compressor, pump or turbine. The subsequent loss of the main machine has the potential for far greater consequence when looked at in a business interruption scenario as major machines can take up to 30 months to replace.

One can sympathise with the difficulty in appreciating how lubricating oil can catch fire. The usual reasons heard include "It's not flammable!" and "It is operating below its auto ignition temperature", however, fires at lube oil consoles still occur.

Past examples on process plants include:

- 1978, Propylene Plant, Spain – fire at lube console which escalated to surrounding equipment
- 1988, Refinery, Scotland – leak of lube oil at power station generator causes fire and subsequent refinery shutdown
- 1989, Refinery, USA – leak of lube oil resulted in a fire and spreads to main hydrogen compressor and surrounding area
- 1996, Ammonia Plant, Canada – cracked three-quarter inch line on seal oil pump discharge resulting in fire which destroys syngas compressor
- 2005, Ethylene Plant, Scotland – fire at lube console which escalated to the cracked gas compressor

Lubricating or mineral oil is used to reduce friction and wear on rotating parts and is traditionally hydrocarbon-based. Lube oil consoles are typically located close to the main rotating equipment. It is quite common for lube oil consoles to be located at grade underneath the elevated compressor

or next to the pump or generator. This is typical to minimise lube oil pumping head as well as to conserve plot space and is favoured by EPC contractors.

The very nature of lubricating oil systems sets the scene for a perfect storm; take high energy fluid, pumped under pressure from a large reservoir, operating at elevated temperatures and in close proximity to "hot" surfaces and then throw in a leak – not so unusual given that rotating equipment is synonymous with vibrations.

Given this perfect storm scenario and the associated context – the presence of a rotating machine handling a large quantity of flammables in close proximity to other potentially critical (and unspared) equipment – one would assume that installing fire detection and fixed fire protection for consoles would be an industry norm. However, there is no industry norm and best practice is not being applied consistently, a shortcoming that continues to cause loss. The installation standard is often set by a licensor or contractor with wide variations in facilities seen, even amongst new build equipment at the same site.

Marsh recommends that in the context of lube oil consoles, a risk assessment to understand the likelihood and consequences of a lube oil fire should be determined, especially where these consoles are located close to business-critical, unspared equipment.

This is particularly vital during the design phase, where suitable provisions for fire detection and suppression are much more cost effective than potentially expensive retrofits.

For areas where the inherent risk is deemed unacceptable then, as a minimum, fire detection systems should be installed. Examples of fire detectors include infra-red (IR) or ultra-violet (UV) sensors which are linked to the overall site's distributed control system. For reliability purposes two different types of fire detector are recommended. A more economical alternative is to use a linear heat detector in combination with a fire detector on an instrumentation-voting basis. Moreover, fire detectors should be appropriately located in order to realize the benefit. Line-of-sight type (UV/IR) detectors (as shown on the right) should be focused on areas prone to leaks, such as flanges and joints.

Fire detectors

Detectors are the first line of defence and support the subsequent fire-fighting effort. In addition, a well-defined pre-plan specifically tailored for fire fighting at the lube console and the surrounding area is then required. The pre-plan must be concise, specific and easy to understand and should be practised as part of the site's drill schedule. More guidance on fire pre-plans can be found in Marsh's position paper on the subject.

Depending on the nature of the process materials handled, the surrounding equipment and the capabilities of the first intervention team, consideration should be given to installing fixed fire protection systems. Examples of these include deluge systems or inert gas suppression systems which either provide cooling, reduce the level of oxidants in the atmosphere or inhibit the fire chain reaction.

The application of fixed systems is site and unit-specific and should be considered as part of the risk assessment. Particularly in older units, the space and access to allow effective intervention by fire fighters can be sorely compromised. There may also be cases where water deluge systems may be detrimental as water damage could render machines inoperable.

The risk engineering team at Marsh continues to observe and review various practices at sites globally and is well placed to provide support and advice to meet clients' individual needs.

Safety Snippet

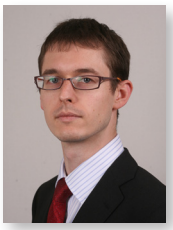
PIPELINE MOVEMENT MONITOR

One operator had the challenge of running a natural gas pipeline from a jungle area to an altitude of around 5,000 metres and then down to sea level through areas of substantial landslide (up to 45 degree gradient) and earthquake potential.

By running a strain-measuring fibre optic cable along the pipeline and linking to their Supervisory Control and Data Acquisition (SCADA), the operator was able to monitor for movement of the pipeline well in advance of potential pipeline rupture conditions. Since its installation, it has already detected shifting of the pipeline due to small ground slide/movement by a few inches in a 45 degree slope allowing prompt repairs to the anti-slide terracing structures, hence preventing escalation.

AIR FRANCE FLIGHT 447

LESSONS FOR THE ENERGY INDUSTRY



Chris Price-Kuehne, a Risk Engineer in Marsh's Energy Practice based in London, provides some potential lessons from the Air France crash of April 2009 which may also be applicable to those in the process industries.

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INTRODUCTION

Air France Flight 447 was flying from Rio de Janeiro to Paris on 1 June 2009 when it crashed into the Atlantic Ocean killing the 228 passengers and crew. The aircraft involved was an Airbus A330-200 that first flew in February 2005 and had subsequently undergone a major overhaul in April 2009.

The last radio contact with the aircraft was at 01:33 UTC on 1 June 2009 when it was approximately 350 miles off Brazil's north-east coast. The crew reported that the aircraft was flying normally and the flight left Brazil's Atlantic radar surveillance at 01:48 UTC. There was no further communication with the flight and at 02:20 UTC Brazilian air traffic controllers contacted their counterparts in Dakar after noticing that no radio call had been received to indicate that the flight had entered Senegalese airspace. The aircraft had crashed. Although a series of automatic electronic messages were sent by the aircraft over a three minute period, no one knew what had happened.

Speculation regarding the reasons for the crash continued until the flight-data recorder was found in April 2011 and the memory unit recovered in May 2011. A transcript of the cockpit voice recorder was leaked and published in October 2011. Based on this transcript, the American magazine *Popular Mechanics* featured an article in December 2011 analyzing the chain of events that led to the crash of Air France Flight 447. A number of the conclusions drawn are relevant to all industries that rely on safety management.

The following is a very much abridged summary of the tragic events. Some of the points are inferred from the transcripts and from *Popular Mechanics* commentary.

BACKGROUND

Air France Flight 447 was operating in auto-pilot when a pitot tube froze, causing the air speed indicators to lose an input. This instrument fault caused the auto-pilot to disengage totally, leaving the pilots (both first officers of equal "rank") in full manual control of the aircraft; a situation similar to one which may occur if critical plant trips had been overridden. At this point the aircraft was safely in control and operating normally, albeit with an instrument fault.

The pilots took control of the aircraft and attempted to climb in a bid to avoid the weather that had caused the pitot tube to freeze; this action reduced the aircraft's air speed. The alarm system warned the pilots that a stall may occur, the alarm taking the form of an audible "STALL!" warning. This alarm sounded 75 times.

When an autopilot is functioning normally in a supervisory capacity, it will take action to prevent an aircraft from stalling, even overriding a pilot's inputs. However, when totally disengaged (as in this case) this protective function is not active. It is inferred that the pilots of Air France Flight 447 believed that they could not stall the aircraft; they did not understand, or were unaware, that these protective functions were not active. The very prominent stall alarm was apparently totally ignored; at no point in the transcript is the issue of stalling discussed by the pilots.

The pilots continued to try to climb, losing air speed until the aircraft stalled and began to drop. One other area of conflict is that the two control yokes on the Airbus are asynchronous. In other words, they move independently with no interlock so that there is no feedback from one control yoke to the other. In this case, one pilot was trying to make the plane gain height, while the other was trying to descend to gain speed. The net effect of this was that the two pilots are cancelling each other out and there is no change to the airplane's trajectory.

