9th Biennial International Conference
& Exposition on Petroleum Geophysics

"HYDERABAD 2012"

P-176

# Changing Face of offshore HSE – A case study

***Badal Roy,*** *ONGC*

***Summary***

*ONGC, the multinational hydrocarbon giant of India had its modest beginning in the year 1956. The last fifty years has seen its exponential growth from a small upstream operator to an integrated giant. Major part of ONGC's Oil and gas production is generated from its western offshore fields in the Arabian Sea. The present offshore operation of ONGC also covers fields in the Bay of Bengal.*

*Commercial production from the western offshore fields of ONGC started in the year 1976 with modest facilities and few men. Like every other technology and facility at that stage, HSE was also a low-key affair. Initial period of offshore operations involved a basic focus on safety. Issues concerning Environment and Health were given little weightage. Safety involved checklist based inspections by the onboard safety officers. In a nutshell, the issue of safety lacked systematic approach.*

*A few major accidents spreading over the entire world's offshore E&P operations including that of ONGC and the subsequent enquiries prompted offshore operators to recognize their responsibility towards safe operations for protection of life and property. Over a period of time ONGC also realized the economic, ethical as well as the moral values of loss control. It was recognized that control of loss would have as much effect on the bottom line of the company as increase in production. It was also recognized that losses do not help the company's image, which is of significant importance while stepping out into the global scenario.*

*As a result, the turn of the century has seen a paradigm shift in the way ONGC deals with HSE issues. Rapid developments have been witnessed in the last few years in the field of HSE in ONGC in general and in offshore operations in particular. The change from Safety to HSE and the rising commitment to systematic management has changed the face of HSE in ONGC's offshore operations.*

*ONGC has managed to emerge stronger from the few major mishaps it had to face in the recent past. The mishaps have acted as significant lessons in the development of the organization. They have spurred the organization into raising the bar for its HSE performance and bringing in vast improvements in the way it operates.*

*This paper discusses the various developments made in ONGC's offshore activities and its present position in the field of HSE.*

## Introduction

Oceans cover 75% of the earth's surface so it is no surprise that today, 60% of the world's petroleum production comes from offshore operations in waters of more than half the coastal nations on earth.

Oil and gas production from offshore wells dates back to 1887 when an enterprising Californian named H L Williams drilled the first offshore well using a rig erected on a wharf extending 300 feet into the Pacific Ocean. This started a new and significant phase in the history of hydrocarbon industry, which has not looked back since. Kerr-McGee Corporation drilled the first well from a fixed platform offshore, out-of-sight of land in 1947. This event marked the

*Neelam & Heera Asset ONGC, Mumbai*
*i.badalroy@gmail.com*

beginning of the modern offshore industry, as it is known today. By 1949, 11 fields were found in the Gulf of Mexico with 44 exploratory wells. The 1958 Geneva Convention gave rights to the nations to develop and exploit - along with other resources, petroleum resources from the continental shelves adjacent to their coast. Today activities involving exploration and production of hydrocarbon are being carried in the waters of more than half the coastal nations of the world. Over the years there has been a tremendous advancement in technology and the techniques of exploration and production have taken rapid strides. Increasing price of hydrocarbons and the consequent economics is pushing mankind into deeper waters and throwing up new challenges every day.

The major player in the Indian offshore hydrocarbon Industry is ONGC. ONGC, the National Oil and Gas Company of India had its beginning in the year 1956. Oil and Natural Gas Corporation - as it was christened at that time – had its initial forays on land. However, it quickly set its sight on offshore fields and in 1963 deployed 'SS Mahindra' in the western offshore for experimental seismic survey. This was followed by more reconnaissance surveys and drilling of the first exploratory well by 'Sagar Samrat' was started on 30th January 1974. Within three weeks ONGC tasted its first success. More intense exploration followed, resulting in more discoveries and the year 1976 saw ONGC start its first barrel of commercial oil production. Today ONGC is the only integrated oil and Gas Company of India involved in complete chain of activities of hydrocarbon value addition from exploration to marketing of finished and value added products. In addition to the western offshore fields in the Arabian Sea, ONGC's offshore activities have now been extended to the eastern coast in the Bay of Bengal. It is now venturing into greater water depths to exploit the deep-sea fields.

