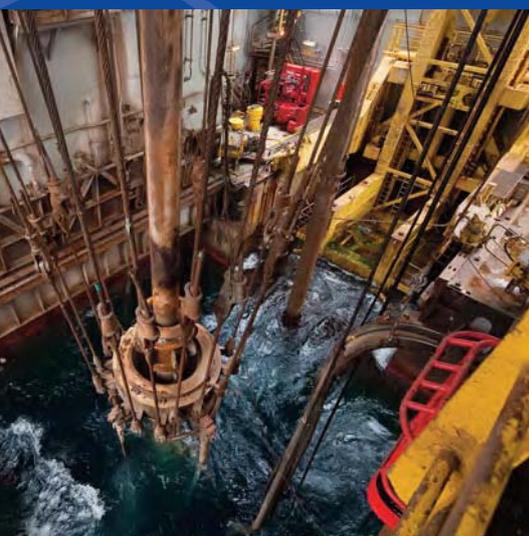




International
Association
of Oil & Gas
Producers



Deepwater Wells

Global Industry Response Group recommendations

Report No. 463

May 2011

OGP Vision, Mission and Objectives

Vision

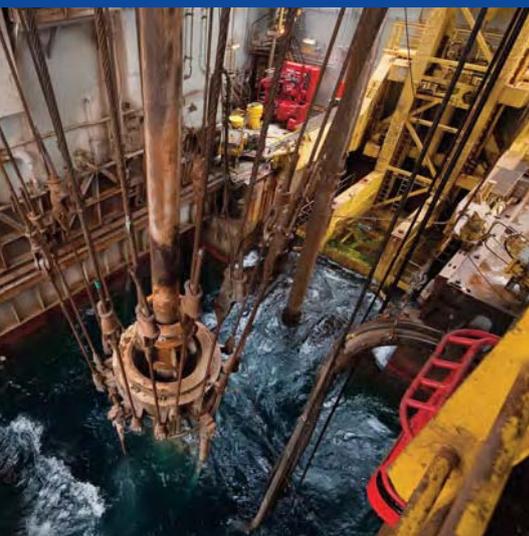
To work on behalf of the world's oil and gas exploration and production (E&P) companies to promote safe, responsible, and sustainable operations.

Mission

- To facilitate continuous improvement in HSE, security, social responsibility, engineering and operations.
 - To undertake special projects and develop industry positions on critical issues affecting the industry.
 - To create alignment between oil & gas E&P companies and with relevant national and international industry associations.
 - To advance the views and positions of oil & gas E&P companies to international regulators, legislative bodies and other relevant stakeholders.
 - To provide a forum for sharing experiences, debating emerging issues and establishing common ground to promote cooperation, consistency and effectiveness.
-

Objectives

- To improve understanding of our industry by being a visible, accessible, reliable and credible source of information.
 - To represent and advocate industry views by developing effective proposals based on professionally established technical arguments in a societal context.
 - To improve the collection, analysis and dissemination of data on HSE and security performance.
 - To develop and disseminate good practice in HSE, security, engineering and operations continually improved by feedback from members, regulators and other stakeholders.
 - To promote awareness and good practice in social responsibility and sustainability.
 - To ensure that the membership is highly representative of our industry.
-



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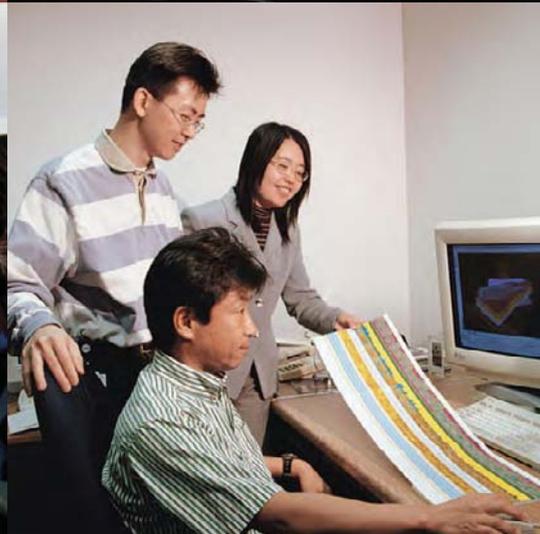
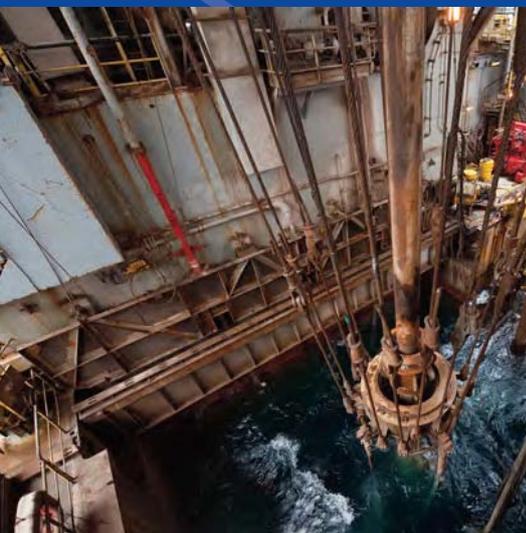
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The Global Industry Response Group (GIRG) was not tasked with determining or reaching conclusions as to the facts or possible causes of any of the accidents considered during its work; nor was the GIRG tasked with assessing or expressing views as to the robustness of current processes, procedures or management systems in relation to any specific incidents, or the extent or quality of adherence to them, whether in relation to any of the incidents considered or across industry more generally. Accordingly, the GIRG did not attempt to do so, and nothing in this document is intended to be read to suggest otherwise. As regards the Deepwater Horizon accident, governmental investigations or inquiries remain ongoing, and anything in this document relating to that accident must be considered as subject to revision in light of further information.

This document includes statements relating to future events but actual events may differ materially from what is expressed in such statements and these statements are therefore not guarantees of future performance and may involve uncertainties and assumptions that are difficult to predict, such as operational hazards and drilling risks, technical difficulties, changes in environmental and other laws, etc.





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Executive Summary

The International Association of Oil & Gas Producers (OGP) formed the Global Industry Response Group (GIRG) in July 2010 in the aftermath of the tragic accidents in the Gulf of Mexico on the Macondo prospect, Montara in Australia, and other similar accidents. Previously, the oil and gas industry had drilled more than 14,000 deepwater wells around the world without major incident but, this history notwithstanding, the Macondo and Montara accidents were a reminder of the risks inherent in such operations.



1.0 Introduction

GIRG aimed to ensure that the lessons learned from Macondo, Montara and other accidents are applied around the world. To do that, part of GIRG's remit is to monitor and collate the outcomes of the official Macondo and Montara accident investigations. This process is helping to identify and answer other questions about Macondo, Montara and other deepwater operations.

GIRG is working in three areas:

- Prevention: developing better capabilities and practice in well engineering design and well operations management in order to reduce the likelihood of future incidents;
- Intervention: improving well capping response readiness (in the event of an incident) and to undertake further studies into potential containment solutions;
- Response: delivering effective and fit-for-purpose oil spill response preparedness and capability.

OGP formed three teams of technical experts to address these objectives: Well Engineering Design and Equipment/Operating Procedures; Capping and Containment; and Oil Spill Response. Each team has prepared a report documenting its work in support of GIRG's objectives. This report documents the conclusions and recommendations of the Well Engineering Design & Equipment/Operating Procedures Team (the Team).

GIRG consisted of technical specialists and managers from OGP's member companies around the world and associated national offshore industry bodies. Their role was to consider what lessons may be learned from the occurrence of the Deepwater Horizon, Montara and other accidents, and to make recommendations to OGP's membership and beyond.

The wider purpose of the GIRG and reports such as this one is to review all lessons learned from various accidents, foster continuous improvements in industry practices and promote the appropriate standards for safe extraction of oil and gas.

The sub-groups' approach is based primarily on factual analysis of potential failure scenarios. Our workgroups have looked in particular at well engineering design and management processes and the leadership and training of industry personnel and management. They also looked at

BOP design and operability in association with the IADC. However, at the time of writing, not every report relating to these incidents has been published and, therefore, the teams were unable to incorporate their recommendations in full but will in time.

Although the Deepwater Horizon accident has provided a context and stimulus to our work, a number of other incidents were also reviewed. The recommendations are not based on a determination of, or conclusions about, the specific facts or possible causes of the Deepwater Horizon, Montara and other accidents; rather they are largely based on the sub-groups' deep knowledge of the industry and many years of experience dealing with drilling contractors, regulators and trade associations. This helps to make the recommendations as relevant and current as possible.

Complementary to this collective work and against this backdrop, OGP member companies have also challenged their own procedures and practices, with a significant focus placed on prevention.

The aftermath of the Deepwater Horizon and Montara accidents provides a opportunity for OGP to promote international standards and to encourage its members to commit to meet or exceed these standards. Although this report contains recommendations, OGP recognises that there may be other, equally suitable ways of addressing the risks to which those recommendations relate.

We encourage all OGP member companies and associated members to map their practices against the recommended practices of this report. We also encourage them to share lessons and data from all well incidents in a formalised way so that the industry can improve well control performance and equipment integrity.

The recommendations that follow, focusing on contractors, service companies and operators, apply only to the design and operation of subsea wells, with an emphasis on deep water wells.

Whilst all risk of losing control of a well cannot be eliminated, many subsea wells can be designed to withstand well incidents ensuring they can be capped to prevent or minimise the leaking of hydrocarbons.



1.1 Key Recommendations

This Team's work focused on design, procedures and well operation management improvement and governance and risk management standardisation, with a view to promoting a consistent approach to adherence to applicable standards.

In order to achieve the above the Team makes the following six key recommendations:

A 3-tier review process

Prevention and resilience begins with three levels of review to further assure that a company is adhering to its own processes and procedures within the framework defined by the local regulator. These three levels are:

- Operators and contractors carrying out regular and meaningful audits of themselves and their associated operators, contractors and service providers to verify adherence to applicable standards, processes and procedures, including technical audits of all well control equipment and personnel competency.
- Operators and contractors are encouraged to promote independent oversight of the well design and well procedures, both prior to and during day-to-day construction activities, by establishing clear monitoring and verification processes to assure adherence to applicable procedures and standards. Our recommendation is that such processes are implemented by an engineer or engineers (either in-house or third party) who is independent of the project and that any material changes to the design or procedures are also subject to such independent oversight. However, it is important to manage priorities according to available skills and it is recognised that at this time there is across the industry a shortage of suitable candidates for these positions. Therefore companies implementing this recommendation are encouraged to give priority to completing this level of assurance for deepwater, HPHT and other high risk wells until such time as these resources can be developed and deployed more widely within the industry.

