Innovation and R&D in Well Control Perspective

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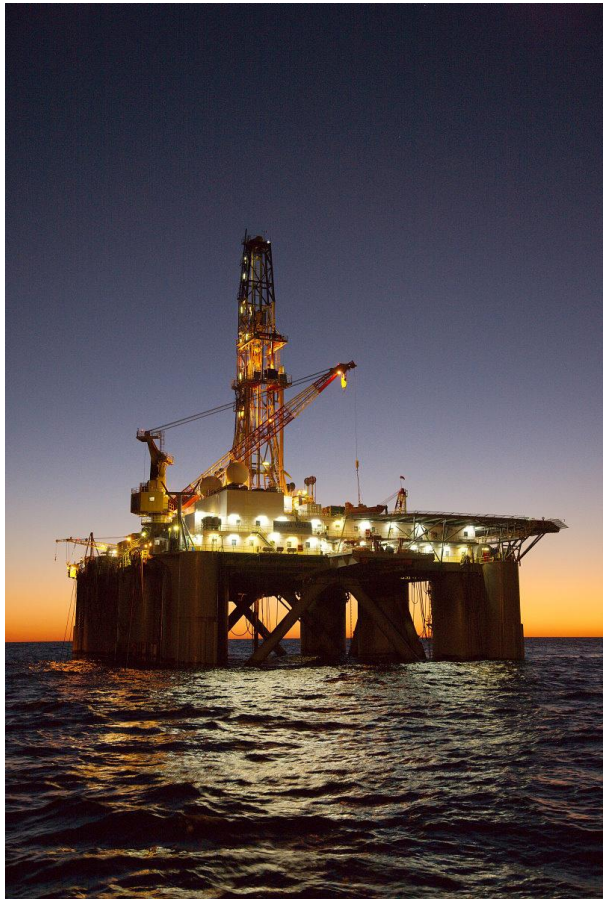
Well Construction and Integrity

Introduction



Themes

- Cooperation
- Commitment
- Prevention

Subjects

- INPEX Activities
- Historical Perspective
- Innovations
- Future Perspective
- Questions

INPEX Activities - Post Montara and Macondo

Cooperation

- Participated in drafting MoU for mutual aid
- Member of working group for self audit checklist
- Member of working group for Australia based cap and contain system

Commitment

- Signed MoU for mutual aid
- Committed to help oversee and fund engineering of cap and contain
- Working to secure oil spill dispersants and equipment for the INPEX area of operations

Prevention

- Revised and updated D&C management system to WC&I system
- HQ developed global INPEX well construction website
- Annual INPEX well integrity forums with global participation

Early Blowout Control Devices

Insofar as can be determined, **the earliest device that may be classified under the general heading of "blowout preventers" is one patented by M.A. Lanagan, bearing the patent serial number 267,903, and dated November 21, 1882** (see Fig. 1). This device was designed to serve as a means of shearing the drilling cable in a cable-tool well and to the seal the well bore…In the intervening 55 years there have been granted approximately 10,000 patents covering various forms of well control apparatus. Almost all of these inventions and improvements have striven to embody the fundamental principles of blowout control as recited in the letters patent of the Lanagan invention to wit: "If the flow of oil or gas from the well can be quickly stopped or diverted... it is a comparatively easy matter to arrest their progress... An apparatus which, when not in use, will not interfere with the boring of the well... but which, when the occasion requires, can be instantly operated from a safe distance..."

Paper Number 37- 049

The Development of Mechanical Control Equipment Used to Prevent Blowouts

Madden T. Works, Cameron Iron Works. Inc.

Drilling and Production Practice, 1937 Copyright 1937 American Petroleum Institute

History - Lucas Gusher - Spindletop Texas 1901

The paper makes no attempt to deal with the normal nonpressure method of drilling but is confined entirely to the control of wells after pressure has been encountered. Conditions to be Dealt with. A short description of pressures likely to be met with and their relation to the depth at which they are encountered. **Mentions the assistance to be obtained by the effect of a static column of mud fluid and of the necessity of augmenting this effect by pressure applied at the well-head**. Brings out the possibility of fractured formations rendering the use of mud fluid difficult or impossible.