**HSE in Offshore – Global Scenario**

The economic significance of hydrocarbon industry was recognized early as the revenues generated through oil and gas became major inputs in the financial resources of the countries. As a result of this, laws addressing title, ownership and jurisdictions over continental shelves were formulated. The initial focus in the offshore hydrocarbon industry was on ownership and jurisdictions and little was thought about Safety or Environment. The Santa Barbara Oil spill in 1967 prompted the US Congress to introduce the National Environment Policy act followed by the Clean Air Act, Coastal Zone Management Act and Clean Water Act. International convention for the prevention of pollution of the sea by oil in 1954 was the first multinational instrument to be concluded with the prime objective of protecting the environment and preserving the seas and the coastal environment from pollution.

With time, most of the governments, either on their own, or through conventions started addressing the issues of environmental protection. However, safety remained an issue that was mostly practiced by self-regulation, and was not given as much importance as it deserved. Some serious accidents across the globe in hydrocarbon and other industries made companies sit up and think about safety of life and property. Various types of accidents cutting across industries have witnessed huge amount of property loss and casualties. Some major disasters like FLEXIBOROUGH disaster, BLEVE (Boiling Liquid Expanding Vapor Explosion) at Mexico City, MIC leak at Bhopal, Sandoz Warehouse fire - 1986, Chernobyl, Radioactive release - 1986, Seveso Toxic Release Dioxin - 1976, Pasedena VCE HC/H2 Mixture-1989 and the fire at PIPER ALPHA platform in North Sea had very severe consequences on the industries as well as the society. Capsizing of ships in the high seas due to various reasons has also

resulted in a huge amount of release of oil in to the sea.

Piper Alpha disaster on 6th and 7th, July 1988 in the North Sea drew the attention of oil and gas industry and governments, to the extent of destruction that can be caused by the devastating energy and explosive power of hydrocarbon inventories in offshore oil & gas production facilities and pipelines. Out of 226 persons on board Piper Alpha, 165 lost their lives. M/S Occidental operated the platform and the facilities came under the purview of British Legislation. The public inquiry that followed was headed by Lord Cullen and was the longest in British history. The 500-page report published in November 1990, made 106 recommendations. Lord Cullen made it clear that the responsibility for safety, first and foremost, lies with the operators. Requirement of Safety Case for all installations to demonstrate that the arrangements for safe operations are adequate and that certain safety objectives have been met was deemed mandatory. He opined that Safety Case preparation should adopt an integrated approach to risk assessment and management of safety and the risk to persons from major hazards should be reduced to the lowest levels 'Reasonably Practicable'. `Reasonably practicable' requires conducting a cost benefit analysis for a risk. The Safety Case is required to be submitted for acceptance to the regulatory authority. Major hazards need to be identified and risk evaluated through Quantified Risk Assessment (QRA) in conjunction with sound engineering judgment. The results can be used to bring about changes in safety management system to reduce the risk. Equivalent changes were brought about in USA, Canada and Norwegian regulations. In the year 1993, American Petroleum Institute (API) issued Recommended Practice (API RP - 75) titled `Recommended Practice for Development of a Safety and Environmental Management Program for Outer Continental Shelf (OCS) Operations and Facilities' and Recommended Practice (API RP)-14J titled `Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities'. These two documents address the basic concerns of Lord Cullen. Peter Velez, API executive committee Chairman on Drilling and production operation has studied on industry standards results in improved offshore safety and concluded that frequently updated standards, improved technology training and better communication lowered offshore illness/injury rates by 49% in USA.

The Piper Alfa disaster is considered to be a watershed event in the offshore hydrocarbon industry. The disaster and the following enquiry report drastically changed the approach of offshore operators towards HSE. The spate of regulations that followed added to the safety of operations in the offshore fields. The realities of an actual disaster dawned upon people and there was a serious attempt to reduce work place risks to minimum possible levels.

Few more recent major incidents in international and national operations like the Gulf of Mexico oil spillage and the Jaipur fire has galvanized the authorities in stringent implementation of the HSE norms in E&P operations. This has also increased the responsibility of the operators in ensuring that all operations are carried out in safe manner not only for the safety of the workers and stakeholders but also for sustaining the company's bottom line and reputation.

**ONGC's Western offshore operations and Development of HSE**

ONGC's offshore operations started with one survey vessel in 1963. Over the years ONGC has increased its offshore operations manifold in terms of area, water depth, facilities and equipment. The operations of western offshore of ONGC are mainly off the Mumbai coast and extend from 100 Km Northwest to

70 Km South west of Mumbai. The water depth is up to 80 Meters. In addition to this, ONGC's offshore operations have also spread to east coast in the Bay of Bengal. Like other operators from rest of the world, to begin with, ONGC's focus on HSE was also a low-key affair. Barring a few environmental regulations, ONGC's operations in the western offshore were largely based on self-regulation.