- The third level can be provided by the regulator undertaking robust and meaningful inspections of all operations to assess adherence to applicable local regulations.

The promotion of human competency management systems so that individual staff and staff teams have the skills they need as well as the ability to appreciate the risks

- We recommend that operators and contractors implement a formalised competency management system (CMS), that identifies key personnel and verifies that they have, or provides them with, the necessary well control knowledge and experience necessary for their role.
- We recommend that the industry trains all relevant personnel – from the rig floor, to those in command – to look for anomalous and unexpected information that may have a bearing on well integrity or well control, to question and be prepared to stop operations if the information or situation is unclear, and to prepare ahead of time for unfavourable and unexpected events. Industry training should teach personnel with well control responsibilities to err on the side of caution and to secure the well and stop work whenever there is any uncertainty about the integrity of the well or the interpretation of well bore integrity data.

Recognition of existing national and international standards as the baseline for industry improvement (eg API, NORSOK and ISO standards)

- We recommend that, where appropriate, nationally approved practices and standards on subsea well design and Blowout Preventer (BOP) equipment are used as a basis for continuous industry improvement with additional GIRG recommendations.

1.1 Key Recommendations

continued

Improved technical and operational practice for the overall governance of well construction

- We recommend that operators and contractors have a well management system with a management of change process, using API RP 75¹ principles (or equivalent principles) at a minimum, as a reference for all operations, covering the full life cycle of the well.
- We encourage operators and contractors to have a ‘technical authority’ (to organise, manage and maintain the organisation’s in-house practices relating to well design, construction and management) and a technical assurance process.
- We recommend that a bridging document, describing the chain of command and agreed procedures for well control operations and emergency response, is agreed and put in place between the operator and the drilling contractor.

A “two (independent and physical) barrier policy”

- We recommend that operators maintain a permanently applied minimum of two well barriers when the well is capable of discharging hydrocarbons or other fluids to the surface or external environment². In situations where two barriers are not feasible companies are recommended to design alternative control procedures
- During the drilling, completion, and abandonment phases of a well we regard a BOP as a barrier for the purposes of such a policy even when operated in the open position – if the BOP and associated procedures meet the operator’s policy in respect of the following matters:
 - configuration and certification;
 - redundancy for the operations being undertaken;
 - function and pressure testing; and
 - operational controls to use the BOP to shut in the well.

Creation of a new, permanent Wells Expert Committee (WEC) to share industry learnings by analysing incidents, advocating harmonised standards, communicating good practice and promoting continued R&D

- We recommend the establishment of a new, permanent Wells Expert Committee for the above purposes.
- Its primary tasks will be to:
 - Define the scope of a centralised database of selected well incidents (see below)
 - Work with API and manufacturers to identify R&D and technological needs
 - Influence and renew API, ISO and other industry standards
 - Provide input for regulators to help on regulatory change
 - Liaise with similar bodies covered by NOIAs
 - Steer a task force to upgrade competency management and ensure well control training institutions and maintenance staff training programmes benefit from incidents learning
 - Produce an OGP guide of technical and managerial recommendations based on the findings of the GIRG work, after consultation with the full OGP membership, regulators and including the final findings of the Macondo and Montara accident investigations

¹ *Recommended Practice for Development of a Safety and Environmental Management Program for Offshore Operations and Facilities*

² *Includes other fluids and non-hydrocarbons (e.g. mud)*

1.1 Key Recommendations

continued

For full details of WEC’s terms of reference, please see Appendix B).

- WEC will also encourage OGP member companies to share lessons and data from selected well control and operational events so that the industry can continue to improve its well operations. A secure database with this information could be used to identify repeat events and common potential weaknesses that the industry can focus on.

- In order for this database to be as useful as possible, WEC will encourage all companies to securely declare to an elected Third Party all agreed types of incidents as swiftly as possible. These submissions would be categorised and reviewed by the WEC who would be able to produce practical guidance to be fed back to the industry.
- To the extent possible, the analysis and classification methodology should be common to all national and international initiatives. It is suggested that OGP could promote, coordinate and manage this process.

Industry improvement through sharing and learning from high potential wells incidents

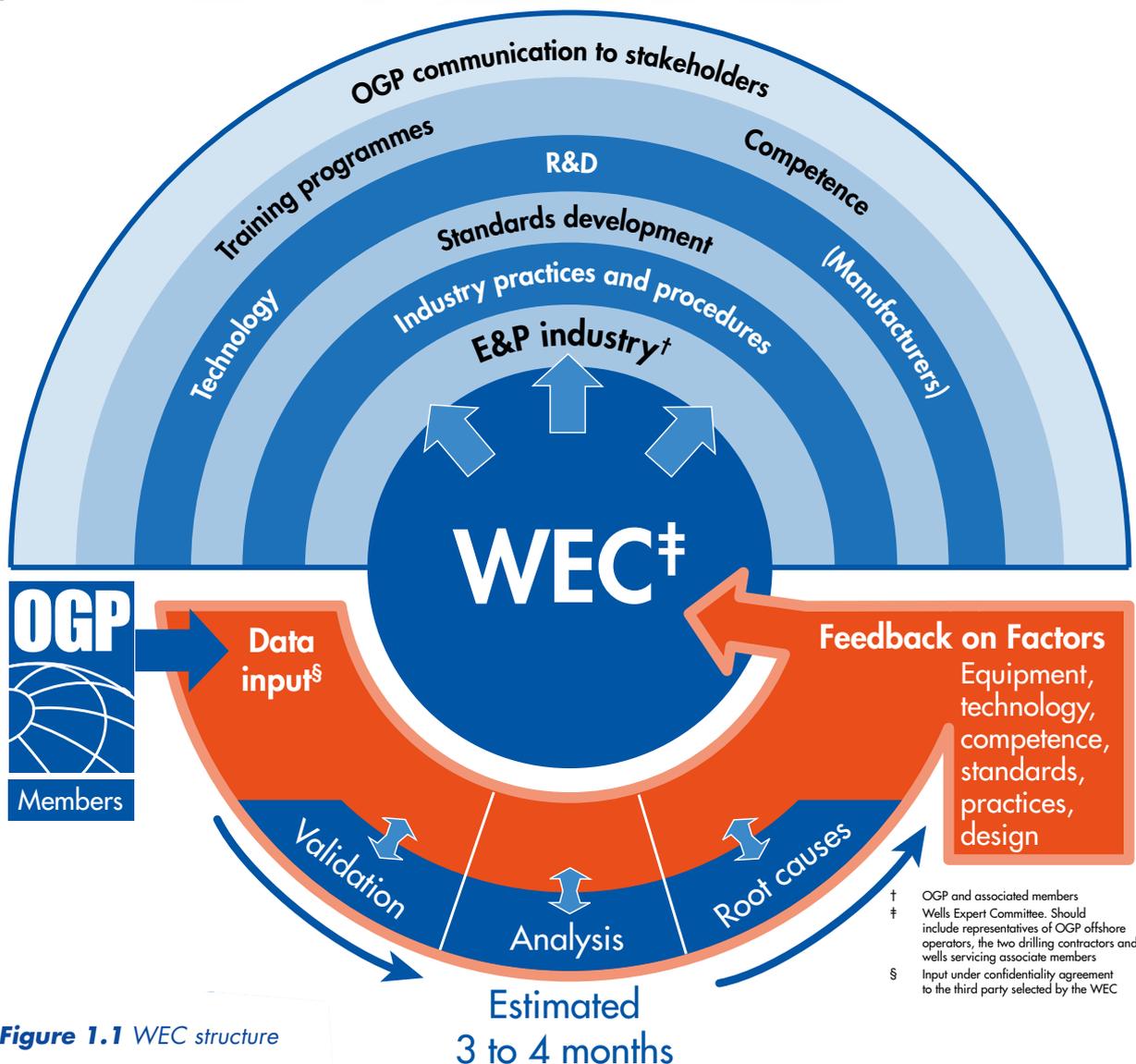


Figure 1.1 WEC structure

2.0 Background and Context

2.1 OGP and GIRG

The International Association of Oil & Gas Producers (OGP), announced the formation of a Global Industry Response Group (GIRG) on the 14th of July 2010. The overall objective of OGP GIRG was to discuss and devise practices to:

- (a) Improve drilling safety and reduce likelihood of a well incident
- (b) Decrease the time it takes to stop the flow from an uncontrolled well
- (c) Improve both subsurface and surface response capabilities

GIRG did this by identifying and gathering work being done by OGP's member companies and associations, and national regulators, in response to the Macondo and Montara accidents and other well incidents.

After the announcement of the plan to develop a Marine Well Containment System (MWCS) for the Gulf of Mexico, other oil and gas companies, governments and authorities raised questions on the potential need for and desire to have similar capability available in different regions around the world.

Some individual initiatives had already started among operators and national associations, and some coordination was needed between these initiatives.

GIRG was tasked to examine improvements to the industry's capability to prevent and respond to a major well incident.

2.2 Structure of GIRG and setup of Sub-Groups

In order to achieve these objectives, three separate GIRG sub-groups were established to focus on Prevention (Well Engineering Design & Equipment/Operating Procedures Team), Intervention (Capping & Containment Team), and Response (Oil Spill Response Team).

Prevention is the most effective way to reduce the risks from well control events, and remains a primary focus for the industry's work. Improvements to oil spill response, and capping and containment, could reduce the consequences of an event.

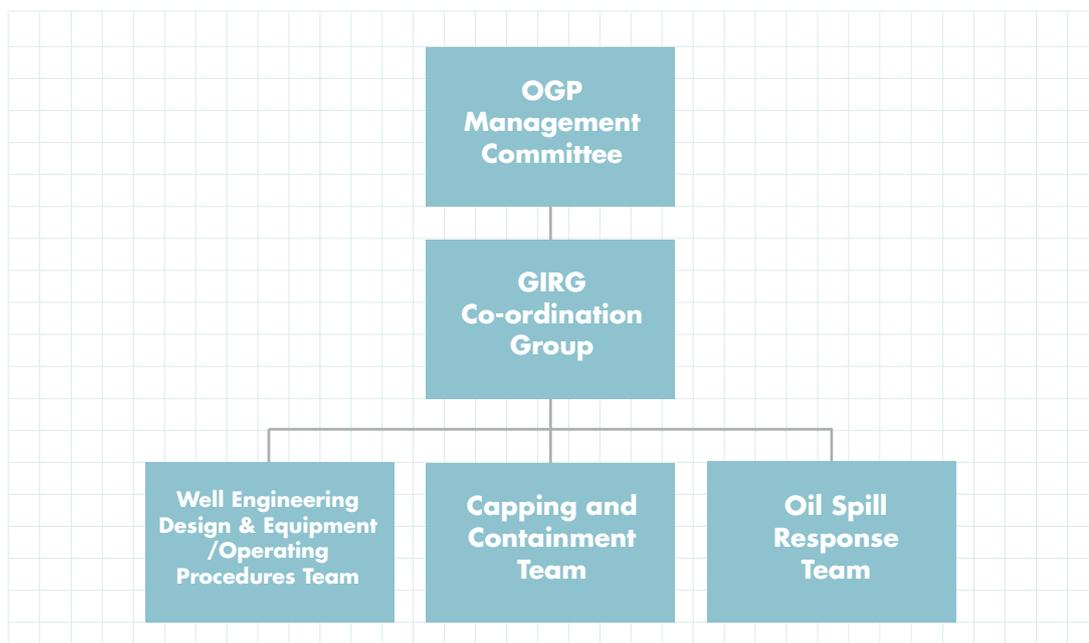


Figure 2.1 Organisational structure of GIRG

Background and Context

continued

Over the past year more than 100 industry specialists have worked on these three teams. These teams have established cooperation with other existing industry efforts, such as MWCC, API JITF, OSPRAG, OLF, IADC, API, and specialist service providers (e.g. OSRL) and continue to work closely with them to align efforts and eliminate duplication where possible.

