Preventing Major Accidents in the Oil and Gas Industry

Nov 2010

BACKGROUND

The recent Macondo blow out incident in the Gulf of Mexico has brought into sharp focus the need of the oil and gas industry to effectively identify and manage the risk from major accidents. This incident is by no means unique. Over the last 30 years there has been a large fatality accident on average every 2 to 3 years associated with oil and gas offshore operations including:

- 2001 - P36, sinking of semi-submersible, 11 fatalities
- 2005 - Bombay High, ship collision with platform and riser fire, 22 fatalities
- 2007 - Usumacinta, jack up collision with platform, 22 fatalities

Similar events have also occurred on onshore facilities. Recent examples include:

- 2003 - Chongqing, sour gas blow out, 243 fatalities
- 2004 - Skikda, explosion on LNG plant, 27 fatalities
- 2005 - Texas City, explosion on refinery isomerisation unit, 15 fatalities
- 2009 - Nigeria, pipeline explosion, 100 fatalities
- 2009 - Jaipur, explosion in gasoline storage area, 12 fatalities
- 2010 – Congo, gasoline road tanker overturned, 230 fatalities
A number of changes are occurring within the industry impacting the potential consequences and risks of a major accident. These include:

- More severe process conditions - higher temps and pressures
- Larger and more complex facilities
- More inhospitable regimes - deeper waters and colder climates
- Greater financial and resource challenges as competition increases

Support for this is evident in the size of losses suffered by the industry. These have steadily increased over time. For example, an analysis of insurance data by Marsh (100 largest losses) has shown that refinery losses over a 5 year period increased 8 fold between the periods 1975-79 and 2005-09.

**MITIGATION PROCESSES**

If a business is to avoid the severe negative consequences of a major accident, it must have a rigorous process in place to identify major hazards, and assess and manage such risks. There is no "silver bullet" to managing major accident risk. To be successful all the elements of a comprehensive HSE and Operating management system must be in place.

Most companies have adopted a HSE / Operations management approach similar to that described by the Center for Chemical Process Safety (CCPS) – (Guidelines for Risk Based Process Safety pub Wiley 2007). This offers a comprehensive approach with detailed processes and systems covering everything required to deliver good process safety and operational performance.

Within this type of framework, everyone has a role to play in assessing and managing major accident risk, although the roles and emphasis will be different at different levels within the organisation.

At the corporate level, leadership will set the values and culture within the organisation. The primary focus will be on assessing and managing "Group Risks" - those risks which have the potential to severely impact on the reputation and financial performance of the entire company. Group leadership will need to addresses such issues as:

- What is the company policy on major accident risk? What methodology is used to identify and assess major accidents and other Group Risks? What are the company’s criteria on risk tolerability and its approach to residual risk? How are potential conflicts between safety, environmental and financial performance resolved?
- What company strategy should be pursued? What types of business will be pursued, in which regions of the world, when will the company choose to be the operator?
- What governance systems are in place? Are everyone’s roles and responsibilities for process safety clearly defined? Is everyone clear where they are able to make a decision and when it needs to be referred upwards? Is there a formal system for delegation of authority? Is there a route outside of the line where issues of concern can be raised? What is the organisational structure for providing assurance at board level?
- What corporate standards and practices are needed?
- What capability is required across the company both in terms of level of resources and competencies to effectively manage the risks?
How will crisis management and emergency response be organised?

How will the company measure and monitor performance on major accident risk? What group metrics are appropriate?

At the operating level the focus will be on managing day to day activities at a local level. Here risk assessment will be more detailed addressing plant design, construction, operation, modification, maintenance and decommissioning. A variety of techniques will be employed addressing the various stages of an operating plant’s life.

- Design - Are inherently safer design principles being applied? Are Hazard Identification and Hazard and Operability Studies being applied rigorously and do they involve front line operations staff? Is Quantified Risk Assessment being utilised appropriately? Is the Layer of Protection Analysis philosophy logical and are the results being applied to the safety system philosophy? What systems are in place to provide quality assurance of safety studies and safety related decisions?

- Project Development and Construction – Are independent Project Safety Reviews being carried out? Is there a robust prestart up approach in place? Are adequate checks being performed on contractor and supplier activities?

- Operations – Is the Control of Work process effective? Have safe operating limits been established? How good are operating and maintenance procedures? Is key documentation up to date? How is operator competence assessed? Is a process in place to learn from incidents and near misses? How are modifications to the plant, procedures or organisational structure controlled?

**KEY COMPONENTS IN MAJOR ACCIDENT RISK MANAGEMENT**

The steps required for assessing and managing major accident risks are illustrated below:
IMPLEMENTATION CHALLENGES

Many organisations have suffered major accidents despite having clear corporate policies and expectations and good risk mitigation processes and systems. They have been surprised to learn that application in the real operating environment was lacking. To effectively bridge the gap between corporate expectations and on the ground reality it is important that:

- Effective systems and processes are in place which are communicated to and understood by those required to use them
- Compliance with the systems and processes at all levels in the organisation is rewarded
- People, especially at the front line operational level, are involved in a meaningful way in developing the systems and processes
- An attitude is in place which encourages people to indicate when they are concerned and leadership welcomes this and is prepared to address concerns

The importance of the so called "softer" issues relating to people and their attitude to the effective application of the risk mitigation systems and processes has been long recognised, but to date it has proven difficult to assess the health of an organisation in this regard. However, current research has identified a number of characteristics which are common to organisations with a superior track record of successful operation in high hazard environments. These are:

- Preoccupation with Failure – constantly being on the lookout for weak signals especially when things are apparently going well
- Reluctance to Simplify – recognising that systems are complex and that attention needs to be paid to detail if true understanding of previous incidents is to result
- Sensitivity to Operations – recognising that every initiative or idea has the potential to detract from safe operation and being careful to assess the potential impact before creating unnecessary distractions
- Commitment to Resilience – building capability when things are going well so that recovery can be more rapid when incidents or unexpected events occur
- Valuing Expertise - not relying solely on the organisation structure but recognising that expertise in any situation can reside at unexpected levels in the organisation and creating an approach which allows that expertise to be heard however low in the official structures it may be

Understanding what needs to be present for success in these “softer” or cultural dimensions enables assessment of corporate and individual plant capability and helps identify more clearly the gap between expectation and reality.

RPS has been involved in developing and implementing Safety and Hazard Awareness programmes, from Enterprise to Asset level with over 50 clients over the last 10 years. For further information, or to arrange an exploratory conversation with our senior specialists, please contact:

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## APPENDIX

# Major Accident Risk – Assessment and Prevention

At RPS Energy – Downstream we have the breadth and depth of expertise to offer clients a complete risk assessment and mitigation process from strategy and philosophy development to field application and verification.

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Delivering effective major hazard management has never been easy, and the penalties for failure, in terms of impact on people, environment, reputation and finances are becoming more extreme.

Maintaining rigorous processes which identify and mitigate risk and continuously improve operations are consequently now part of the basics for any operator who wishes to run a sustainable business.

RPS brings over 20 years experience in delivering Health, Safety and Environmental (HSE) risk management solutions to the industry. We currently have over 150 professionals working in this sector. We have a specialisation in supporting Enterprises in major hazard management, from corporate to asset level, across Upstream, Midstream and Downstream.

Our expertise is differentiated in that:

- Our people bring many years of deep practical and operational experience - as well as theoretical knowledge and understanding
- We have a truly global reach, with our resources based in the Americas, Europe, and Asia
- We specialise in supporting organisations at all levels in the business from defining high level corporate expectations down to detailed implementation at asset level. We are able to offer a service covering both the strategic and transactional areas
  - We focus on the behavioural and organisational dimensions of hazard prevention in addition to the technical
  - We are totally independent, using a combination of proprietary and best of breed tools.

We have a process to identify, quantify and mitigate major hazards, based on best in class experience from right across the oil industry:

- Firstly, we can help you to identify, assess, quantify and prioritise the key HSE risks that your enterprise faces. This is facilitated by professionals who have many years of practical experience in applying these techniques within the oil and gas sector. We have systems and tools that allow a leadership team to assess the probability and resultant impact of each hazard.
- Next, we can help you develop mitigation strategies for the hazards that are prioritised for action. This covers the full range of solutions including engineering design, operational processes, organisational behaviours, performance management and learning loops.
- Finally, we can support you in the implementation of these strategies. Through the application of specialists in each specific area, we can maximise the chances of each strategy being effectively implemented based on our experience in implementing these changes over multiple assets, companies and periods.

Our Services cover:

- Corporate Risk Strategy Development
- Development of Group Risk Practices
- Independent Peer Reviews
- Facilitation of Risk Workshops
- Organisational Capability
- Behavioural and Cultural Alignment
- Process Safety Training
- Transactional Support (eg QRA’s, Audits, HAZOPs, HAZIDs etc).

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Our Clients

The HSE & Risk Management Group has worked with over 200 oil and gas companies including the majors, independents and National Oil Companies. Some examples of case histories are summarized below:

**Amerada Hess**

- Development of Company Risk Management Strategy & Standards. Facilitated development of the company’s upstream HSE & SR risk management strategy and developed standards to guide implementation - providing ongoing support in implementation.

**BHP Billiton Petroleum**

- Senior management workshops on leadership in HSE & CSR.

**Devon Energy**

- Corporate Risk Management Workshop. Facilitated risk management workshop to provide a rational basis for development of the company’s corporate HSE Management System.

**Saipem**

- Development of the Safety Case for the Scarebeo 6 semi-submersible drilling rig. Undertook hazard analysis and risk assessments of the rig and agreed/assessed mitigation measures – the study was documented as prepared in accordance with the IADC Health, Safety and Environment Case Guidelines for Drilling Contractors.

**Sonatrach**

- Risk analysis program for the BBK/BBKN, Edjelieh Flared Gas Recovery project and Hassi R'Mel Fields in Algeria.

**Cairn Energy**

- Risk assessment of a field development in CB-OS/2 block in Cambay, India.

**Murphy Petroleum**

- Managing risk assessment process during development of the Azzurite Field offshore Congo. The work comprised management of HSSE hazard identification and risk analysis studies, incorporation of mitigation measures into the design and construction of the facilities – providing ongoing support in implementation.

**Centrica Resources**

- Risk management support for Grove Extension Project, UK

- Work has included Hazard Identification and Analysis, HAZOP, FMEA, QRA, Identification of safety critical elements, modification of inspection, maintenance and independent verification scheme, review of maintenance systems, pre start-up reviews and development of a change management process.

**Locations**

Geographically, our consultants have supported clients on both onshore and offshore projects in most regions of the world, as seen in the darker shades of the globe.