The captain, at this point roused from his rest break, became involved at the tail end of the incident and was not able to identify the critical issue until it was too late. The appropriate corrective action (descending, nose down, to gain air speed) was eventually taken, tragically out of time.

PARALLELS

This incident contains a catalogue of issues to learn from:

- Very poor communication between the pilots compounded problems – competing and counterproductive actions were taken as a result
- Poor understanding of safety systems – the pilots may have failed to understand the safety systems' limitations
- Being thrust into the middle of an incident (in this case the captain) – if one has not been following an incident develop, it will be a struggle to identify the problem and act appropriately
- Insufficient or ineffective training in emergency response scenarios – the pilots do not appear to have responded in an appropriate manner to the instrument failure

"The energy industry would do well to learn from losses outside of its immediate sphere of expertise."

Easy parallels can be drawn with the energy industry. Hydrocarbon processing – specific examples include:

- Process operators failing to understand the basics of their processes and relying on APC (Advanced Process control) systems
- Burner management systems being over-ridden for speed of operations without understanding the importance of the purge and Trial for Ignition (TFI) delay periods

While there are some obvious differences between the aviation and energy industries, we share the common thread of risk management being critical for our safe operations. The energy industry would do well to learn from losses outside of its immediate sphere of expertise.

The article "What Really Happened Aboard Air France 447" is available on the *Popular Mechanics* website; it is an engrossing, if rather melancholic read.

CHIBA REFINERY

Paul Talbot, a Risk Engineer in Marsh's Energy Practice based in London, reviews the Chiba Refinery incident in Japan in 2011.

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INTRODUCTION

It has been over a year since the 2011 earthquakes and tsunami hit Japan; some of the most enduring and startling images at the time of the incident were those of the fire and BLEVE at the Cosmo Chiba Refinery in Japan.

An accident investigation was conducted following the disaster and the formal conclusions of that were published last year. Below we summarize the incident and the actions taken to minimise the chance of a similar event recurring.

OVERVIEW OF THE INCIDENT, 11 MARCH 2011

- At 14:46, an earthquake of the fifth degree on the seismic scale (magnitude 7.7 on the Modified Mercalli 'Richter' scale) occurred in the Pacific Ocean off the coast of the Tohoku region.
- Many of the braces that were diagonally supporting the legs holding LPG Tank No. 364 fractured. The tank was normally filled with LPG but on the day of the incident, was filled with water as part of planned inspection activities.
- At 15:15, another earthquake of the fourth degree on the seismic scale occurred off the coast of Ibaraki Prefecture.
- Several legs holding up LPG tank No. 364 bent and the tank collapsed. The collapse led to the damage of several pipes near the tank which resulted in significant leaks of LPG with subsequent ignition.
- Due to the fire, the LPG tank adjacent to LPG Tank No. 364 exploded, spreading fire from one tank to another.
- As a result of the spreading fire, a number of neighboring LPG tanks exploded, further expanding the fire.
- Efforts to extinguish the fire began immediately after the outbreak; it was fully extinguished on 21 March.

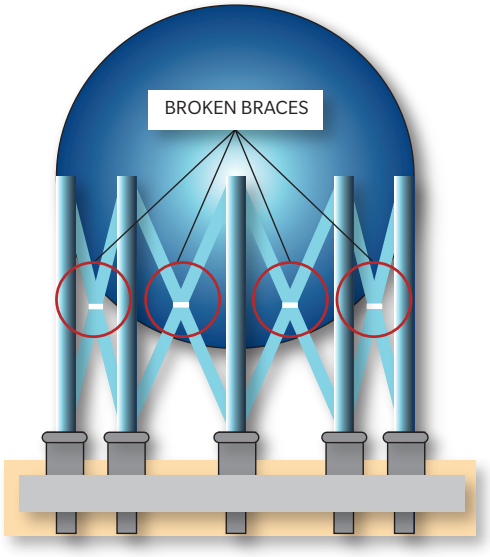
Chiba Refinery at time of BLEVE
Note the height of stacks compared to the fireball

CAUSE OF THE EVENT

Whilst nothing could have been done to prevent the earthquakes, there were other contributory causes that could have prevented the incident.

DAMAGE TO BRACES SUPPORTING THE LPG TANK LEGS

Damaged LPG Tank No. 364 met all the earthquake-proof structural requirements. However, since at the time of the earthquake Tank No. 364 was filled with water instead of less dense LPG, the initial earthquake put such a heavy load on the braces that some of them collapsed . This coincided with the second earthquake which led to the tank falling down.



Braces (circled) fractured as a result of the earthquake and excessive loadings

LPG LEAKS

It was likely that it was damage to piping as a result of the tank's collapse that caused the initial LPG release. One of the emergency shut-off valves that would have isolated one of those piping systems had been forced open and disabled from closing for maintenance purposes. This was a temporary measure and whilst in place, the operation procedure was to manually close the valve at the time of an emergency. However, at the time of the incident it was not possible to gain access to close the valve due to LPG leaks.

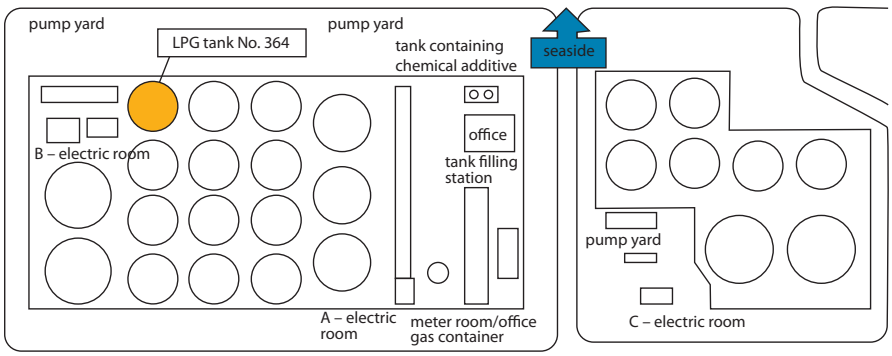
The lack of inherent flexibility in piping design was also cited as a possible contribution to the extent of LPG leakage. Design, such as step geometry at suitable intervals and reduced continuous straight lengths, greatly reduces stresses on piping systems during earthquake events.

LAYOUT

At no point is the spacing between the LPG tanks mentioned within the official incident investigation nor in the corrective actions (summarized below). The photographs and layout diagram clearly show that the proximity of the tanks to each other would have had the detrimental effect of:

- Increasing the possibility of physical interaction between the vessels during collapse
- Increasing thermal radiation exposure to tanks not on fire (essentially adjacent tanks were engulfed)
- Impairing the ability of emergency responders to access isolation valves and gain access for fire fighting or cooling of equipment

Active fixed fire fighting systems and passive fire protection will always improve the risk of escalation but can be impaired. The inherent safety afforded by having good separation between tanks or spheres cannot be compromised.



Layout of LPG Storage Area
Tank 364 Highlighted

CORRECTIVE ACTIONS

As a result of these causes Cosmo Oil has committed to the following actions:

- Future tanks to be designed for earthquake loadings even during hydrotesting
- Minimise duration of hydrotesting
- Improved isolation standards during testing to prevent damage to piping or other storage facilities
- Improved piping design to minimise pipe stresses

Interestingly, there were no specific conclusions regarding the effectiveness of the emergency response arrangements or the safety management systems prior to the incident. However, there were a number of actions proposed to reduce the risk of recurrence, although the context in which these are intended is not wholly clear. These are:

- Comprehensive safety inspections
- Improved awareness of employees to the relevant regulations and their roles and responsibilities
- Improved checking of work through checklists and cross-checks
- Improvements in contingency response capability
- Improved drills and exercises on large-scale incidents
- Better education / learning lessons from incidents to less experienced personnel
- Improving the updating of incident response arrangements
- Improved auditing

CONCLUSIONS

It would be easy to criticise those at the refinery for failing to take into account the chance of an earthquake when hydrotesting an LPG tank; after all, Japan is no stranger to the destructive effects of such earthquakes. It is obvious, with hindsight, that a sphere with significantly higher mass as a result of its contents will be more vulnerable in the event of an earthquake. However, it is all too easy to miss such 'obvious' facts, especially if these activities have been conducted in line with established procedures, on a regular basis without any repercussions.