The Well Engineering Design & Equipment/Operating Procedures Team is looking into improvements in well design and procedures and has brought forward recommendations. It is likely that some of the most significant reduction in risk of deepwater drilling will come from work in this area.

The Capping & Containment Team was tasked to determine whether a single worldwide

standardised capping and/or containment system (outside the Gulf of Mexico) could and should be designed and deployed with the support of international and national associations, in consultation with governments and regulators. The Capping and Containment Team was a full-time 12-person team that included specialists from BG Group, BP, Chevron, ENI, ExxonMobil, Petrobras, Shell, Statoil, and Total.

The overall purpose of the Oil Spill Response (OSR) Team was to gather and share information and conclusions on OSR performance from members and member associations in respect of Macondo, Montara and similar accidents, distil learning points and recommend possible improvements for OGP/IEECA action.

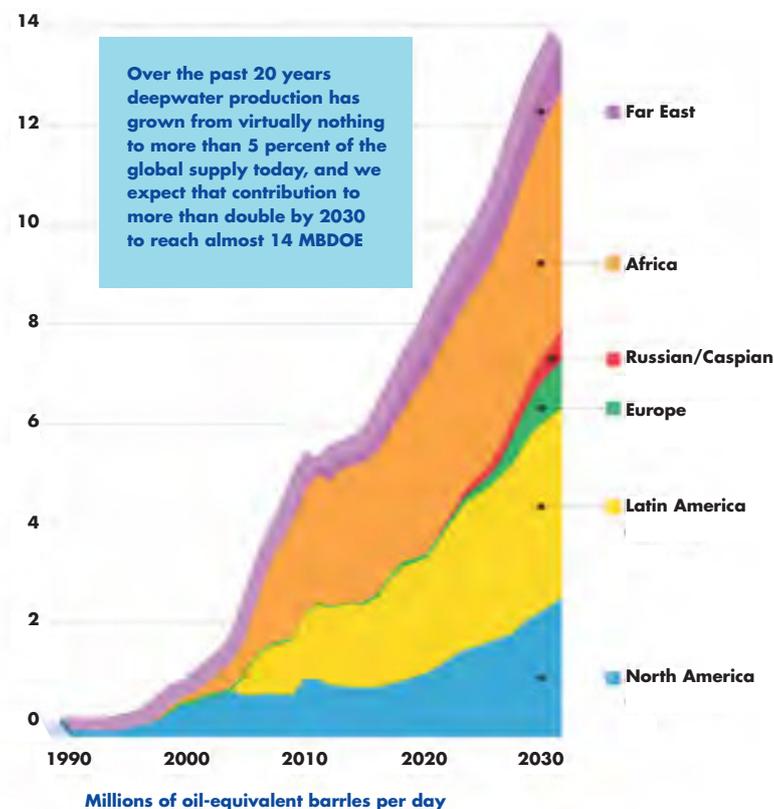


Figure 2.2 Deepwater outlook by region (ExxonMobil 2010 Outlook for Energy)

Background and Context

continued

OGP will continue to monitor developments in these two areas and will continue to assess the need for any additional activities that might be required to assist in achieving the objectives of GIRG.

This report comes from the Wells Design & Equipment/Operating Procedures Group. It had some thirty members³ divided among three sub-groups looking at well design, blowout prevention equipment, the management and supervision of operations and revision of standards.

The purpose of all involved is to mitigate the risk of future accidents by promoting:

- The continuous improvement of operators' and contractors' approaches to systematically maintaining adherence to applicable internal and regulatory existing standards;
- The development of new industry standards where necessary; and
- The sharing and use of good oilfield practices and new technological development when necessary

2.3 The offshore industry: some history

Since the oil and gas industry's modest beginnings in the late 19th century it has grown to become the supplier of some 60% of the world's primary energy needs⁴. Over this time the industry's methods have developed from the rudimentary to the sophisticated.

The technology of deepwater production has evolved in the same way as the first offshore technology developed out of onshore technology. By 2007 production from deepwater wells was double that from shallow waters, and ultra-deepwater⁵ wells were also beginning to produce large volumes of hydrocarbons.

The hunt for new resources has continued, with drillers prepared to venture to more remote areas and deeper waters, leading to 15 new discoveries in 2008 alone. The demands of deepwater production have yielded advances in rig technology and seismology, and new mobile offshore drilling units are coming into operation every year, some capable of operating in water of up to 12,000 feet and drilling an additional 28,000 feet below the seabed.

³ The following companies were represented in the group: BP, Chevron, Shell, Total, ExxonMobil, Petrobras, Statoil, ConocoPhillips, BG Group, Baker Hughes, Cairn Energy, ENI, Dong Energy, MOL, OMV, Maersk Oil, Schlumberger, Talisman, Transocean, IADC.

⁴ ExxonMobil 2010 Outlook for Energy

⁵ Defined here as greater than 3,000m

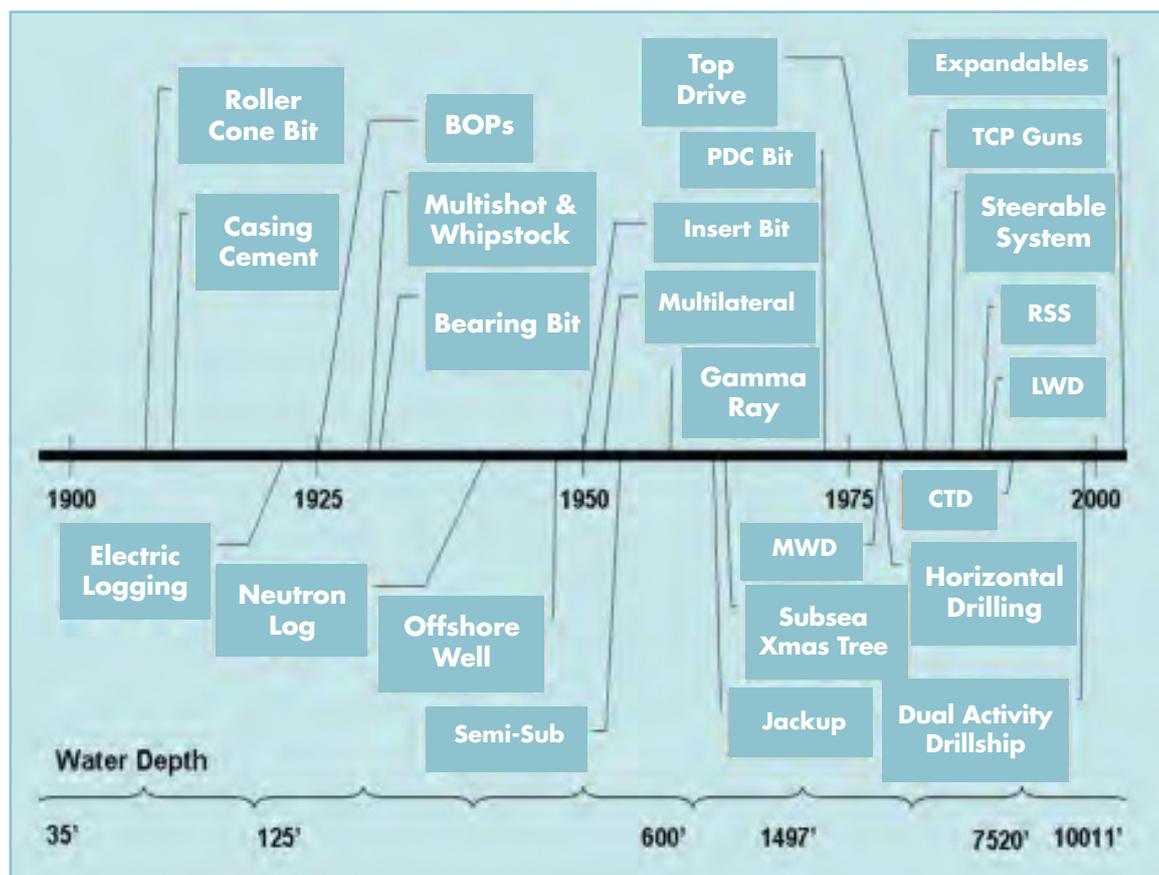


Figure 2.3 Water depth vs Time vs Technical Achievements

The diagram above (SPE 108477) shows the increase in water depth during the 100 years from 1900 through to 2000 and major technical achievements over the same period. By definition, it also shows the progress the industry has made to satisfy demand.

Overall, global deepwater production capacity has more than tripled since 2000. Ten years ago, capacity stood at 1.5 million barrels per day in water depths over 2,000 feet.

By 2009 it had risen to over 5 million barrels per day – and according to some sources could reach more than 14 million by 2013. Deepwater discoveries also comprise a significant portion of new finds. In 2008 total oil and gas discovered in deep water globally exceeded the volume found onshore and in shallow water combined.

The industry has successfully drilled over 14,000 deepwater wells around the world and future exploration is likely to take place increasingly in deep water.

Offshore resources are essential contributors to world energy supply. Between 1999 and 2003, some 30% of the world’s liquid hydrocarbons

came from the conventional offshore (under 500m depth). Reserves in deep water are still relatively low, but in the Gulf of Guinea and Brazil, 75% of new discoveries in recent years have been found in deep water. Production from them is becoming a reality thanks to the many technological advances and innovations of recent years.

As knowledge and understanding of deepwater operations has increased, so has the focus on risk management. The *Piper Alpha* disaster in the North Sea in 1988, when fire and explosion cost the lives of 167 workers, had a major impact on offshore operations in the UK continental shelf. Recent events, including the *Deepwater Horizon* and *Montara* accidents, emphasise the importance of continued risk management.