After the initial discovery of hydrocarbons in the western offshore fields of India, ONGC developed its facilities for exploration and production at a very rapid rate. New rigs, process platforms, well platforms and pipelines for carrying the products were built at speeds unprecedented in the Indian industry. It is proved by the fact that at one time in the year 1993, twenty five different installation and pipe laying barges worked simultaneously in the western offshore fields of ONGC and carried out over 100,000 tons of cumulative structural installation work and laid more than 500 Kms of pipeline. Most of the activities carried out during the initial development of the facilities including installation of platforms, were carried out by international contractors who took care of safety issues relating to their work as per their own standards. The equipments and facilities being installed complied with international standards for offshore petroleum industry. ONGC adopted basic guidelines for offshore operations from international sources like SOLAS and IMO as a process of self-regulation. Implementation of HSE was initially limited to basic inspection based on checklists, which lacked systemic approach.

July 30, 1982 saw the first major accident in the history of ONGC's offshore operations when there was a blow out on the rig 'Sagar Vikas' which led to a fire. All the 74 personnel on board were evacuated but the rig suffered extensive damage. The well was capped 42 days after it went out of control.

The 'Sagar Vikas' disaster, a main oil trunk line rupture, and few more accidents and near misses combined with increasing experience in offshore operations and exposure to international operations and incidents prompted ONGC to sit up and take a good, hard look at the status of HSE in its offshore operations. 'Code of Safe Practices' for various operations was developed and issued by in-house experts of ONGC based on international codes and practices. ONGC's 'Institute of Engineering and Ocean Technology' started the work of Risk Analysis for offshore operations. These were the first positive steps towards formal systematic HSE approach. Meanwhile, other areas related to HSE were also given due attention. In 1993, ONGC took a major step in improving its communication network. Communication and Navigational equipment were installed in offshore installations to meet 'Global Maritime Distress safety System' requirement and VHF (Marine) Radio sets installed.

The focus on safety issues started bearing fruit very soon. There was an increase in safety awareness and reduction in number of incidents. The visible and effective change in the safety culture did not go unnoticed. Mumbai Region, under which the offshore operations are carried out, bagged OISD and Gujarat Safety Council Awards for best overall safety performance in the year 1996-97.

In the quest for a systematic management system for safety, which could work as benchmark for its performance, ONGC adopted DNV's ISRS based Safety Management System for some of its work centers. 'SH Process Complex' and 'Sagar Pragati' Drilling rig got certified for level-4 of ISRS in the year 1998-99. A few process complexes also went in for third party certification of their topside facilities and acquired certificate of fitness for them. In the same year QAD section of Mumbai region acquired ISO- 9002 certification for its Quality Management System. The era of Systematic Management of HSE in ONGC's offshore operations had finally arrived.

**Y2K- The Paradigm Shift**

The turn of the century has seen a paradigm shift in ONGC's approach towards HSE. There were a few major factors, which influenced this shift. These were

- ONGC's Shift from being a national to a multinational operator.
- Growing awareness and concern over HSE issues in international hydrocarbon industry.
- Increasing cost of Insurance for ONGC's Assets.
- Growing stress on environment protection throughout the world.
- Shift in ONGC management's viewpoint on the significance of HSE.

ONGC's forays into the international markets exposed it to the ways the other multinationals operate and also to the priorities in business of hydrocarbon industry. It soon realized that control of loss was as important for maintenance of the bottom line of the organization as increase in production. It also realized that, to make its presence felt in the international market it was imperative to maintain a good image of the company and suffering losses does not help that cause. Therefore good HSE meant good business.

In the early 2000 ONGC embarked upon massive exercise in order to overhaul its HSE performance. The first step was to shift from Safety to HSE. In all the years that ONGC developed its offshore activities, it took considerable efforts in improvement of Safety. However, precious little was done for environment protection.

The development and operational activities in the offshore fields in the Continental shelf and maritime zone of India is controlled by the regulations formulated by the Ministry of Environment and Forest, Government of India. It is mandatory for the companies operating within the territorial waters of India to obtain a permit to operate from The MOEF. The permit stipulates that half yearly returns related to environmental performance be submitted to the ministry. Stepping into the new century, it was decided by ONGC management that, as responsible citizens of the world it was their duty to contribute positively towards environment protection. It decided that something beyond compliance to regulatory requirements needed to be done. Keeping this in mind, ONGC looked for some self regulatory mechanism which would not only help them fulfill their requirement of environment protection, but would also allow them to demonstrate to rest of the world, their performance in doing so and benchmark their performance at par with the best in the world. As a result, Environment Management System based on ISO 14001 was developed and implemented by some of the offshore process complexes like ICP. Certificate for compliance for the same were obtained through reputed international auditors.