Paper Number 1087

THE DRILLING AND CONTROL OF HIGH-PRESSURE WELLS

M. C. SEAMARKSource1st World Petroleum Congress, ***July 18 - 24, 1933 ,*** *London, UK Copyright 1933. World Petroleum Congress*

On March 24, 1976, Tenneco Oil Company experienced a blowout in the West Cameron 165 Field. West Cameron 165 Well No.3, a single-well platform installation, was blowing out of control. By April 11, 1976,the casing strings and the platform had subsided beneath the surface of the Gulf of Mexico, leaving a huge gas boil approximately 100 feet in diameter as the only remaining visual evidence of the blowout. During the ensuing events, new methods were employed for utilizing the Hewlett-Packard Quartz Pressure System and side scan sonar equipment to determined if the blowout well was flowing underground and/or beneath the surface of the water. In addition, **Tensor Incorporated's Magnetic Gradient Ranging System (MAGRANGE) was utilized to determine the distance and direction from the relief well to the blowout well.**

Paper Number 2766-MS
NEW INNOVATIONS FOR FIGHTING BLOWOUTS
James B. Lewis, Jr., Gary J. Mabie, James Z. Harris and Richard D. Barnett, Tenneco Oil Co.
Offshore Technology Conference, 2-5 May , Houston, Texas Copyright 1977.

History - Underwater Blow-Out Control

The paper describes a series of model tests carried out with **a bell shaped structure, designed for subsea collection of oil and gas from an underwater blow-out.**

The environmental loads on the structure, at various positions in the plume, have been investigated, and based on the test results a suggestion for an installation procedure that seems feasible for practical applications, is put forward.

As long as certain minimum requirements are met, the main experimental findings are thought to be fairly general and basically independent of the specific structure in question.

Paper Number 4416-MSDOI

Installation of a Bell-Shaped Structure for Underwater Blow-out Control

Per S. Teigen, Norwegian Hydrodynamic Laboratories
*Offshore Technology Conference, **3-6 May 1982,** Houston, Texas*
Copyright 1982. Offshore Technology Conference

Oil well firefighters and blowout specialists see well control problems from a slightly different view than most industry personnel.
Often, the well control event "has gone wrong"and developed into a bad problem usually resulting in a blowout. Several situations occur with some frequency and, with proper actions, can be avoided or the damage can be mitigated

Paper Number 7099-MSDOI
What Can Go Wrong And How To Deal With It: One Company's Experiences
N.J. Adams and L.G. Kuhlman, Neal Adams Firefighters Inc.
Offshore Technology Conference, 3 May-6 May 1993, Houston, Texas Copyright 1993. Offshore Technology Conference

History - Deepwater Well Control Guidelines

In response to technical challenges unique to deepwater drilling and production operations, a Task Force comprised of representatives from major and independent operators, drilling contractors, academia, well-control experts and equipment manufacturers has developed the ***IADC Deepwater Well Control Guidelines*** for industry wide circulation. Problem prevention is the emphasis of the *Guidelines* , which includes chapters on the five key issues identified by participants: **Well Planning; Well Control Procedures; Equipment; Emergency Response; and Training**. The result is a compilation of the industry's existing best practices, covering considerations and procedures from some of the best people in the industry. Developing the *Guidelines* within a one-year timeframe with a minimal budget was accomplished through the dedication of committee members, the support of their companies, and use of the Internet to facilitate peer review.

Paper Number 52761-MSDOI

An Overview of the IADC Deepwater Well Control Guidelines

S. Christman, Exxon Upstream Development Company; A. Kelly, M. Plaisance, Diamond Offshore; S. Kropla, J. Metcalf, Newfield Exploration; E. Robinson, BHP (Americas) ; C. Weddle, British Petroleum

SPE/IADC Drilling Conference, 9-11 March 1999, Amsterdam, Netherlands Copyright 1999

Innovation - OnePetro (operated be SPE)

OnePetro.org is a multi-society library:

- American Petroleum Institute (API)
- American Rock Mechanics Association (ARMA)
- American Society of Safety Engineers (ASSE)
- International Society for Rock Mechanics (ISRM)
- The National Energy Technology Laboratory (NETL)
- Offshore Technology Conference (OTC)
- NACE International (corrosion engineers)
- Petroleum Society of Canada (PETSOC)
- Society of Petroleum Engineers (SPE)
- Society of Petrophysicists and Well Log Analysts (SPWLA)
- The Society of Underwater Technology (SUT)
- World Petroleum Council (WPC)

Innovation - ROV Intervention

Events during 2010 have focused attention on increased ROV/BOP Intervention capabilities and standardization of BOP/ROV interfaces in the oil and gas offshore industry. Currently no enforced set standards for ROV intervention panels or manifold types for use on BOP Override systems are specified. The industry offers multiple configurations at present. **This abstract will discuss the advantages and disadvantages of the various configurations in existence, trending toward suggested industry standards taking shape as requirements in the near term**.