For this reason it is essential that the industry’s policies and operational responses are informed by careful reflection and by available information on other recent well incidents, both to reduce as far as possible the risk of such accidents happening again and to be better prepared for the consequences if they do.

3.0 The Deepwater Horizon and Montara accidents

This section summarises the preliminary conclusions of various investigations into what went wrong to cause the 20 April 2010 blowout, explosions, fire and subsequent major oil spill from the Deepwater Horizon rig operating on the Macondo prospect in the Gulf of Mexico.

The well was capped on 15 July 2010 and was permanently plugged and abandoned on 19 September 2010⁶. At the time of the explosion, there were 126 crew on board the Deepwater Horizon rig. Eleven workers were presumed killed in the initial explosion. After burning for approximately 36 hours, the rig sank on 22 April 2010.

This section also considers the events at the Montara field off the northern coast of Western Australia, when a spill followed a blowout on 21 August 2009, with the leak finally being capped on 3 November 2009. There were 69 crew on board the Montara wellhead platform, all of whom were evacuated safely.

Although less well known to the public, and without the tragic consequences in terms of loss of human life, there are similarities with the causes of the *Deepwater Horizon* accident and we have considered the lessons of both in our reporting.

3.1 Primary factors

The prevention of hydrocarbons in wells rising to the surface out of control is crucial to the safety of offshore operations. *The Accident Investigation Report*⁷ into the Deepwater Horizon accident identified four critical factors and eight key findings. The following chart quotes from that report:

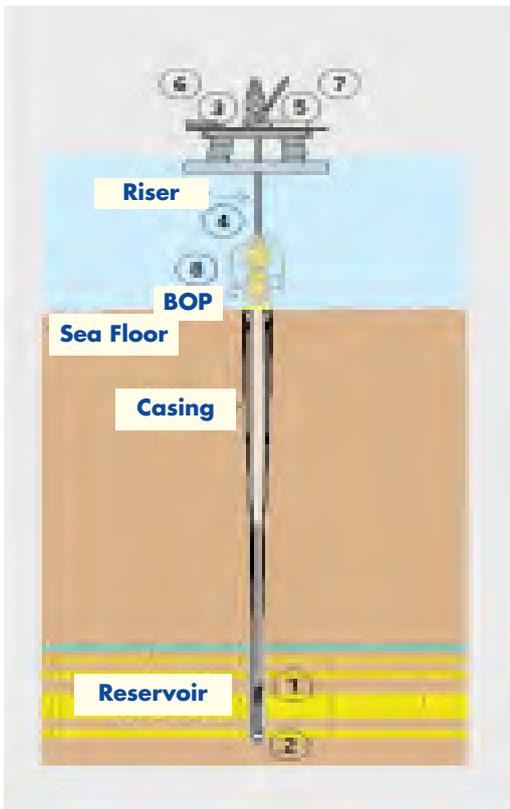
⁶ Details of the accident have been addressed in the following publicly available documents:

- Deepwater Horizon Accident Investigation Report, September 8 2010, BP
- Deepwater Horizon Interim Incident Investigation, Washington Briefing, May 24 10, BP as superseded by the September IIT Report
- Deepwater, The Gulf Oil Disaster and the Future of Offshore Drilling
- National commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling – January 2011
- Chief Counsel’s Report, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, February 17, 2011
- UK Deepwater Drilling – Implications of the Gulf of Mexico Oil Spill – Second report of Session 2010-11, Volume 1, House of Commons Energy and Climate Change Committee

⁷ Deepwater Horizon Accident Investigation Report, September 8 2010, BP

Capping and Subsea Dispersant Systems

continued



Well integrity was not established or failed

1. Annulus cement barrier did not isolate hydrocarbons
2. Shoe track barriers did not isolate hydrocarbons

Hydrocarbons entered the well undetected and well control was lost

3. Negative pressure test was accepted although well integrity had not been established
4. Influx was not recognized until hydrocarbons were in the riser
5. Well control response actions failed to regain control of well

Hydrocarbons ignited on the *Deepwater Horizon*

6. Diversion to mud gas separator resulted in gas venting onto rig
7. Fire and gas system did not prevent hydrocarbon ignition

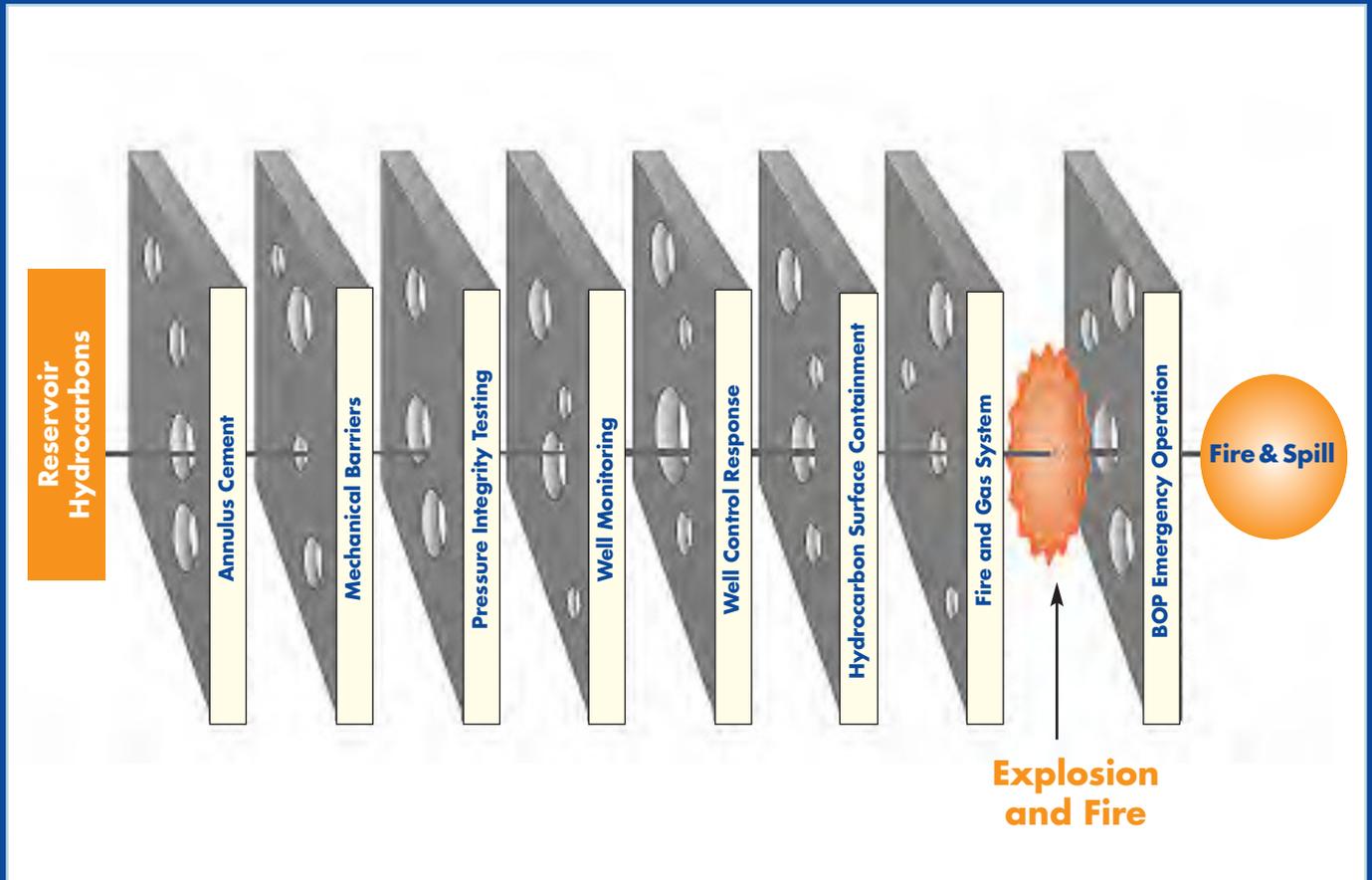
Blowout preventer did not seal the well

8. Blowout preventer (BOP) emergency mode did not seal well

Figure 3.1 Extracts from Accident Investigation Report

Capping and Subsea Dispersant Systems

continued



The holes in such a diagram represent failures or vulnerabilities in the defensive barriers. The eight key findings are represented by the holes that lined up to enable the accident to occur.

The Deepwater Horizon and Montara accidents

continued

The report of the Montara Commission of Inquiry⁹ concluded that the source of the blowout resulted from the primary well control barrier failing. The report noted that the initial cementing problems were compounded by the fact only one of the two secondary well control barriers – pressure containing anti-corrosion cap – was installed and then removed and that furthermore the key personnel both on the rig and onshore were under the mistaken impression that the fluid left in the casing string was overbalanced to pore pressure and would therefore act as an additional barrier.

After analysing available information on both accidents, the industry has understandably and unsurprisingly increased its focus on prevention. We consider that a focus on the multiple layers of defence and their reliability should be a constant preoccupation of companies as looking for disconformity at the earliest possible juncture will enable such disconformities to be addressed as soon as possible.

This summary does not reflect the uncertainty after the Macondo blowout occurred, about whether the well was flowing out through the main bore or through the casing annulus. Investigation reports indicate that the flow of hydrocarbons occurred through the shoe track and up the casing, not through the annulus. However, preventing flow through the annulus is an important aspect of safe operations in offshore drilling generally, so we have considered potential methods for further protecting the integrity of equipment. For this reason both annulus and main bore issues are addressed in this report.

Similarly, the Team focused on wells and well control equipment specifically and has not addressed the issue of Mobile Offshore Drilling Units (MODUs) particular to the Deepwater Horizon rig.

3.2 The accidents in context

As with any complex offshore operation, the well construction process in all of the accidents considered for this report involved numerous design and operational decisions relating to well architecture, cement type and quality, cement quantity, float equipment type, shoe track configuration, barrier verification methods, riser displacement procedure, volumetric control, barrier quantity, BOP configuration and many other factors.

Maintaining control of fluids throughout the life cycle of a well is of primary concern. The integrity of a well is fundamentally dependent on barriers, and their design, installation, maintenance and use. A common approach is to use a minimum of two physical barriers (when the well is capable of producing a flow), so that the failure of one for any reason, does not lose the well's integrity: it provides a margin of safety. The design, installation, maintenance and use of barriers is critical to this expectation.