Certification for compliance to ISM code was made mandatory for all MODUs in line with requirements of IMO and all of them obtained the required certification.

In the year 2001 ONGC carried out comprehensive HSE audits of all its offshore facilities through its own 'Institute of Oil and Gas Production Technology'. This was followed by a third party audit of all offshore facilities, which was carried out by internationally reputed auditors. This gigantic exercise was aimed at finding the factual status of HSE performance and practices on the offshore facilities and taking corrective actions wherever required. The audits were successful in identifying issues that required attention. This was the first time in the history of ONGC that such a huge job of auditing was undertaken in the western offshore fields. The audits were in direct focus of the top

Management. Hence, the recommendations were immediately complied with. This exercise and the follow up helped in a big way in raising the base level of HSE preparedness in the offshore operations.

With the Management showing its inclination in overhauling the HSE set up in the organization, HSE became the buzzword in ONGC. HSE heads of work centers were provided with elevated status in the hierarchy of the organization. Personnel holding HSE responsibilities were provided with internationally recognized exclusive trainings. The change in the HSE culture was beginning to shape up.

By early 2000 a large number of offshore platforms had already been functioning for considerable length of time and integrity of their topside facilities needed to be reexamined. During the year 2001-02 most of the offshore process complexes got their topside facilities inspected and recertified for fitness through reputed international agencies.

In the year 2001 Neelam and Heera Asset in the Western Offshore developed and implemented an Integrated Quality, Health, Safety and Environment Management System based on ISO 9001, ISO 14001 and OHSAS 18001. The same was audited and certified by one of the most reputed international agencies. The success of the integrated management system clearly reflected in the changed HSE culture of the Asset, which was acknowledged by the international Risk surveyors. This turned out to be one of the most significant steps towards systematic HSE Management in the History of ONGC. Convinced by the success of the Integrated Management System Model, ONGC decided to roll it out to the operations of the entire Organization. This was to replace the different kinds of Management systems based on different protocols being practiced at various work centers.

March 2005 saw ONGC becoming perhaps the only Organization in the world to have had their entire facilities certified for compliance to ISO, 9001, ISO 14001 and OHSAS 18001. The humungous exercise involved attaining more than 1200 certifications spread over more than 400 work centers all over the country.

The wind of change in the HSE scenario in the Organization has brought about a perceptible improvement in HSE culture. This is reflected in improvement in its HSE performance. Reportable accidents in offshore operations went down from 119 in the year 2004-05 to 28 in the year 2010-11. This was achieved in spite of the activities in offshore increasing manifold due to various redevelopment and revamping projects taken up by ONGC which involved a large number of contractual workers being engaged for work.

The concerted focus on effective Management of HSE as a responsible company and the endeavor to attain world class levels on self commitment found ONGC in an advantageous position when regulations were first introduced in India for offshore E&P operations in the year 2008 by Government of India in the form of 'Petroleum and Natural gas (safety in offshore operations) Rules 2008.' It was found that ONGC was already following most of the things as required by the regulations which are at par with most of the international regulations. This was an additional recognition of the steps taken by ONGC Management over the years in offshore to ensure safe operations even when no regulations were applicable for their operations.

The overwhelming recognition of the changing face of HSE in the offshore operations of ONGC by the International Risk Surveyors, who assess the organization's HSE performance in offshore annually for the purpose of insurance of the offshore Assets, is evident from their comments on risk perception levels of these operations over the years. From a

level in the year 2000 when the Risk surveyors while commenting on the risk perception level of ONGC,s offshore operations, opined that 'Safety Management system in ONGC's offshore operations does not even merit risk evaluation' it advanced to a level in 2005 when their assessment found 'Improvement in Asset protection and Safety culture' and gave a rating of 'Acceptable'. Moving further, the comments of the Risk Surveyors after the 2010 Audits was that "The condition of the Complexes in ONGC's western offshore field were comparable with that of installations in Europe and no unacceptable risks were identified." In real terms these has translated into reduction of insurance premium from a level of $US50.47mn for the year 2002-03 to $US27.7mn for the year 2011-12 in spite o the total Asset value increasing from US$15.89 Bn to US$27.55 Bn.