What other operators can draw from this incident, irrespective of whether they have facilities that are vulnerable to the effects of natural catastrophes, is that even established practices should always be reviewed and critically questioned; and yes, the unthinkable can happen.

There were no fatalities, although six people were injured. All 17 tanks in the storage area and associated piping were damaged. Damage as a result of explosions, fires and missile effects also spread to nearby asphalt tanks as well as off-site receptors, including industrial, commercial and residential premises.

"...even established practices should always be reviewed and critically questioned; and yes, the unthinkable can happen."

EMERGENCY RESPONSE 'GRAB' FILES

Here's an example of a system being improved following experience gained during emergency simulations. It's a pack that is issued to everyone who is on the Emergency Incident Management duty rota.

A pack was designed to combat the issue of basic items, such as stationery, not being easily available in an emergency situation.

The pack or "grab" file was distributed to everyone on the Emergency Incident Management duty rota and includes all information and basic items required when called to site (or an off-site command post). The compact nature of the pack means it can be easily stored somewhere accessible.

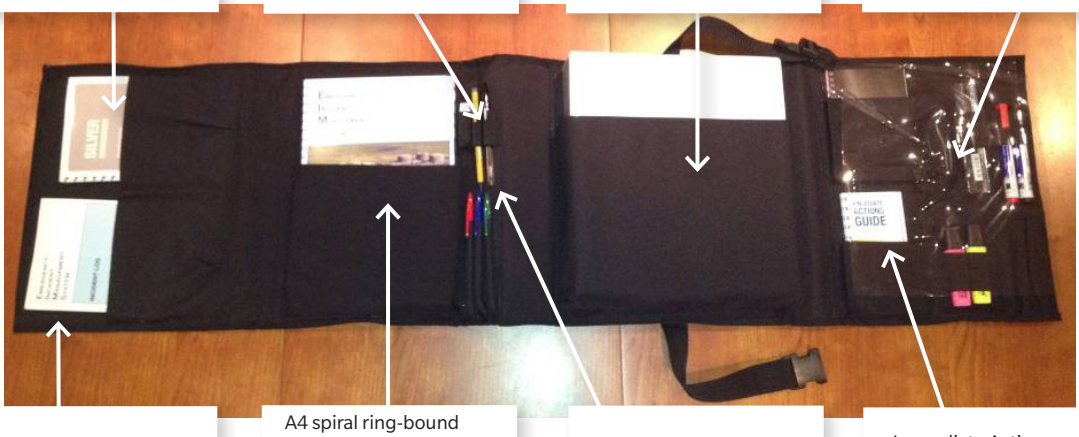
For those on the duty rota, it is compulsory to carry the pack in their car at all times during working hours and also to have it available when on-call. Regular audits are carried out to ensure that individuals comply with these guidelines and to check that the contents are complete and in good order. An example is shown below.

A5 incident log – pre-printed tear-out sheets with columns for time, event and initial

Secure USB stick containing complete Emergency Incident Management System reference manual

A4 folder – containing complete Emergency Incident Management System reference manual

Assorted highlighters, whiteboard/flipchart markers, rule, post-its, etc. – useful for person acting as scribe during incident



Specific role guidance – in this case: Silver Commander

A4 spiral ring-bound Emergency Incident Management System containing fire pre-plans; responsibilities of all duty holders, tel. nos, etc.

Assorted pens, pencils and eraser

Immediate Actions Guide (145mm x 74mm so it easily fits in top pocket of overalls)

FROM THE ARCHIVES...

This edition's article from the Marsh archives was previously published in a 1999 Loss Control Newsletter.

Dick Barton, a Risk Engineer in Marsh's Energy Practice based in London, explains the issues to be considered when constructing pipelines in the vicinity of high voltage power lines.

HIGH-VOLTAGE POWER TRANSMISSION SYSTEMS AND PIPELINE RISKS

Dick Barton, Risk Engineer, Marsh's Energy Practice.
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While oil, gas and product pipelines have their own operation-related risks, including those arising from mal-operation, poor design, corrosion initiated failure, excavation or even terrorism-related hazards in some parts of the world, those near to high voltage power transmission facilities have their own unique risks which are often overlooked. These include exposure to the effects of potential ground faults or induction, a process by which the pipeline becomes electrically charged. This charge is not only a hazard to personnel coming into contact with the pipeline, but also has the potential to cause severe metal loss where any induced current enters or leaves the pipeline. Weakening of the pipe wall is often the precursor to catastrophic failure.

Ground fault charging of the pipeline arises from conduction, resistive and electrolytic coupling. This may occur as AC power travels through the ground from a fallen transmission line, an accidental electrical connection onto a tower leg, via a lightning strike, or an imbalance in a grounded power system. High potentials arising from ground faults can expose the pipe coating to high stress levels as the soil surrounding the pipeline becomes charged, thereby generating a high voltage differential across the coating. Coating disbondment can occur and if voltages are sufficiently high, arcing may damage the steel itself. The breakdown in protective coating will result in accelerated corrosion.

Induction arises due to the electric or magnetic fields generated by the AC power transmission lines, which then results in a current flow or potential gradient within the pipeline. This capacitive or inductive coupling is dependent upon the geometrical alignment of the power transmission line to the pipeline, the frequency of the power system, magnitude of the power current flow, and the resistivity of the coating, soil and pipeline (longitudinal).

The potential effects of AC interference under both normal operating and ground faults can be readily estimated from knowledge of the power transmission and pipeline systems. Key factors in assessing risks are the characteristics of the AC power and the distance from the pipeline.

There are a number of methods to minimise AC interference effects and to protect both the pipeline and personnel, e.g. operators or maintenance, coming into contact with the pipeline. These include electrical shields, grounding mats, independent structure grounds, bonding to existing structures, distributed anodes, casings, proper use of connectors and conductors, insulating joints, electrolytic grounding cells, polarization cells and lightening arrestors. Monitoring may also be required.

The following example, involving the installation of an underground electrical cable duct and above ground piperack in the vicinity of a 1.5km stretch of underground 34 inch and 36 inch natural gas pipelines within the Map Ta Phut petrochemical complex in Thailand, helps highlight some of these aspects.

While calculations showed that the induced voltages on the large diameter pipelines would be within the limits required by established codes (for example, those recommended by the Canadian Standards Association) during normal operations, hazardous voltages could have occurred during transient conditions such as ground faults or lightning strikes. Consequently, the pipeline owner required the contractor to install gradient control mats in the vicinity of above ground valve manifolds for personnel protection. The contractor was also required to both relocate and increase the spacing between piperack ground rods in order to minimise the risk of an electrical arc impacting on the main pipelines.

Pipeline operations with the lowest risks will be those with good separation between pipelines and high voltage transmission lines. "Good" here may mean as much as 300m, although it should be noted that inductive interference has been observed in high resistivity soils as far away as 2km. It is well worth operators checking pipeline design features and routings in relation to power transmission lines to highlight areas meriting detailed analysis and possible modification.

With land costs ever increasing, particularly in developing countries, it is likely that there will be increased pressure for

pipeline operators and power transmission companies to share common routings. Consequently, without proper management, pipeline operating risks can be expected to increase under such circumstances. The situation is further compounded where there is rapid economic expansion without long-term risk-based planning regarding pipeline and utility location.

Marsh (formerly Sedgwick) has observed such a situation in Thailand, where the main natural gas supply pipeline 'right of way' has been shared in a number of locations, not only with other pipeline operators, but also above and below ground power transmission lines. A 28'' gas pipeline was shutdown for three days to effect repairs following damage and subsequent gas leak due to an overhead 115 kV power transmission ground fault. When the gas pipeline was originally constructed, power transmission lines located in the vicinity of the pipeline were not envisaged.