The design and operation of wells has become increasingly complex as oil and gas are sought in more extreme environments and deeper buried reservoirs. This complexity has led to increased technical specialisation among both the individuals and companies involved, and extensive policies and procedures have evolved to minimise errors and provide benchmarks against which activities can be technically assured and audited. This has led to a greater emphasis on team competence, in addition to individual competence, in analysis and decision-making processes. This, in turn, has made the need for clearer definition and understanding of roles and responsibilities by all the individuals and teams involved more important.

⁹ Details of the accident have been addressed in the following publicly available documents:
- Report of the Montara Commission of Inquiry and draft response from the Australian Government, 24th November 2010
- Review of PTTEP Australasia's Response to the Montara Blowout, Noetic Solutions, November 2010

**The Deepwater Horizon
and Montara accidents**
continued



4.0 Findings, action plan and recommendations

At the time when the work on this report was undertaken, forensic examination of the Deepwater Horizon BOP was still underway. Given the importance of BOPs in well control, the Team is making a number of recommendations on BOPs in addition to those made on well design and management, supervision and procedures. These recommendations apply to subsea wells, though some may also be relevant to other well types. These recommendations may be reviewed as and when further information is available.

This section summarises the key principles identified by the working group and outlines a suggested action plan detailing how the recommendations can be taken forward.

The first task of WEC will be to ensure all companies are aware of these recommendations by a) helping companies to conduct gap analysis benchmarking their practice against these recommendations and b) issuing a definitive guide of all the recommendations in full under OGP governance.

4.1 Key findings

Robust standards and practices are critical to prevention

- The Team supports the API's standards development and its recommendations are in line with the last revisions of the API RP Bulletin 96 (Deepwater Well Casing Design and Construction), API Std 65 (Isolating Potential Flow Zones During Well Construction) and the API Std 53 (Blowout Prevention Equipment Systems for Drilling Wells); the Team also highlights, reinforces or supplements API recommendations in several areas it considers critical.
N.B. We recommend refraining from using the term 'best industry practice' until this definition is clarified; we prefer 'good oilfield practice' for the time being.

- The Team is also issuing recommendations on management and procedures, in line with API RP 75 (Development of a Safety and Environmental Management Program for Offshore Operations and Facilities), and it recommends that this should be used as a reference in the design of management systems covering any well design and operating activities, across the full well life cycle from drilling to final abandonment.
- One of the important features of API RP 75 is the use of a management of change process. The Team recommends operators and contractors maintain a well management system with a management of change process, using API RP 75 (Recommended Practice for Development of a Safety and Environmental Management Program for Offshore Operations and Facilities) or its equivalent as a reference for all operations, covering the full life cycle of the well.
- The Team also recommends that all members of OGP have a well management policy – including a standard on well control and a rigorous and permanently applied two barrier policy – and be able to demonstrate its application to well design, construction and maintenance operations.
- The value of bridging documents (or equivalent arrangements) is a recurrent theme in our recommendations, notably a Safety Management System (SMS) bridging document between operators and drilling contractors and a well control bridging document that describes the chain of command and the authorities for well control operations and emergency response. These bridging documents help to address and resolve any gaps or conflicts between the management systems of operators, drilling or well servicing contractors or other organisations involved in the construction. The IADC/API Bulletin 97 (currently under development) Well Construction Interface Document Guidelines (WCID) could be used as a guideline for each company to construct their own versions.

¹⁰ The DNV Forensic Examination of Deepwater Horizon Blowout Preventer carried out for the United States Department of the Interior was published on 20 March 2011.

Findings, action plan and recommendations

continued

- OGP promotes harmonisation among different Standards Development Organisations (SDOs) and the dissemination of these standards. We also support in principle the ISO/TC67 programmes and propose to collaborate with the Ad Hoc Group (AHG) in the revision or elaboration of new ISO standards to ensure compatibility with OGP recommendations, existing and future SDO publications and industry priorities.
- Furthermore OGP is well placed, if recognised as a representative organisation, to cooperate with international regulators to optimise their operations while keeping high safety standards.
- OGP should seek opportunities to prompt the continual improvement of international safety standards: setting industry guidelines, promoting industry and international standards and regulation for safe operations, and encouraging our members to follow or exceed them.



Sharing and expediting learning from well incident analyses is critical

- We propose establishing a permanent Wells Expert Committee, under the governance of OGP, to communicate incidents and disseminate the lessons learned and good practices based on shared experience. Drilling and well maintenance contractors will be invited to participate through IADC and the International Wells Training Forum (IWTF).
- Companies are encouraged to utilise a risk management system for the systematic assessment of risk to protect people, the environment and property.

There are a variety of tools for wells construction management identified by the Team which are a core part of the designing, specifying, planning, construction and operations of the wells. As part of sharing and promoting good practice, WEC will encourage OGP members to use a standardised approach to risk management systems and tools as much as possible.

- A method can be used to mitigate risk and to compare residual risk to the time, cost and effort which would be required to reduce that risk further. The principle of reducing risk to ALARP (As Low As Reasonably Practicable) has been used by regulators in the UK. However, operators should be prepared to deem a risk level to be unacceptable and in these circumstances operations should not proceed. *(Please see Appendix A for further detailed definition on ALARP).*
- Through WEC, there should be regular and rapid feedback to the OGP Membership, the exploration and production industry, standards development bodies, manufacturers, training organisations and regulators, on major well incidents impacting on standards and training. *(Please see Appendix B for the full Terms of Reference of WEC).*

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Both technological and behavioural factors are important for prevention

- We have looked at a number of areas where technology could be developed to reduce the risk or consequences of well control events. Among these are real time monitoring and automatic alarm systems for pressures, flow rates and volumes into deepwater risers, the shearing efficiency of BOPs, the ability of the acoustic secondary systems to function in all environmental circumstances and the reliability and ease of interpretation of Cement Bond Logs (CBL).
- There were also suggestions for taking human factors into account and optimising such data and its useability for personnel involved in well control. It is anticipated that once the Wells Expert Committee is established, it would undertake a review of such technology, in cooperation with API and IADC.
- While technology is undoubtedly important, so too is reducing human fallibility. Therefore, we recommend that the WEC works on ways to measure the preparation for and management of the unexpected, with a view to developing guidance on how operators and contractors can train their personnel to:
 - improve their ability to notice well and drilling anomalies, lapses and disparities
 - anticipate, recognise and respond quickly and rigorously to the unexpected.GIRG sub-groups have explicitly addressed this issue with academics and are working on ways to measure the preparation and management of the unexpected.
- Our main objective here is to reduce the number of uncontrolled well events. We believe that adopting the recommendations outlined in this document, or those resulting from further work, will significantly reduce the chance of accidents, if implemented. More importantly, our recommendations need to be completely understood by the rig floor personnel and enforced by the chain of command. We should still, however, continue to put effort into reducing the scale of accidents such as those occurred at

Deepwater Horizon and Montara so that when they do happen, we are far better prepared to mitigate their effects.

- OGP is also proposing to develop a capping toolbox for worldwide use that will be operated by a future for-purpose organisation, and we will recommend the development of methods to adapt subsea well design and equipment to this toolbox.

4.2 Action plan to implement recommendations

As outlined previously, the primary action contained within these recommendations is that a Wells Expert Committee (WEC) is established with Terms of Reference and nominated members (OGP and from similar bodies within NOIAs).

WEC will undertake to oversee or implement the following over a minimum two year programme:

a) Formalising the culture of learning and sharing

- The creation of a database through which OGP member companies can securely share lessons and data from well incidents. This will be done under the guidance of the WEC and in liaison with NOIAs with the assistance of an independent third party competent to perform the incident analysis. The WEC will define the typology of serious incidents and outline all agreed types of incident that may be included, as well as providing further guidance on how the data submitted will be used and managed.
- OGP encourages all member companies to share information and declare incidents as swiftly as possible as the process will require widespread support to be beneficial.
- OGP anticipates that a formalised process will motivate prompt and effective sharing.
- OGP will call for experts and resources from its membership to populate the WEC.
- The database will be maintained under the custody of OGP but regular reports will be issued and sent to regulators, thereby contributing to the ongoing dialogue and sharing of information.

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b) Standards and practices

- In some areas of the world the regulators are highly skilled in many aspects of well construction and highly knowledgeable about management structures and systems. A regulator who performs his or her tasks in a diligent and consistent manner assists the well construction process greatly, as it helps operators understand regulatory requirements and work with the regulator on common goals.
- This is not the case everywhere however, and occasionally regulators can be non-existent or unfamiliar with well construction techniques and procedures. When a regulator is not carrying out meaningful audits or inspections, or is sending out mixed signals, the result can be a loss of focus on some of the more important elements of an operator's own audits.
- We recommend that OGP members are aware of this and appreciate that if a regulator is not carrying out a robust oversight then an important part of the technical assurance process may be missing. This is a 'weak signal' and should be recognised as a reason to carry out a more extensive programme of self-audit to compensate for the lack of competent regulatory oversight.
- In accordance with the above, the Team suggests identifying industry and other stakeholders, such as IRF, European Commission, US agencies (in close cooperation with API), Standards Developing Organisations such as ISO and API and trade associations, to advocate the best response in any new regulatory code, for the benefit of OGP members and the wider exploration

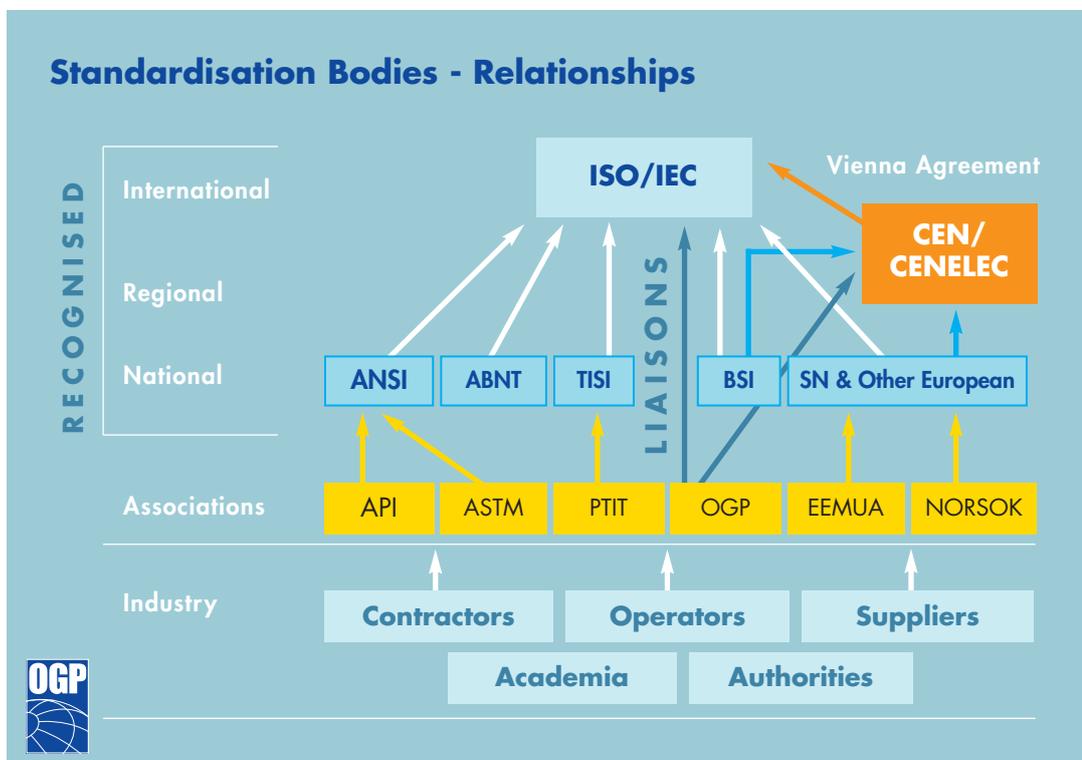


Fig 4.1

Please refer to Appendix C for a more detailed overview and background to current industry standards.