**Commitment to continuance**

The present operations of ONGC in the offshore involves operation of

- Drill Ships / Jack up Rigs 39
- Well platforms 162
- Process Complex 12
- Offshore Supply Vessel/ Multi Support Vessel 62

More than 4000 personnel are involved in round the clock activities of exploration, drilling and production operations of Oil and Gas from more than 1400 wells. About 5000 Km of pipeline crisscrosses through the entire field. To maintain effective HSE Management under such conditions is a daunting task. ONGC Management is committed to minimize any kind of loss during the operations and is relentlessly perusing ways and means to fulfill this commitment.

ONGC has recognized the edge provided by well-trained employees in carrying out safe and effective work. ONGC has identified four training courses namely, Survival at Sea training, Helicopter underwater egress training, basic fire fighting training and first aid training as mandatory training for all offshore going personnel including the contractors. ONGC is perhaps among few Organizations that have an Institute of their own for imparting training exclusively on HSE. 'The Institute of Petroleum Safety Health & Environment Management' (IPSHEM) at Goa is equipped with the best facilities and Faculty for imparting training on diversified HSE fields. All the mandatory training courses are organized by this institute. Over 3000 personnel from ONGC and other industries are trained in the institute every year. The offshore Survival and Fire fighting courses provided by IPSHEM have been very helpful in controlling loss during various emergencies. In its effort to improve upon its standard of training and include international best practices in its curriculum and exchange of ideas IPSHEM has gone in to collaboration with internationally reputed institutes.

The pursuit for excellence in the field of HSE continues in ONGC and new and significant strides are taken every day. Some of the systems that ONGC has adopted and are actively practicing are as follows.

- Third party Certification of topside facilities and underwater structures for all platforms and Class certification of all mobile offshore drilling units and vessels.
- Carrying out Environmental Impact Assessment and QRA for all projects.
- Implementation of new projects like ICE (Information Consolidation for Efficiency), IMPETUS (Implementation, Maintenance and Procurement Efforts Through Upgraded Systems, PROMISE (Professional review of

Major Information, Communication systems and Equipment).

- SAP based reporting and monitoring of all accidents, near misses, audits and other HSE parameters.
- Third party Certification for platform stability before rig deployment.
- Review of sustained casing Pressure.
- Refurbishment of well control equipment through OEM.
- Turnaround shut down policy.
- Management of Change procedures
- Simultaneous Operations Procedures
- Marine operations Procedure
- Long-term maintenance policy for rotary equipment.
- Corrosion Monitoring
- Revamping and replacement policy.
- Inspection and Reporting Requirements for process and well head platforms, pipelines and sub- sea structures.
- Integrated contract for platform repair and maintenance.
- Permit to work
- Emergency Response and Disaster Management Plans and Drills.
- Tie up with Boots and Coots for Blow out Management.
- Own capability for combating Tier I oil spills and Membership of Oil spill response UK for larger spills.
- VATMS system for monitoring movement of vessels and aircraft in the field.
- Helicopter operations under improved AS-4 standards
- Standardization of systems and practices.

ONGC has managed to emerge stronger from the few major mishaps it had to face in the recent past. The mishaps have acted as significant lessons in the development of the organization. They have spurred the organization into raising the bar for its HSE performance and bringing in vast improvements in the way it operates.

The Regional contingency Plan for managing disasters has been revised. Standard Operating procedure for Marine Operations has been introduced and there has been particular focus on safe helicopter operations with introduction of international safe practices in consultation with DGCA.

Today there is particular emphasis on disseminating all information right up to the grass root level and ensuring that persons involved directly with the offshore operations understand and implement procedures and practices in line with international norms.

**Conclusion**

Notwithstanding a few major mishaps that ONGC had to suffer in the past, its commitment to develop itself as one of the best in the industry in the field of HSE continues. Taking positive lessons from the few national and international incidents in the industry, ONGC is continuing in the quest for excellence. With Assets close to $US 30Bn without considering the wells, in western offshore, and developing new Assets in the eastern offshore, ONGC has earmarked more than $US1000Mn for revamp and replacement of its ageing process complexes, rigs and pipelines in the next few years. The underlining driving force for its relentless pursuit for excellence in the field of HSE is derived from one of its corporate missions that of ‘ABIDING COMMITMENT TO HEALTH, SAFETY AND ENVIRONMENT TO ENRICH QUALITY OF COMMUNITY LIFE.’