Furthermore, two years later this operator had to contend with the construction of sixteen 230kV carrying power transmission towers directly above a 5km section of its 34'' and 36'' gas pipelines. Here, calculated steady state induced AC voltages were found to exceed the recommended safe levels. The induced voltage was to be safely managed by the installation of specially designed electrical grounds at each end of the pipeline, while the transmission towers required ground rods to be installed far below the level of the pipelines than would usually be required. The existing pipeline cathodic protection system also had to be modified to reduce interference effects that would arise from the power line towers.

While this article highlights this often overlooked risk, which also extends to pipelines in the vicinity of electrical railways, it should however be stressed that construction or maintenance excavation-related hazards often pose even more significant risks for pipeline owners, particularly when located in populous or environmentally sensitive areas.

These risks can be reduced by effective management of change work systems involving the pipeline operator, relevant authorities and third party companies requiring access to any pipeline area, good engineering records and plans, and careful site construction practices when working in the vicinity of the pipeline. Such precautions might have avoided the explosion outside Caracas, which occurred when workers from a telephone company subcontractor damaged a 20'' gas pipeline during excavation work to lay a fibre optic cable adjacent to a busy highway. Sadly, in the ensuing fire over 50 lives were lost and many more injured.

MARSH SHARING KNOWLEDGE IN ASIA

#1 – PROCESS SAFETY MANAGEMENT CONFERENCE

YueFeng Chen, leader of Marsh's Energy Practice's Global Energy Risk Engineering in Asia, was recently invited to represent the insurance profession at the Industry Process Safety Management session of the 14th Asia Pacific Confederation of Chemical Engineering (APCChE) Conference.

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The Oil, Gas and Petrochemical sectors in Asia are in a continuous state of growth across many markets in the region. Despite this momentum, the industry has suffered record losses across the region thus highlighting the risk exposures as the industry develops and matures.

A dedicated one-day industry session provided participants with an understanding of the critical elements that are necessary for managing process safety, allowing practitioners to share their knowledge, experience and challenges encountered in achieving and sustaining zero incident operation.

DuPont USA, ExxonMobil, Chevron, MOM/WSHC and other eminent process safety management (PSM) subject matter experts joined YueFeng Chen to give the key note presentations. YueFeng Chen presented a paper entitled 'Process Safety Reduction Approach - An Insurance Risk Engineer's Perspective'. His presentation provided insights and Marsh's approach to risk management. Risk ranking and the insurance market's areas of concerns in rating risks was also shared in the presentation.

Ms Judith Hackitt, Chair of UK Health and Safety Executive (HSE), who wrote the foreword for Marsh's "The 100 Largest Losses 1972 - 2011", was also in attendance. She gave a plenary talk on "Major Hazards and Process Safety – The UK HSE Regulator's Approach and Lessons Learned".

#2 – ASIA SAFETY EXCHANGE PROGRAMME CONTINUES

Readers of previous LCNs will recall Marsh Asia's energy risk engineering team's safety exchange programme initiated in 2009.

In the past 12 months another Asian petrochemical leader, Petrochemical Corporation of Singapore (Private) Limited (PCS), participated in this programme. The purpose of the programme is to exchange risk management and best process safety practices in the petrochemical industries as well as providing excellent networking opportunities for the future.

In September 2011, the Formosa Plastics Group (FPG) sent a team to visit a PCS site in Singapore.

The FPG team consisted of their Deputy Head of Safety Heath Environment Centre, Risk Management Department Manager and Maintenance and Inspection Engineers.

Subsequently, a similar PCS team paid a visit to FPG Mailiao Petrochemical Complex, Taiwan in April 2012. The PCS team consisted of their HSE Manager, Maintenance Manager and General Manager of Plant. The Olefin process unit, control room, Fire Brigade and Harbour were visited. Views on practices in safety, maintenance and inspection and fire fighting were shared during the visit. In addition, a Risk Management Seminar was jointly conducted with FPG, Marsh and PCS. Robert Robinson and YueFeng Chen from Marsh Global Energy Risk Engineering (GERE) group gave their presentations on 'Asset Integrity KPIs' and 'Lessons Learned from Losses – Recent Losses and Fired Heater Loss Case study' respectively.

Over 100 participants were present including representatives from other petrochemical companies in Taiwan.

The General Manager of PCS commented after the exchange visit, "In addition to establishing strong technical contacts within FPG, the programme has enabled the sharing of skills, practices and insights across borders. We have much to learn from their organizations and facilities, as well as other good practices, which help to inspire new initiatives."

Marsh and Members of the FPG/PCS Safety Exchange Programme

The Risk Management Seminar was well attended

Safety Snippet

LEAK THROUGH METAL – PROCESS SAFETY KPI

A refinery has been collecting Process Safety Performance Indictors (PSPIs) for some time and the system is evolving as they are gaining experience; some indicators being dropped as they are considered to add little value and new indicators are being added.

One of the new lagging indicators being collected in 2012 is "Leaks Through Metal".

This is a sub-set of the "Loss of Containment" process safety events and covers Tier 1, 2 and 3 loss of integrity events as defined in API 754, which are as a result of loss of containment through the wall metal plant, equipment and piping (to differentiate from seal and gasket leaks.) This PSPI is owned by the Inspection Department and is proposed as a measure of the effectiveness of the facility's integrity management programmes.

MARSH NEWS

CHANGES AT THE TOP OF THE ENERGY PRACTICE

Marsh announced this month that it has appointed Andrew George to be Chairman of its Global Energy Practice in succession to Jim Pierce who now leads Marsh's Global Industry Practices group.

Consequently Mr George, who was previously Head of Marsh's Energy Practice for Europe, the Middle East and Africa (EMEA), will be succeeded by Andrew Herring, currently head of Marsh's London-based Wholesale Energy Practice.

Commenting on the announcement, Mr Pierce said: "With his extensive experience of global energy insurance markets and his deep understanding of the risk issues companies face, Andrew George is one of the most knowledgeable and well-qualified insurance professionals in our industry. Given his strong history of developing innovative solutions to meet the rapidly-changing needs of clients, Andrew will be a strong advocate for our clients as we further develop our market leadership serving the global energy industry."

Mr George added: "I am excited to be taking on this opportunity at such a challenging time. With companies facing ever-tighter margins and increased regulation, never has the management of operational risks been more crucial to the global energy market. My Energy colleagues and I look forward to working with our clients around the world to enable them to deal with these important issues effectively."

Mr Herring, who rejoined Marsh from JLT in 2010, began his career at Sedgwick International – later Marsh – in 1987 as a property broker specializing in the energy business and became an assistant director in Sedgwick's energy team on its formation in 1990.

Commenting on his appointment, Mr Herring said: "The EMEA region encompasses some of the world's most promising emerging markets and many of its well-established economies. All of them face increased risks as they find ways to meet the growing demand for energy in uncertain economic times. I relish the task of further developing Marsh's offering in this diverse region."

MARSH ENGINEERING IS EVOLVING

21 June was not just the summer solstice in the northern hemisphere, it also marked the beginning of a new chapter for Marsh's Global Energy Risk Engineering (GERE) team. The team now has dedicated practices for upstream, downstream, specialties (BI, third party liability, terrorism and renewables) and construction. Each engineering hub in Houston, London, Singapore and Dubai will also have its own leader, with a new hub to be opened in Brazil too.

The major changes will be an increased focus on the core issues affecting both the insurance profession and also Marsh's clients, combined with our well-established engineering services. At the forefront of this are developments in the upstream industry. Oil and gas exploration and production (E&P) operations are taking place in ever more challenging environments, pushing technological boundaries further, as traditional fields are slowly depleting and energy demands are increasing. Deepwater drilling, shale gas drilling and oil sands recovery call for the right expertise and present their own independent challenges.

Marsh strives to meet both the industry's and our clients' needs and we will be continuously developing our products and colleagues to achieve this.