Findings, action plan and recommendations

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and production industry, onshore and offshore. OGP will work in close cooperation with API and IADC.

- Communicate to the regulators and the European Commission the arrangements in place for international standards and their adoption.
- WEC to consider setting up some funding or establishing a JIP to enable provision of the resources required to do the work without undue delay in order to deliver the ISO standards required under this initiative expeditiously.
- Promote the updating of standards and practices via national regulators and also encourage OGP members to undertake a gap analysis of their existing standards and practices against the recommendations outlined in this document.
- Devote time and resources to the harmonisation of international and national standards during the revision process or when new standards are found necessary. The upstream industry needs more clarity and uniformity rather than the addition of layer upon layer of supplementary standards and practices. The Wells Expert Committee may be able to facilitate this process through a dedicated task force or JIP.

c) Technology

• BOPs, cement jobs and shear tests

- Improve reliability and efficiency of BOPs including acoustic system reliability, BOP ram position indicators, subsea accumulator pressure readouts, control system reliability, volumetric measurement of flow and low force shear rams.
- The Team recommends that there should be a minimum of two shear rams on the BOPs of dynamically positioned (DP) rigs, at least one of which can seal. Blind shear rams need to be sufficiently powerful to shear the pipe body of the work strings while still being able to seal the well.
- We also recommend that all DP rigs are equipped with Deadman and Autoshear contingency systems, and all primary and secondary BOP functions and associated controls are tested on the surface each time before running the BOP. The Deadman system should also be tested at installation of BOP stacks provided an acceptable risk assessment has been carried out. Both systems should be armed and their reliability assured as soon as BOPs are latched onto the wellhead to the exception of nonshearable periods.



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- The BOP design including the BOP connectors should be reviewed to determine survivability and operability during a well blowout.
 - Review Cement Bond Log technology and develop a more robust system of determining the integrity of cement jobs.
 - Work should commence to develop equipment and procedures to be able to avoid delay in shut in from non shearable components being across the BOP in deepwater wells.
 - Review details of shear test procedures
 - **Remote Operating Vehicles (ROV)**
 - The Team recommends the ROV should be able to close and lock a minimum of one pipe ram, each shear ram, and unlatch the lower marine riser package (LMRP). Where possible, Remotely Operated Vehicle (ROV) manufacturers' recommended function response times should be equivalent to the primary system and should be performed with BOP fluid. The hot stab should be standardised as per API RP 17H ROV Interfaces on Subsea Production Systems for single port, high flow stabs.
 - **Mud Gas Separators (MGS)**
 - Mud Gas Separators are designed to separate mud and gas when they flow from the riser and divert flow safely away from the personnel and the drilling rig. The Team recommends that rig crews are trained to understand their limitations and the hazards routing returns from a well to the MGS: most MGS cannot handle a large surge of gas in the riser.
- d) Regulation*
- WEC and OGP propose taking the lead in assisting experienced regulatory agencies to develop a single unified approach. This approach, preferably goal setting, could be the foundation for improved safety performance on a global basis for OGP members and non-members. The new regulatory controls must address technical and management issues identified from all the investigations into the Deepwater Horizon, Montara and any other recent accidents.
 - Continue to encourage regulators to participate actively in international standards work and to make references to more globally relevant standards.
 - WEC's mission and objectives will be built on managing these issues with the possible creation of dedicated working groups and JIPs.
 - The International Regulators Forum (IRF) met in October 2010 where much of the focus was on the Deepwater Horizon and Montara accidents. IRF has now agreed to focus on the following five topics (issue leader):
 - safety culture and leadership (Canada);
 - BOP integrity and operational issues (Norway);
 - performance indicators (IRF working group);
 - operator competency/capacity criteria (Australia);
 - standards and industry good practices (Netherlands/UK).

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The regulators in the Netherlands and the UK have invited OGP to open discussions on how their focus area on standards and industry good practice should be handled.

- Following a request from the IRF, OGP and the IADC have started to exchange views with the IRF on BOP integrity and operational issues and will respond on these through WEC.

e) Well design and operations

The well design and procedures sub-group examined the available information on recent well incidents, and consulted widely on current practices in extracting oil and gas.

- Casing design and cementing standards
 - The Team's first conclusion was that ongoing work on API RP 96 will, when it is published, address the main issues of subsea well design and should be used as a key reference.
 - The Team recommends that well construction companies should document a casing design methodology, with definition of load cases, minimum safety factors and consideration for triaxial load effects.
 - The Team recommends that well construction teams have cementing standards which address the design and quality control of cementations. The cementing standards should specify limitations on the use of foam cement and should specify requirements for minimum cement column height above hydrocarbon intervals. The cementing guidelines in API RP 65 part 2 should also be considered. Companies are also recommended to consider the effectiveness of any systems in place for verifying the critical cement design and all properties specified in the design (for example, by reviewing the systems that contractors have in place to carry out such verification in contractor cementing labs by the contractor prior to use, or, where considered to be appropriate by the company, by carrying out verification in in-house or third party cementing labs).

- The Team recommends that a casing hanger should be locked down in the wellhead when the casing has the potential to be in contact with hydrocarbons. This also applies to the tubing hanger. The primary casing hanger lockdown capacity should be designed for the maximum anticipated well loads. Calculation of the required casing hanger lockdown capacity should be performed as part of the well design process.

- The well programme or well construction standards should provide a detailed procedure and acceptance criteria for any inflow test (negative pressure test). Inflow test procedures should consider the fact that inflow tests can sometimes be inconclusive for large fluid volumes due to temperature effects and migration of entrained air bubbles.

• Capping systems

It is not possible to eliminate all risk of blowouts, and we must remain aware of this at all times, but where possible we can design subsea wells to survive a well blowout, ensure they can be capped, and either restrict or mitigate the leaking of hydrocarbons.

While the Team believes that the focus of the industry should primarily be on preventing blowouts, the Team is also considering how operators can respond to subsea blowouts more rapidly and successfully.

- Fast and effective capping requires subsea well designers, wherever possible, to design the production and main protective casing string (defined as the casing and the liners constituting the first barrier envelope of the well before entering a hydrocarbon zone) to survive a blowout and be compatible with any subsequent well capping operation. This implies designing for three scenarios: unconstrained flow to the sea floor, well shut in and cold bullhead kill.
- The 'worst case discharge flow design' should allow the well to support the flow for a sufficient time for it to be capped or during relief well operations. The 'SPE

Findings, action plan and recommendations

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- guide lines for calculations of worst case Discharge from Offshore Wells' is one methodology to be considered for calculating the worst case discharge flow rate.
- The well shut in scenario is where the well is allowed to flow and then a capping stack is installed. The well needs to be designed to withstand the pressures created during installation of the capping stack, formation fracture being allowed at casing shoe if there is any open hole section.
 - In the bullhead kill scenario the design needs to be suitable with the operations required to kill the well once it has been successfully capped.
 - Consideration should be given to design 30 inch or 36 inch (or other size) structural casing such that it is not the weak point for extreme riser offset scenarios which could occur during a well incident.
 - The Team recommends that new rigs and those where BOP systems have been retrofitted should fabricate all components of the lower BOP (including the LMRP connector) to the rating of the full BOP working pressure to facilitate use of a high pressure capping system. A subsea BOP system should also be compatible with tertiary well control equipment (well capping and containment system).
- f) *Well Integrity and Barrier Policy*
- The Team recommends that member companies establish and conform to a Well Integrity and Barrier Policy that should, as a minimum, address the following areas: primary well control, cementing, casing design, barrier requirements and acceptance criteria, well control practices and chain of command.
 - The Well Integrity and Barrier Policy should meet or exceed both the Team's recommendations contained in this section and the local regulatory requirements, with member companies having internal technical standards that describe the well integrity and barrier philosophy.
 - Critically, the Team recommends that there should be a minimum of two well barriers in place during all well activities and operations, when the well is capable of discharging hydrocarbons or other fluids to the surface or the external environment. In situations where two barriers are interdependent companies should design alternative control procedures.
 - The Team also recommends that well programmes include well barrier diagrams or well barrier descriptions for each phase of operation, with the barrier policies addressing the limitations of each barrier type and stating that it is good practice for each barrier to be independently sound. All efforts should be focused on reestablishing two barriers or a risk assessment should be made each time the two barrier recommendation is not met.
 - Barrier policies should specify under what circumstances a cement filled casing shoe track can be accepted as a valid barrier during well suspension.
 - Since BOPs are considered as a barrier, The Team has made several recommendations in relation to well equipment and BOP hardware, though these may change or be added to when further analysis information about the performance of the Deepwater Horizon BOP is done. The Team also expects that when API Standard 53 (Blowout Prevention Equipment Systems for Drilling Wells) is completed in early 2011 it will be an important industry standard to bring into use. For this reason the following recommendations may also be revised after the next edition of API 53.
 - In addition, the Team recommends that verification of a subsea BOP system is carried out by the original equipment manufacturer or an independent Third Party (see glossary for definition) as agreed by the operator. As regards the operation of a BOP and well control, a bridging document should set out working rules, procedures, responsibilities and the relationship between operator, contractor and other parties. Any changes to a subsea BOP should be subject to a management of change process.