Paper Number 21322-MSDOI

ROV: Improving Remotely Operated(ROV) Intervention Capabilities for Blowout Preventer Override Systems

John Edward Davis/ Oceaneering International, Inc.SourceOffshore Technology Conference, 2-5 May 2011, Houston, Texas, USACopyright2011. Offshore Technology ConferenceLanguageEnglishPreview

Major offshore accidents, like the Macondo blowout, receive an enormous amount of publicity and are instrumental in enact-ing new and/or revised industry standards and governmental regulations. This paper reviews four major offshore accidents that occurred prior to 1988, and the effect that these accidents had on improving the reliability and safety of offshore operations. **There had not been any significant offshore accident in more than twenty years.** The absence of accidents, coupled with technological advances in being able to drill and produce in ever deeper waters, had gradually changed the public's perception of the safety of offshore drilling and had lessened the opposition for exploration in new offshore areas. All this has come to a halt with the 2010 Macondo blowout. **The industry, unprepared to rapidly contain the Macondo blowout, will now be subject to new regulations and be required to develop a rapid containment capability.**

Paper Number 144011-MSDOI
Offshore Accidents, Regulations and Industry Standards
Robert C. Visser/Belmar Engineering, Torrance, CA
SPE Western North American Region Meeting, 7-11 May 2011, Anchorage, Alaska, USA
Copyright2011. Society of Petroleum Engineers

Innovation - R & D Activities

- Oil and Gas Operators
- Service Companies
- Academia
- Industry Associations
- Entrepreneurs

Innovation - Capping, Containment and Recovery

- The Marine Well Containment Company
- Wild Well Control – Capping Stack
- HELIX Energy Solutions Group
- OSPRAG – Capping and Containment
- OGP – Capping and Containment
- SQUID Eco – Inventor Steven Dvorak
- Australia – APPEA Drilling Steering Committee

Innovation – using new or existing technology in a novel fashion

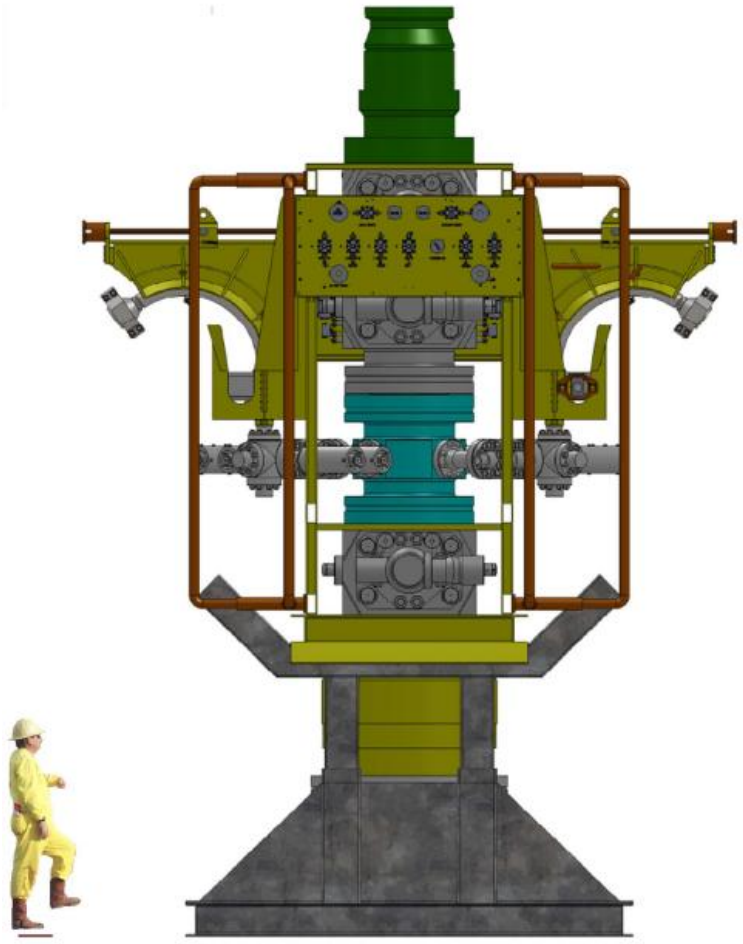
- Top Kill – Junk Shot attempt
- Top Hat
- Static Kill
- Helix Surface Collection
- Subsea Dispersant Injection
- Real Time ROV Displays and webcast
- Periodic Updates on Web
- Coordination of Multiple Emergency Response Centres