NEW MARSH ENERGY PRACTICE ENGINEERS

Marsh's Energy Practice has been boosted by the recruitment of three additional risk engineers: Ryan McGovern, John Yates and Matthew Sas.

RYAN MCGOVERN

Ryan has joined our growing team of risk engineers in Marsh's Dubai office. Ryan is a Chemical Engineer and has more than eight years operational experience gained at ExxonMobil's Fawley Refinery in the UK and their Ausgusta Refinery in Italy. During this period Ryan gained experience as a Process Design Engineer before moving to the Refining Coordination department responsible for scheduling and quality management. Thereafter, he held operational roles concerned with cat cracking and hydrotreating, resulting in his promotion to the FCCU Operations Supervisor.

JOHN YATES

John is a chartered mechanical engineer, beginning his career at Bechtel Ltd where he was responsible for the process, piping and mechanical design of mainly downstream oil and gas and petrochemical facilities. John subsequently spent many years working for DNV, where his responsibilities included certification and classification of energy installations (offshore and onshore), providing process safety advice to oil and gas clients, and reviewing asset integrity and legislative compliance arrangements for operators. His career also involved several years in the United Arab Emirates where he was responsible for all Energy operations.

John joins Marsh's Energy Practice in London, to review and advise on both operational and construction facilities.

MATTHEW SAS

Newly recruited to our upstream team, Matthew graduated with a degree in Geology and Geography in 1995 and has since gained extensive experience of drilling engineering, wellbore construction and operations within the upstream petroleum industry.

Matthew has worked worldwide, from the UK North Sea to Australia via Norway, Morocco and the United States. During this period he has worked on land-based projects and deepwater projects. Most recently his focus involved the design and management of a drilling and evaluation system, taking into account HSE, including location, geology and formation pressure regimes, equipment and rig limitations, directional and formation evaluation requirements and financial considerations.

We would like to warmly welcome Ryan, John and Matthew to Marsh.

A FOND FAREWELL

John Munnings-Tomes, a member of the Marsh Global Energy Risk Engineering team for the last 14 years and a regular contributor to this publication, has recently left Marsh and hopped across "the divide" to take up a position at underwriters Navigators. We wish John success in his new role and look forward to further contributions to the Loss Control Newsletter from an underwriter's perspective.

LOSSES

DECEMBER 2011– JUNE 2012

CHEMICAL

LOSS NUMBER	129594
EVENT DATE	21/01/2012
COUNTRY	Germany
LOCATION	Nordrhein-Westfalen
UNIT TYPE	Polyethylene
EVENT	Explosion
INJURIES	7

An explosion occurred in a LDPE plant. Seven people were slightly injured and three of them were taken to hospital for observation. The plant was shut down after the explosion. No hazardous material was released.

LOSS NUMBER	129650
EVENT DATE	06/04/2012
COUNTRY	Taiwan
LOCATION	Kaohsiung
UNIT TYPE	Ethylene
EQUIPMENT TYPE	Vessel
MATERIAL	Butadiene
EVENT	Explosion, fire

It is understood that there were two incidents on the 500,000 tons/year (t/y) naphtha cracker. There was a fire in a butadiene storage vessel and the failure of a pipe that resulted in an explosion. The subsequent fire was extinguished after two hours and resulted in no casualties. The cracker had been operating at 90% capacity. It was understood that the fire led to the shutdown of the cracker and the 140,000 t/y benzene unit.

LOSS NUMBER	129662
EVENT DATE	10/04/2012
COUNTRY	Argentina
LOCATION	Zarate, Buenos Aires province
UNIT TYPE	Warehouse
MATERIAL	Solvent
EVENT	Fire
INJURIES	4

A major fire broke out while workers were transferring drums of solvent. It was reported that one of the drums ignited as a result of static electricity. Flames were reportedly reaching a height of 100 metres (m). Four workers were hospitalized with minor burns. The warehouse where the fire occurred was completely destroyed along with part of a truck.

LOSS NUMBER	129676
EVENT DATE	05/05/2012
COUNTRY	Thailand
LOCATION	Map Ta Phut
UNIT TYPE	Polybutadiene
MATERIAL	Toluene
EVENT	Explosion, fire
FATALITIES	12
INJURIES	129

At least 12 people were killed and 129 injured in an explosion and fire at a petrochemicals plant that manufactures polybutadiene. In addition, thousands of people were evacuated from adjacent factories and communities within a three kilometer (km) radius of the site. The explosion and subsequent fire sent thick black smoke into the air above the site. The deaths and injuries resulted from blast injuries, burns and inhalation of toxic fumes. It was reported that the explosion and fire occurred while workers were cleaning the polymer production line to change between batches and using toluene as a cleaning solvent.

DISTRIBUTION

LOSS NUMBER	129595
EVENT DATE	04/02/2012
COUNTRY	Venezuela
LOCATION	Monagas State
UNIT TYPE	Pipeline
EQUIPMENT TYPE	Pipe
MATERIAL	Crude Oil
EVENT	Explosion
PLANT STATUS	Operating

A crack in a crude oil pipeline at an oil complex resulted in a release and explosion. Released crude oil reached a dam in a river and forced the shutdown of a water treatment plant and a power plant. Workers used absorbent barriers to block the river and remove the crude oil. Up to 2,000 people were involved in trying to contain the release and recover the crude oil. It was estimated that up to 60,000 barrels of crude oil were released into the river.

LOSS NUMBER	129605	A fatal vehicle accident caused a fire at a pipeline pumping station. It was forced to shut down the 318,000 bpd pipeline after the collision, which caused the fire and spill of crude oil.
EVENT DATE	03/03/2012	
COUNTRY	United States	
LOCATION	New Lenox, Illinois	
UNIT TYPE	Pipeline	
MATERIAL	Crude oil	
EVENT	Fire	
INTERRUPTION	3 days	

LOSS NUMBER	129617	An explosion at a natural gas compressor station resulted in a fire but caused no injuries. The station compresses natural gas for transport through a pipeline system. The compressor station houses seven compressors and was heavily damaged in the explosion. Prior to the explosion an alarm was sounded in the station and the gas was stopped. The workers evacuated immediately. Subsequently, the release resulted in a spark, apparently igniting the explosion. The station's automatic emergency shutdown equipment worked properly to isolate and minimise the fire.
EVENT DATE	29/03/2012	
COUNTRY	United States	
LOCATION	Susquehanna County, Maryland	
MATERIAL	Natural gas	
EVENT	Fire, explosion	

LOSS NUMBER	129654	Militants blew up an oil pipeline causing a huge fire. It is understood that an armed group fired more than three rocket-powered grenades at the pipeline setting it on fire. This was the second such attack in two weeks.
EVENT DATE	10/04/2012	
COUNTRY	Yemen	
LOCATION	Shabwa Province	
UNIT TYPE	Pipeline	
MATERIAL	Crude oil	
EVENT	Explosion, fire	
CAUSE	Terrorism	

LOSS NUMBER	129656	A 1m diameter underground pipeline ruptured and subsequently caught fire, resulting in flames estimated to be 100 - 150m high. No fatalities or injuries were reported and there was no disruption in gas supply. It was reported that the pipeline rupture was as a result of corrosion.
EVENT DATE	04/04/2012	
COUNTRY	Kazakhstan	
LOCATION	Nazarbek	
UNIT TYPE	Pipeline	
MATERIAL	Natural gas	
EVENT	Fire	
CAUSE	Corrosion	

LOSS NUMBER	129661	An explosion and fire occurred after part of a crane fell onto an LPG pipeline in a port area. One person on the crane was killed. Other workers suffered minor injuries including smoke inhalation. The crane was under inspection in advance of being dismantled.
EVENT DATE	12/04/2012	
COUNTRY	Portugal	
LOCATION	Porto	
UNIT TYPE	Pipeline	
MATERIAL	Propane	
EVENT	Explosion, fire	
CAUSE	Impact	
FATALITIES	1	