Findings, action plan and recommendations

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- The Team recommends that rig contractors ensure BOPs and control systems operate in accordance with all the applicable industry standards and original equipment manufacturers' operating specifications.
- It is recommended that all primary and secondary BOP functions and associated controls are tested on the surface each time before running the BOP. One ram should be tested subsea each time the stack is run.
- The Team recommends that on DP rigs the Emergency Disconnect System (EDS) is tested subsea at rig commissioning, then every five years or when modifications impacting hydraulic volumes or response timing for the EDS have been made.

g) Training, competence and human factors

• **Competency Management System (CMS)**

The Team recommends that operators and contractors maintain an efficient and formalised competency management system (CMS) that identifies key personnel and verifies that they have, or provides them with, the well control knowledge and experience necessary for their role. The Team and OGP believe that any CMS should:

- cover all the skills required for the jobs assigned, and ensure that personnel can perform the tasks involved;
- carry out competency assessments on a regular basis;
- develop and assess additional competencies for all positions when personnel are working on challenging or high risk wells, or using new technologies;
- detail how competencies for all contract staff used for positions are selected and assessed;
- address team competency and emergency preparedness;
- have a detailed audit schedule;
- record sufficient information to allow an audit to be carried out by operators, partners, government regulators, and customers.

The Team has undertaken considerable research into who should be included in a CMS. The principle that the Team recommends is that if a position has a direct influence on any factor which is critical to emergency management in general and well control in particular, whether offshore or onshore, then the position should be included in the scheme.

- Well Control Training and Qualification
 - The level and content of well control training and certification should be commensurate with risk, consequence and well complexity. While the standard well control training is adequate for simple low pressure wells, it should be enhanced and simulator training may need to be more frequent for more complex wells, such as those in deep water, with high pressures and temperatures, or in novel circumstances.
 - For these more complex well types and situations there needs to be more emphasis on hands-on simulation and the ability to react effectively to unfamiliar or unexpected events, in particular:
 - preparing for loss of well control during unusual operations;
 - response to loss of well control with unusual well conditions;
 - response to losses and remedial actions;
 - response to hydrocarbons in the riser;
 - identification of equipment limitations, including those of MGS, BOP, diverter and control systems;
 - management of well barriers – i.e. verification, monitoring and repair; and
 - testing of well control equipment.
 - The Team recommends that the industry trains all relevant personnel (from those on the rig floor to those in command) to:
 - look for anomalous and unexpected information that may have a bearing on well integrity or well control;
 - to question and be prepared to stop operations if the information or situation is unclear; and

Findings, action plan and recommendations

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- to prepare ahead of time for unfavourable and unexpected events.
- Industry training should teach personnel with well control responsibilities to err on the side of caution and to secure the well and stop work whenever there is any uncertainty about the integrity of the well or the interpretation of well bore integrity data.
- Behavioural and human factors in rig teams
 - The Team recommends that all member companies include in their well control and emergency management systems consideration of the human factors that can influence how decisions are made and how people behave in specific circumstances – this will be encouraged by WEC, who will provide guidance on good practice.
 - The Team recommends the following are included in any robust system:
 - people feel empowered to work safely and it is clearly communicated to them that they are permitted and indeed expected to stop operations (shut in the well and then investigate) if there are any concerns – without retribution;
 - the ‘stop work authority’ (permission to stop work without penalty) is also made explicit to all service companies and their personnel;
 - teams are provided with the skills, knowledge and tools to work safely;
 - management inspires a culture of safe working;
 - stress testing such as unannounced pit drills or trip drills are carried out to prove the competence of critical individuals and teams to manage the unexpected.
 - **Connecting Management to the rig floor**
 - The Team recommends that management should be sufficiently connected to operations to have a good understanding of what is going on and take the view that any incident or near miss is a learning opportunity for the operation as a whole. This also means management being open to listening to the ‘weak signals’ and providing a cascade of consistent safety messages from the top.
 - The Team recommends management reinforces key messages such as: “If in doubt, first make-safe/shut-in then investigate”, making clear that intervention on safety grounds is expected, not just permitted.
 - The Team would also like to see management accountability for, and engagement in, the rig floor risks: a robust risk management process together with a gated process provides a clear channel to the top of the organisation.

Appendix A

Glossary of terms

ALARP

The principle used by regulators in the United Kingdom to weigh risk versus the cost to reduce that risk further is to reduce the risk to As Low As Reasonably Practicable (ALARP). This involves weighing a risk against the activities, time and resources needed to control it. ALARP describes the level to which the HSE expects to see workplace risks controlled.

See the below from the HSE website¹:

"In essence, making sure a risk has been reduced ALARP is about weighing the risk against the "sacrifice" (In terms of time, cost and effort) needed to further reduce it. The decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure. To avoid having to make this sacrifice, the duty-holder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate "sacrifice".

Annulus

Any space between concentric tubular goods or between tubular goods and the wellbore (formation).

Anomaly

An irregularity or a departure from the expected response of a system or calculated trend.

Barrier Independence

Barrier Independence means that the failure of one barrier does not lead to the failure of any other well barriers. The intention is that a back up is always available in the event that the first individual barrier malfunctions. An example of poor barrier independence is a hydrostatic column of kill fluid sitting on a fully tested, deep set plug. Some will regard this arrangement as two separate barriers. However, they cannot be regarded as two independent barriers as a failure of the deep set plug may lead to the hydrostatic column being lost to a formation. In this way a single failure could lead to the loss of two well barriers.

Blowout

An incident where formation fluid flows out of the well or between formation layers after all the predefined technical well barriers or the activation on the same have failed.

Bridging Document

A document which is agreed between two parties as to the methods, processes and procedures which will be adopted when working on joint projects between the two parties. There can be multiple bridging documents which are specific to any area of the operations, for example safety management systems or well control.

Bullhead kill

The squeezing of formation fluids back into the formation by applying pressure at the top of the well.

Appendix A

Glossary of terms

continued

Casing string

Steel pipe placed in an oil or gas well as drilling progresses. The function of casing is to provide pressure containment, prevent the wall of the hole from caving during drilling and limit oil or gas production to the zone perforated or open.

Cement

A powder, consisting of alumina, silica, lime, and other substances that hardens when mixed with water. Other materials can be added to alter the cement's physical properties, such as its density or the thickening time. Cement is used in well cementing to provide pressure isolation, restrict fluid movement between permeable zones within the well and provide mechanical support for the casing and bore hole wall.

Cement Bond Log (CBL)

A well log of the vibrations of an ultrasonic acoustical signal as it passes through a four phase system of fluid, pipe, cement and formation. If the cement is bonded or acoustically coupled tight to the pipe, the energy is heavily dampened and the signal nearly disappears, indicating that the casing is well cemented.

Concession Owner

In relation to a well, means the person who at any time has the right to exploit or explore mineral resources in any area or to store gas in any area and to recover gas so stored if, at that time, the well is, or is to be, used in the exercise of that right.

Competency

Is a combination of knowledge, skills, experience and behavior which confers on an individual the ability to undertake responsibilities and perform activities for a specific role, to a recognised standard, on a regular basis.

Competency Management System

A structured and documented method of assessing the competence of personnel.

End of Wells Report

The report which is produced at the end of any well construction, completion intervention or abandonment activity. The report will detail all the work which has been carried out on the well in order that the next team of engineers who prepare the next activity will have sufficient information to fully understand the history of the well and the current status of the well.

Float equipment

Drillable, one way valves placed at the bottom of the casing (the shoe) and one or two joints above the shoe (float collar). Together, these valves prevent mud from entering the casing while it is being lowered in the hole and to prevent cement from flowing back into the casing once it is displaced behind the casing.

Fluid displacement procedure

The description of the steps involved in displacing fluid from all or part of a well, such as is needed when cementing. The procedure includes the equipment configuration, fluid properties, circulating rates and associated calculations required to confirm well design or equipment limitations will not be exceeded at any stage during the procedure.

Appendix A

Glossary of terms

continued

Good Practice

Practices that are considered proven to give consistent, good results with low or manageable risk, and are supported by engineering calculations or principles that predict a good outcome.

Hot stab

A hydraulic probe which allows fluid to be pumped into a control function of well control equipment, usually used for closing BOPs and/or unlatching the lower marine riser package (LMRP) in the case of umbilical failure, to allow the rig to move off the location or well.

Hydrocarbon intervals or Zone

A formation zone containing petroleum oil or gas.

Independent Oversight

The review and approval of planned work or work by a competent person(s) who cannot be unduly influenced by financial or business considerations. This role may be filled by a person(s) either internal, or external to the organisation conducting the work, so long as the above independence can be demonstrated.

Inflow tests

The deliberate reduction of the hydrostatic pressure in a well, under controlled conditions to test the integrity of a pressure seal, such as the cemented overlap between casing and a liner. An inflow test creates a pressure differential in the potential direction of flow and so may also be referred to as a negative pressure test.

Integrity

Structural soundness and strength, stability and, in the case of a floating installation, buoyancy in so far as they are relevant to the health and safety of persons.

Kick

An entry of water, gas, oil, or other formation fluid into the wellbore during drilling. It occurs because the pressure exerted by the column of drilling fluid is not great enough to overcome the pressure exerted by the fluids in the formation drilled. If prompt action is not taken to control the kick or kill the well, a blowout may occur.

Liner

Partial length of pipe string extending between the bottom of bore hole to an elevation above bottom of the previous casing string. A liner performs the same function as production casing in sealing off productive zones and water bearing formations. A liner may, or may not be cemented in place.

Lockdown

The prevention of movement of a piece of installed equipment in relation to other components, by a snap-ring or other retaining device.

Lower Marine Riser Package (LMRP)

An assembly at the bottom of the marine riser which is used as the disconnect point for the rig from the well and BOP's.

Appendix A

Glossary of terms

continued

Management of Change

A formal, systematic process to document, evaluate, approve and communicate temporary and permanent changes that could impact safe, responsible and reliable operating activity. The change may relate to plant, material, equipment, technology, process, products, services, procedures, practices people and organisation.

May

Indicates that a provision, suggestion, advice, course of action, etc is optional.

Mobile Offshore Drilling Unit (MODU)

A drilling rig that is used exclusively to drill offshore wells and that floats upon the surface of the water when being moved from one drill site to another. It may or may not float once drilling begins.

Mud Gas Separator (MGS)

Captures and separates large volumes of free gas entrained within the drilling fluid. The gas is then vented to an overboard line or flare. Gas flows exceeding the design limit will overwhelm the separator. A mud gas separator is also referred to as a gas-buster or poor boy degasser.

Operators

The individual, company, trust, or foundation responsible for the exploration, development, and production of an oil or gas well or lease. Generally, it is the oil company by whom the drilling contractor is engaged.

Overboard line

A pipe to divert gas safely away from the rig and any potential sources of ignition.

Owner

In relation to a mobile installation means the person who controls the operation of the installation.

Practices

The manner in which a task is accomplished - a procedure of a specialised kind.

Pressure tests

The evaluation of a component or system's capability to withstand pressure by the physical application of a prescribed pressure according to defined procedures.