LOSS NUMBER	129665	A crude oil pipeline was shut after a leak of 1,900 barrels in a rural area. The released crude oil was contained within the immediate area of the release. The pipeline shutdown did not interrupt refinery operations as it is also supplied by tanker. The crude oil supply to the refinery was however limited.
EVENT DATE	28/04/2012	
COUNTRY	United States	
LOCATION	Torbet, Louisiana	
UNIT TYPE	Pipeline	
MATERIAL	Crude oil	
EVENT	Release	

LOSS NUMBER	129669	Two people were sent to hospital after they hit a 24 inch natural gas pipeline whilst digging a trench. Workers shut off valves upstream and downstream of the rupture on the pipe, and allowed the gas to burn off. The fire extinguished after approximately one and three quarter hours.
EVENT DATE	24/4/2012	
COUNTRY	United States	
LOCATION	Hinton, Indiana	
UNIT TYPE	Pipeline	
MATERIAL	Natural gas	
EVENT	Fire	
CAUSE	Impact	
INJURIES	2	

LOSS NUMBER	129670	A major fire at an oil distribution company took six hours to control. It is understood employees were transferring fuel from one tank to another when it ignited. Employees were successfully evacuated but a fire fighter sustained a minor injury. Transformers and electrical lines were damaged during the response.
EVENT DATE	19/04/2012	
COUNTRY	United States	
LOCATION	Clark County, Ohio	
EVENT	Fire	

LOSS NUMBER	129675	Seven people on a tug boat were killed in an explosion while carrying out maintenance on a SPM buoy. The tug did not sink and was towed into port for further investigation.
EVENT DATE	29/04/2012	
COUNTRY	Qatar	
LOCATION	Ras Laffan	
UNIT TYPE	Single point mooring (SPM)	
EVENT	Explosion, fire	
FATALITIES	7	

E&P OFFSHORE

LOSS NUMBER	129590	An explosion, caused by a gas leak, occurred at an offshore facility. 152 of 154 workers were taken onshore and checked medically. Two days after the blowout, hydrocarbons were reported to have reached the coast. It was reported eight days later that the rig had sunk while the fire continued to burn.
EVENT DATE	16/01/2012	
COUNTRY	Nigeria	
EQUIPMENT TYPE	Platform	
MATERIAL	Natural gas	
EVENT	Explosion, fire, blowout	
PLANT STATUS	Operating	
FATALITIES	2	
EVACUATED	152	

LOSS NUMBER	129611	A well was shut at a producing oil field after a platform tilted three degrees. The platform was stabilized and a small leak of drilling fluid was contained.
EVENT DATE	13/03/2012	
COUNTRY	Brazil	
LOCATION	Albacora Field, Campos Basin	
EVENT	Release	

LOSS NUMBER	129612	A company discovered oil was seeping from the ocean floor. The quantities of oil seeping were estimated to amount to less than a barrel of crude oil a day and was being captured by a sub-sea device. The company stands to take a financial loss from halting oil production, about 30,000 bpd, while it studies the source of the leak. It was estimated that it would take months to complete a technical study and to bring the wells back online.
EVENT DATE	15/03/2012	
COUNTRY	Brazil	
LOCATION	Frade Field	
UNIT TYPE	Drilling	
MATERIAL	Crude oil	
EVENT	Release	

LOSS NUMBER	129644	Workers were evacuated from an offshore installation after a major subsea gas release. An initial evacuation left 19 essential workers on the platform but the following day they were also evacuated and a no-fly zone was established around the platform. No injuries were reported. The platform was left unmanned and powered down. The release was thought to be a result of an operation to re-enter a previously plugged well of a gas reservoir. The gas leak was coming from the outer casing of the well. The release was from a gas source 4,000m below the seabed, but 1,500m above the reservoir. The company were later granted approval to mount a dynamic kill to stem the ongoing gas release. This involves pumping mud into the compromised well. A drilling rig was positioned alongside the abandoned platform to act as the pumping vessel. In parallel, work continued to drill a relief well as an alternative solution. It was later reported that the uncontrolled gas leak was finally plugged 12 hours after the company initiated the dynamic well kill operation. Almost 1,000 tons of mud was injected into the well before it was confirmed the leak had stopped.
EVENT DATE	25/03/2012	
COUNTRY	United Kingdom	
LOCATION	Elgin Field	
UNIT TYPE	Well	
MATERIAL	Natural gas	
EVENT	Release	
CAUSE	Blowout	
EVACUATED	238	

LOSS NUMBER	129679	A serious gas leak occurred during the testing of emergency shutdown valves. The platform was not on stream at the time but there were pressurised systems in the area that were not included in the turnaround. The emergency response organisation was mobilized both on the platform and onshore, and standby vessels and helicopters were sent to the area. There were 98 people on the platform. No one was injured during the incident. The personnel boarded in lifeboats in accordance with the emergency instructions but were able to return to their normal tasks in the afternoon.
EVENT DATE	26/05/2012	
COUNTRY	Norway	
EVENT	Release	

E&P ONSHORE

LOSS NUMBER	129601	An exploratory well hit a natural gas patch about 2,600 feet deep, forcing drilling mud back up the drill pipe resulting in a blow-out. About 42,000 gallons of drilling mud was released onto the gravel pad and snow-covered tundra. Additional mud was pumped into the borehole in an effort to kill the well but that mud was also blown out. The company evacuated workers from the site over concerns about methane gas. No fire occurred and no one was injured.
EVENT DATE	15/02/2012	
COUNTRY	United States	
LOCATION	North Slope	
UNIT TYPE	Drilling	
EQUIPMENT TYPE	Pipe	
EVENT	Blow out	

LOSS NUMBER	129639	A small fire at a gas gathering and processing centre resulted in a plant shutdown. The centre separates natural gas and water from about 77,000 bpd of crude oil. Flames were observed in one of two low-pressure gas handling units. Fire fighters entered the unit and found little damage, however, a full inspection was still carried out. No injuries were reported.
EVENT DATE	29/02/2012	
COUNTRY	United States	
LOCATION	Prudhoe Bay, Alaska	
UNIT TYPE	Gas processing	
MATERIAL	Natural gas	
EVENT	Fire	
PLANT STATUS	Operating	

LOSS NUMBER	129609	A well blowout led to the evacuation of several rural homes after natural gas and hydrogen sulfide were released. Workers were carrying out routine well maintenance when problems developed resulting in a loss of well containment.
EVENT DATE	07/03/2012	
COUNTRY	United States	
LOCATION	Artesia, New Mexico	
MATERIAL	Hydrogen sulfide and natural gas	
EVENT	Release	

LOSS NUMBER	129668	Residents were evacuated from their homes when a well leaked natural gas and drilling mud. The company lost control of a shale well while installing a casing, causing the leak. Residents within a 2.5 mile radius were asked to evacuate. No injuries, explosions or fires were reported and air quality was reported to have returned to normal. The gas leak was considered to be under control three days later.
EVENT DATE	24/04/2012	
COUNTRY	United States	
LOCATION	Converse County, Wyoming	
UNIT TYPE	Well	
MATERIAL	Natural gas	
EVENT	Release	
EVACUATED	67	

LOSS NUMBER	129677	A tank overflowed, spilling an estimated 4,200 gallons (16,000 liters) of crude oil and a similar amount of produced water. The spilled oil and water were contained in the area by an impermeable liner and did not leak before the overflow was stopped. Instruments and valves used to control the level of fluids in the tank malfunctioned. An alarm was triggered and a worker investigating it discovered the spill.
EVENT DATE	21/05/2012	
COUNTRY	United States	
LOCATION	Prudhoe Bay, Alaska	
UNIT TYPE	Atmospheric storage	
EQUIPMENT TYPE	Floating Roof Tank	
MATERIAL	Crude oil	
EVENT	Release	
CAUSE	Spill	

FERTILIZER

LOSS NUMBER	129642	Twenty workers were injured when a silo, used for storing fertilizer, collapsed at a fertilizer plant. The silo caved in trapping the workers inside it.
EVENT DATE	20/02/2012	
COUNTRY	India	
LOCATION	Odisha, Paradip	
UNIT TYPE	Storage	
EQUIPMENT TYPE	Silo	
EVENT	Mechanical damage	
INJURIES	20	

LOSS NUMBER	129643
EVENT DATE	28/02/2012
COUNTRY	China
LOCATION	Hebei Province
EVENT	Explosion
FATALITIES	17
INJURIES	46

An explosion at a chemical plant destroyed one factory, badly damaged another and broke window panes within a 2,000m radius. The damaged factory produced farming and other chemicals including ammonium sulfate, guanadine nitrate and nitro guanadine. The Plant No. 1 was razed to the ground with debris scattered all around. There were around 20 people working at the plant when the explosion occurred. The neighboring two-storey No. 2 plant, where a large quantity of sulfuric acid was stored, was also badly damaged.

GAS PROCESSING

LOSS NUMBER	129640
EVENT DATE	24/02/2012
COUNTRY	United States
LOCATION	Acadia Parish, Louisiana
UNIT TYPE	Gas plant
MATERIAL	Natural gas
EVENT	Explosion, fire
INJURIES	1

One worker was injured with moderate burns when a pipe exploded in a natural gas processing plant. An area within a one mile radius of the plant was briefly evacuated. The plant had only become operational in July 2011. It was reported that the natural gas processing plant would remain offline until investigations and repairs were completed. The fire and shutdown did not affect local gas producers or the operation of nearby storage facilities and pipelines.

OIL SANDS FACILITY

LOSS NUMBER	129604
EVENT DATE	02/03/2012
COUNTRY	Canada
LOCATION	Alberta
UNIT TYPE	Coking
EVENT	Fire

A fire at one of three coking units, at an oil sands facility, reduced oil production to two-thirds of its normal capacity of 350,000 bpd. Two workers were sprayed with hot bitumen and received minor burns after opening a valve. A resulting fire forced one of the units offline. Workers were treated and returned to work within one day.

REFINERY

LOSS NUMBER	129587
EVENT DATE	06/01/2012
COUNTRY	Venezuela
LOCATION	Falcon State
UNIT TYPE	Reforming
EQUIPMENT TYPE	Furnace
EVENT	Production loss
PLANT STATUS	Operating

A leak and explosion occurred in a refinery furnace which caused a unit shutdown, forcing the refinery to reduce charge from 305,000 bpd to 245,000 bpd. The unit shutdown affected the production of normal and high octane gasoline for export. The incident impacted the production of lubricant base oil and the hydrotreater plant.

LOSS NUMBER	129588
EVENT DATE	10/01/2012
COUNTRY	India
LOCATION	Assam State
UNIT TYPE	Atmospheric storage
EQUIPMENT TYPE	Tank
EVENT	Explosion, fire
CAUSE	Fire
PLANT STATUS	Operating
INJURIES	7

Welding work was taking place near a tank. A spark from the welder's torch ignited the contents of the tank. The fire spread immediately to the surroundings. When the tank explosion occurred around 200 people were still working at the site.

LOSS NUMBER	129589	A tanker hit a floating platform connected to a refinery. Exports from the 130,000 bpd refinery were halted for three days after the ship's propeller apparently damaged a naphtha pipeline. The company reported that no injuries or environmental damage were caused by the accident.
EVENT DATE	14/01/2012	
COUNTRY	Venezuela	
LOCATION	Orinoco	
UNIT TYPE	Jetty	
EQUIPMENT TYPE	Pipeline	
MATERIAL	Naphtha	
EVENT	Release	
CAUSE	Ship impact	
PLANT STATUS	Operating	
INTERRUPTION	3 days	
LOSS NUMBER	129596	A major fire was reported in an alkylation unit at a 310,000 bpd refinery. The fire affected the production of about 110,000 bpd of kerosene and diesel. The affected unit was expected to be restarted within seven days.
EVENT DATE	05/02/2012	
COUNTRY	Venezuela	
LOCATION	Falcon State	
UNIT TYPE	Alkylation	
EQUIPMENT TYPE	Pump	
MATERIAL	Kerosene	
EVENT	Fire	
PLANT STATUS	Operating	
INTERRUPTION	7 days	
LOSS NUMBER	129597	A fire broke out on a crude distillation unit of an oil refinery. A pipe, that was broken as a result of freezing, may have caused the fire in a furnace of the refinery. The fire was extinguished by staff within five minutes. No casualties or injuries were reported.
EVENT DATE	06/02/2012	
COUNTRY	Kazakhstan	
LOCATION	Shymkent	
UNIT TYPE	Crude distillation	
EQUIPMENT TYPE	Pipe	
EVENT	Fire	
PLANT STATUS	Operating	
LOSS NUMBER	129599	There was a fire at a 115,000 bpd refinery. It caused no injuries and was quickly extinguished by the first response crew. A gas leak was ignited when a release made contact with furnace heaters. A platformer was shutdown for the next few days as a result of the damage from the fire.
EVENT DATE	08/02/2012	
COUNTRY	Canada	
LOCATION	Come by Chance, Newfoundland	
UNIT TYPE	Platformer	
EVENT	Fire	
INTERRUPTION	8 days	
LOSS NUMBER	129600	A leak from a refinery occurred when the refinery's storm-water system overflowed after heavy rain. Most of the spill was in a containment area, however, some did spill into a creek. Containment booms were put in place and the area was flushed with fresh water and detergent. The oil did not cause any damage.
EVENT DATE	08/02/2012	
COUNTRY	Australia	
LOCATION	Sydney	
EVENT	Release	

LOSS NUMBER	129603	An accident at the 200,800 bpd refinery caused an explosion, killing two workers, when a portable vacuum tank exploded. The accident occurred during the loading of catalyst into the FCC unit. Production was unaffected by the incident.
EVENT DATE	02/03/2012	
COUNTRY	Lithuania	
LOCATION	Lietuva	
UNIT TYPE	Fluidized catalytic cracking (FCC)	
EQUIPMENT TYPE	Tank	
EVENT	Explosion	
FATALITIES	2	

LOSS NUMBER	129606	A 163,000 bpd refinery was shutdown after a malfunction on the hydrofluoric acid alkylation unit resulted in the release of chemicals into the air. Water curtains surrounding the alkylation unit were activated on detection of the release. No injuries were reported. An initial analysis showed that propane, butane and pentane were released into the air, along with a small amount of hydrofluoric acid. An estimated 220 kilograms (kg) of HF were released. The leak occurred due to the failure of a 12 inch flange on a process vessel in the alkylation unit. The flange had been reported as leaking in September 2011 and further maintenance was performed three weeks prior to the release.
EVENT DATE	05/03/2012	
COUNTRY	United States	
LOCATION	Corpus Christi, Texas	
UNIT TYPE	Alkylation	
EQUIPMENT TYPE	Flange	
MATERIAL	Propane	
EVENT	Release	

LOSS NUMBER	129607	A fire broke out in one of the gasoline pumps on the reforming unit of a refinery. The fire was preceded by a strong deflagration and was extinguished within fifteen minutes by the refinery brigade. Damage was minimal and limited to electrical cables and to the pump itself. This accident caused the shutdown of the reforming unit. It was estimated that repair to the damage would take at least one week.
EVENT DATE	05/03/2012	
COUNTRY	Algeria	
LOCATION	Skikda	
UNIT TYPE	Aromatics	
EQUIPMENT TYPE	Pump	
MATERIAL	Gasoline	
EVENT	Explosion, fire	
PLANT STATUS	Operating	
INTERRUPTION	7 days	

LOSS NUMBER	129608	A flash fire on a flare platform injured three contract workers carrying out work as part of a crude unit turnaround on a 195,000 bpd refinery. The fire was extinguished before firefighters arrived on the scene. One of the three people injured died four days later.
EVENT DATE	06/03/2012	
COUNTRY	United States	
LOCATION	Memphis, Tennessee	
EQUIPMENT TYPE	Flare	
EVENT	Fire	
PLANT STATUS	Operating	
FATALITIES	1	
INJURIES	2	