Primary Well Control

Prevention of formation fluid flow by maintaining a fluid column which applies hydrostatic pressure equal to or greater than formation pressure.

Secondary Well Control

The closing of the blow out preventers to create a pressure seal and regain pressure control on a kick.

Appendix A

Glossary of terms

continued

Tertiary Well Control

The stemming of hydrocarbons flowing from a blowing well by closing off the flow (capping), or the control and collection of the flow (containment).

Riser

The pipe and special fittings used on floating offshore drilling rigs to establish a seal between the top of the wellbore, which is on the ocean floor, and the drilling equipment, located above the surface of the water. A riser pipe serves as a guide for the drill stem from the drilling vessel to the wellhead and as a conductor of drilling fluid from the well to the vessel. The riser consists of several sections of pipe and includes special devices to compensate for any movement of the drilling rig caused by waves. It is also referred to as a marine riser.

Shear ram / Blind shear ram

A blow out preventer (BOP) component that is capable of severing pipe in the well bore. A blind shear ram also creates a pressure seal once the pipe has been severed.

Shoetrack

The casing joints and float equipment at the bottom of a casing or liner string.

Should

The term should denotes a recommendation or that which is advised but not required in order to conform to the standard.

Standards

A prescribed set of voluntary rules, conditions, or requirements concerned with the definition of terms; classification of components; delineation of procedures; specification of dimensions; construction; criteria, materials, performance, design or operations; measurement of quality and quantity in describing materials, products, systems, services or practices; or descriptions of fit and measurement of size. Standards is an all inclusive term denoting Specifications, Recommended Practices and Bulletins.

Third Party

Conformity assessment activity performed by a person or body that is independent of the person or organisation that provides the object, and of user interests in that object.

Tieback

The extension of a casing string back from the wellhead to surface, or the extension of a liner so that it acts as a casing string.

Technical Authority

A competent person who organises, manages and maintains any of an organization's standards and is independent of organisational assets and projects. While this person may advise assets and projects, he or she should not directly deliver elements of a project as to do so would compromise the organisation's management of risk. (This position is often filled by the Chief Engineer's role)

Appendix A

Glossary of terms

continued

Triaxial Load

The combination of axial (longitudinal), hoop (tangential) and radial loads and the interactions between them in a tubular string.

Tubing Hanger

A mechanical arrangement used to suspend tubing from a tubing head or wellhead.

Weak Signals

A series, or repetition of omissions, events or minor incidents that may not attract immediate attention, but if investigated, maybe a window onto the general health of an operation.

Well

A borehole drilled with a view to the extraction of minerals through it or another well, and is deemed to include any device on it for containing the pressure in it.

Wellhead

The wellhead is a composite of equipment connected at the top of the casing and tubing to support loads and maintain pressure control of the well. Included in the wellhead are casing heads, tubing heads, christmas tree equipment with valves and fittings, casing and tubing hangers and associated equipment. The BOP usually connects to the top of the wellhead.

Wellhead Connector

Is usually a hydraulically actuated assembly for clamping the BOP stack onto the wellhead high pressure housing.

Well Intervention or Workover Operation

Means an operation in which a well is re-entered for a purpose other than to continue drilling. A well intervention operation is an operation which involves entering the pressure boundary of the well.

Well release

An incident where hydrocarbons flow from the well at some point where flow was not intended and the flow was stopped by the use of the barrier system that was available on the well at the time of the incident.

Well Shut-in

To close valves on a well so that the well pressure is contained and it stops producing.

Workstring

A string of drill pipe or tubing suspended in a well to which is attached a special tool or device that is used to carry out a certain task.

Appendix B

OGP Wells Expert Committee

A key recommendation is the creation of a new committee, the Wells Expert Committee (WEC), within the structure and governance of OGP. This will identify areas for improvement and focus on these to strengthen the long-term health of the oil and gas industry across the whole cycle of well planning, construction, operation and abandonment. Involvement of the drilling and wells servicing contractors will be crucial.

OGP has already secured from its membership dedicated funding for additional support of WEC from the OGP Secretariat. WEC will be a standing committee with a Chairman able to propose the creation of ad-hoc task forces and/or Joint Industry Projects (JIPs) subject to the approval of the OGP Management Committee.

The purpose of WEC is to provide a formal and active body through which its members can share good practice to contribute to OGP objectives related to well integrity matters and its mission to facilitate continuous improvements in Safety and Environment. Its scope is to review well industry issues; create and resource workgroups; work with other industry stakeholders, committees and regulators; and ultimately prepare recommendations and guidelines for consideration by the Management Committee and members of OGP.

These activities will include:

- analysing incidents and disseminating lessons learned and good practices based on shared experience, OGP becoming the relevant organisation to formalise the response of the industry in partnership with equivalent bodies in the USA or elsewhere;
- Through WEC, there should be regular and rapid feedback to the OGP Membership, the exploration and production industry, standards development bodies, manufacturers, training organisations, and regulators ;
- identifying and implementing areas for cross organisation cooperation (NOIAs) when implementing GIRG recommendations;
- identifying, implementing and maintaining industry good practice, guidelines and standards applicable to well design, well construction and well management, intervention and abandonment operations during the life cycle of a well;
- providing global industry regulators and stakeholders with a structured committee composed of senior representatives from the wells community to discuss cross industry issues that are relevant to enhancing health, safety and environmental excellence;
- identifying, promoting and following up areas where technology could be developed to reduce the risk of occurrence and the consequences of another well control event; and
- fostering the development of advanced well training schemes and industry work on behavioral and human factors in relation to risk assessment and mitigation.

Membership of WEC will be open to all members of OGP, and participation in workgroups may be extended to include non-OGP members where their organisations have a relevant contribution to make or technical expertise to offer.

Member companies will be invited to nominate a senior and informed person to be their representative in WEC with sufficient availability and ability to participate in meetings. The attendance of representatives at meetings will be on the condition of active participation in and useful contribution to the group.

The WEC will look to OGP's Management Committee for support, linkages with other industry bodies and workgroups, and for access to OGP's government, public relations and media services.

The WEC may see fit to appoint various ad-hoc workgroups or establish Joint Industry Projects (JIPs) where appropriate to conduct activities, undertake initiatives, perform actions, seek funding and/or develop recommendations. The operations and actions of such workgroups should adhere to the same Terms of Reference as that of WEC.

Appendix C

Standards information and background

Both the API and ISO are taking the Norsok standards into consideration. Norsok S-001 'Technical Safety' is now taken into consideration at the revision of ISO 13702 'Control and mitigation of fires and explosions on offshore production installations' and Norsok Z-013 'Risk and emergency preparedness assessment' may be proposed for international work by ISO/TC67. Norsok D-010 'Well integrity in drilling and well operations' is considered in development of API Bulletin 96 and ISO 16530 on well integrity.

ISO/TC67 set up an ad hoc work group (AHG) in October to prepare a roadmap/action plan on their standards which should be revised or developed, in response to the latest accidents. Some of these proposals will seek to merge several existing industry standards, bring useful national standards into the international arena for broad industry consensus agreement and make the resulting ISO standards readily available for global adoption in Europe, Gulf States, Russia, US and many other regions around the globe. These proposed ISO standards will offer a wider basis for regulators' use such that we may possibly have a more uniform set of regulators' requirements on a global scale. OGP supports in principle the ISO/TC67 AHG roadmap/plan for ISO standards.

The International Association of Drilling Contractors (IADC) which organises most of the global drilling and well service contractors has recently updated its HSE Case Guidelines, published December 2010. The industry holds a number of HSE management systems guidelines from many different sources: API 75, IMO ISM, OGP 210 etc. The ISO AHG proposes the harmonisation of HSE Management guidelines by the development of a new ISO standard based on API, IPIECA, OGP and other relevant guidelines. This plan has now been agreed by ISO/TC67 Management Committee.

To develop, revise and maintain new and existing standards requires additional resources. An ideal situation, from an operator's point of view, would be to have global technical requirements with the necessary national adaptations to the prevailing conditions at the operating location. In order to deliver the required ISO standards under this initiative in a prompt manner, OGP may need to work in close cooperation with other worldwide industry bodies, to set up funding, or establish a Joint Industry Project (JIP) to enable provision of the resources without undue delay. The activities of the two entities should be carried out in parallel to ensure work is not duplicated.

OGP should identify specific industry and other stakeholders, such as IRF, European Commission, US agencies (in close cooperation with API), Standards Developing Organisations such as ISO and API and trade associations, to advocate the best response to any new regulatory code, for the benefit of OGP members and the wider exploration and production industry, onshore and offshore. OGP will work in close cooperation with API and IADC.

The OGP Standards Committee undertook a survey in 2008 to obtain detailed lists of the standards members made references to in their specifications. The result was 5,237 different titles from 132 different organisations. The Standards Committee additionally surveyed how many specifications members had and the result was an average of 816 each, meaning that there are around 25,000 different specifications to communicate to the industry. OGP subsequently undertook a survey of standards used by regulators which totalled 1,140 standards from 60 different organisations. Of these, the oil and gas industry directly influences around 380 standards from 12 different organisations like API, IADC, ISO, OCIMF, OGP, OMHEC, Norsok. The depth, breadth and number of standards demonstrates the inherent complexity of the industry. It would be imprudent and impossible to combine them into one unifying and universally accepted document. OGP instead proposes that standards are aligned and rationalised as far as possible, whilst also respecting local constraints, rather than writing new standards. Training and sharing of information will be key to achieving this end.

² OGP report 450

³ OGP report 426

Appendix D

Regulation information and background

Regulations for the oil and gas industry are set by national regulators. This leads to differences in regulations across the globe. OGP will work with stakeholders to encourage more globally consistent standards. There are a number of standards available for drilling, well construction and well operations. The US offshore regulator, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), has issued new rules for the oil and gas industry's operations on the Outer Continental Shelf (OCS) following the Deepwater Horizon accident. In addition, BOEMRE has issued a number of Notices to Lessees (NTL) that provides further guidance to operators on complying with existing regulations. BOEMRE has also issued additional guidance regarding the recommended steps for operators to resume deepwater activity.

The European Commission (EC) published a communication entitled 'Facing the challenge of the safety of offshore oil and gas activities' to the European Parliament and the Council on 12 October 2010. The EC points out that technical standards vary across Europe and that few of them provide a presumption of conformity with EU law and national regulations.

Following the Deepwater Horizon accident, API set up a number of Joint Industry Task Forces (JITF) to analyse what needed to be done. This work has so far resulted in a major effort to revise key existing standards and several new API standards. OGP supports API's standards development. Many OGP members (mainly US based) have contributed actively to the revision and development of the API standards and will continue to do so.





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