LOSS NUMBER EVENT DATE COUNTRY LOCATION EVENT INTERRUPTION	129610 09/03/2012 Venezuela Cardon, Falcon State Mechanical damage 15 days	A 310,000 bpd refinery suffered a complete shutdown following a failure in the instrument air system. The problem required the progressive shutdown of several units following safety routines – eventually forcing the shutdown of all of the refinery units. It was estimated that the plant would be out of service for 15 days. The failure caused minor environmental impact.
LOSS NUMBER EVENT DATE COUNTRY LOCATION UNIT TYPE EQUIPMENT TYPE MATERIAL EVENT PLANT STATUS	129614 19/03/2012 Netherlands Rotterdam Crude distillation Furnace Crude oil Fire Operating	There was a small fire in one of the furnaces of a crude distillation unit on a 400,000 bpd refinery. The company halted crude feed to a furnace at the plant after a small amount of oil leaked following the failure of a furnace.
LOSS NUMBER EVENT DATE COUNTRY LOCATION UNIT TYPE MATERIAL EVENT PLANT STATUS	129615 27/03/2012 United States Texas City, Texas Alkylation Hydrofluoric acid Release Operating	Hydrofluoric acid leaked from a HF Alkylation unit on a 400,000 bpd refinery, triggering alarms in the plant and initiating warnings to area residents. Water cannons surrounding the Alkylation unit were triggered when monitors detected the leak. The workers in the refinery, not immediately concerned with responding to the leak, were ordered to shelter in place. The event did not have an impact on the community. No injuries were reported.
LOSS NUMBER EVENT DATE COUNTRY LOCATION UNIT TYPE EQUIPMENT TYPE MATERIAL EVENT INTERRUPTION	129632 17/02/2012 United States Ferndale, Washington Vacuum distillation Flange Crude oil Fire 60 days	Firefighters extinguished a large fire on a 225,000 bpd refinery. The fire was extinguished after approximately one and a half hours. The fire shut down the sole crude distillation unit on the refinery. All other units were idled in warm standby mode. The fire burned residual oil from the vacuum unit which leaked from a flange in a pipe between a heater and the vacuum unit before igniting. It was expected that the refinery would remain shut for repairs and for other planned maintenance work. The company was unable to restore production by by-passing the vacuum unit due to the extent of the damage caused by the fire. Operations to restart the refinery began within three months and it was reported that it was again running at full capacity two weeks later, with all scheduled maintenance work complete.
LOSS NUMBER EVENT DATE COUNTRY LOCATION UNIT TYPE EVENT FATALITIES INJURIES	129636 22/02/2012 Egypt Suez Lube oil Explosion, fire 5 8	Five workers died as they tried to put out a large fire that erupted on a refinery complex. The fire was reported as starting in an oil separation tank. The area where the workers were standing while fighting the fire in the lubricating oil section collapsed. The fire burned for over two hours before it was extinguished by firefighters.

LOSS NUMBER	129637
EVENT DATE	23/02/2012
COUNTRY	Japan
LOCATION	Mizushima
UNIT TYPE	Alkylation
EQUIPMENT TYPE	Compressor
EVENT	Fire

A fire broke out on the alkylation unit of a refinery resulting product shipments being stopped. It did not however, stop the operation of the 150,000 bpd crude distillation unit. The fire broke out at a compressor of the 9,300 bpd alkylation unit but was extinguished around 20 minutes later. The alkylation unit remained shut for investigation to determine the cause of the fire.

LOSS NUMBER	129638
EVENT DATE	28/02/2012
COUNTRY	United States
LOCATION	Salt Lake City, Utah
EQUIPMENT TYPE	Flare
EVENT	Shut-down
CAUSE	Impact
PLANT STATUS	Operating

Processing on a 49,000 bpd refinery was interrupted after a mechanical excavator hit a flare header forcing an area of the plant to be evacuated. It is understood that the excavator knocked the flare header off a pipe rack.

LOSS NUMBER	129646
EVENT DATE	08/01/2012
COUNTRY	Colombia
LOCATION	Santander department
UNIT TYPE	Building
EQUIPMENT TYPE	Helicopter
EVENT	Collision/impact
INJURIES	4

An air force helicopter crashed into a refinery resulting in minor injuries to four soldiers. The incident occurred as the aircraft approached the area to refuel. The pilot was able to land the helicopter on the roof of a refinery control room. There were no injuries to refinery staff or damage to the installation. Despite the accident, the refinery continued to operate as normal.

LOSS NUMBER	129648
EVENT DATE	01/04/2012
COUNTRY	Venezuela
LOCATION	Anzoategui State
UNIT TYPE	Upgrader
EQUIPMENT TYPE	Vessel
MATERIAL	Crude oil
EVENT	Explosion, fire
CAUSE	Impact
PLANT STATUS	Maintenance
FATALITIES	1
INJURIES	3

Contract welders were carrying out work to install a free water separator in a heavy upgrader on the 190,000 bpd refinery when an explosion and fire caused one fatality and injured three others. It was reported that there was a leak of condensate from a pipe in the upgrader as a result of a machine impact in the area where the welding work was taking place.

LOSS NUMBER	129651
EVENT DATE	04/06/2012
COUNTRY	Romania
LOCATION	Prahova County
EVENT	Explosion
INJURIES	6

Six people were injured in an explosion on a refinery. The explosion was reported to have occurred during the repair of the refinery effluent treatment system.

LOSS NUMBER	129653	An explosion and fire broke out as a result of a leak in the fin-fan cooler area on the hydrocracker of a refinery resulting in flames engulfing some of the plant. Fire tenders from the region responded to fight the fire. The fire was brought under control and no casualties were reported. The hydrocracker and associated hydrogen unit were temporarily shut down.
EVENT DATE	07/04/2012	
COUNTRY	India	
LOCATION	Golaghat, Assam State	
UNIT TYPE	Hydrocracking	
EQUIPMENT TYPE	Fin fan cooler	
EVENT	Explosion, fire	
CAUSE	Leak	
LOSS NUMBER	129655	An explosion occurred in an oil refinery storage tank leading to a major fire. This resulted in one fatality and at least 12 injured people. Fire fighters and the army fought the fire on the refinery that is located close to the centre of the city
EVENT DATE	14/04/2012	
COUNTRY	Egypt	
LOCATION	Suez	
UNIT TYPE	Storage	
EVENT	Explosion, fire	
FATALITIES	1	
INJURIES	12	
LOSS NUMBER	129664	A lightning strike knocked out a compressor in a hydrocracker unit resulting in a small fire that was rapidly extinguished. Black smoke was observed coming from the refinery as a result of release to flares due to disruption to the power supply. The fire was under control in less than 30 minutes. Power was disrupted on the hydrocracker's compressor as a result of the lightning which caused a small fire while the unit was being shut down.
EVENT DATE	20/04/2012	
COUNTRY	United States	
LOCATION	Texas City, Texas	
UNIT TYPE	Hydrocracking	
EQUIPMENT TYPE	Compressor	
EVENT	Fire	
CAUSE	Storm	
LOSS NUMBER	129671	A flash fire occurred in the alkylation unit of a 74,000 bpd refinery resulting in injury to four workers. It was reported that the flash fire caused limited damage to the alkylation unit.
EVENT DATE	08/05/2012	
COUNTRY	United States	
LOCATION	Sinclair, Wyoming	
UNIT TYPE	Alkylation	
EVENT	Fire	
INJURIES	4	
LOSS NUMBER	129672	A crude unit was shut as a result of a fire. The fire was rapidly brought under control and extinguished by the onsite fire response team. A hole was discovered in the crude unit following the fire.
EVENT DATE	09/05/2012	
COUNTRY	United States	
LOCATION	South Philadelphia, Pennsylvania	
UNIT TYPE	Crude distillation	
MATERIAL	Crude oil	
EVENT	Fire	

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