Innovation – PTTEP Montara Well Kill

Relief Well used to kill the well – magnetic ranging used to intercept casing

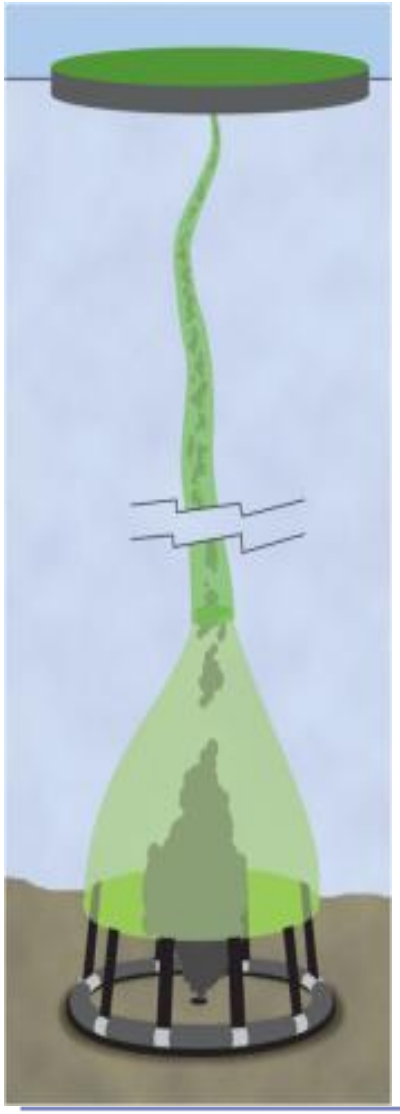
Little opportunity for further innovation due to the prohibition notice preventing access to the platform or rig. Refer to the Montara Commission Report for further information.

Innovation - WWC - Capping Stack



Height (inches)	Weight (lbs)
57	10,300
84	72,000
47	12,500
49	36,000
53	43,000
	8,000
	12,000
	8,000
	10,000
290 = 25ft	212,000= 106T

Innovation - SQUIDeco™ - Inventor Steven Dvorak



Introducing SQUID Eco

The SQUID™ Eco containment device is a flexible polyethylene tube that fits over a subsea well head and functions like an umbilical cord to channel the crude oil and gas to collection vessels at the surface.

Components

- Anchor Hoop (ballast) - 48’ to 100’ in diameter (steel/alum)
- Shroud – 48’ to 100’ in diameter (polyethylene)
- Riser – 8’ to 36’ in diameter (polyethylene)
- Collection Pool – 300’ to 1000’ in diameter (polyethylene)

Benefits

- Simple and elegant to manufacture and deploy
- Can be deployed and operational in 48-72 hrs.
- Can capture 99% of oil and gas
- Can hold approximately 60,000-bbs
- Provides a subsea work space
- Can be combined with dispersants
- Can be configured like a gathering system in multi-leak scenarios
- Costs but a fraction of the current subsea oil containment solutions

IADC implemented the Well Control Accreditation Program (WellCAP) in 1995.

IWCF was formed in 1994 renamed form the European Well Control Forum

Q. What is the difference between IWCF and IADC WellCAP Drilling Well Control?

A. The well control training course is the same, with the same fee. The difference is in the method of testing and how universally accepted the certification is accepted worldwide. Written testing is performed independently by IWCF and practical assessments are performed by IWCF accredited assessors. IWCF routinely audit both practical and written tests. IADC WellCAP accredit the training school, and once the training is accredited, the school then delivers both training and testing in-house…. IADC is not universally accepted by all Drilling Contractors and Operators. (WellTrain)

Certification ≠ Competence

Generally speaking well control school curricula focuses on kick identification and well kill techniques that occur while drilling or tripping pipe.

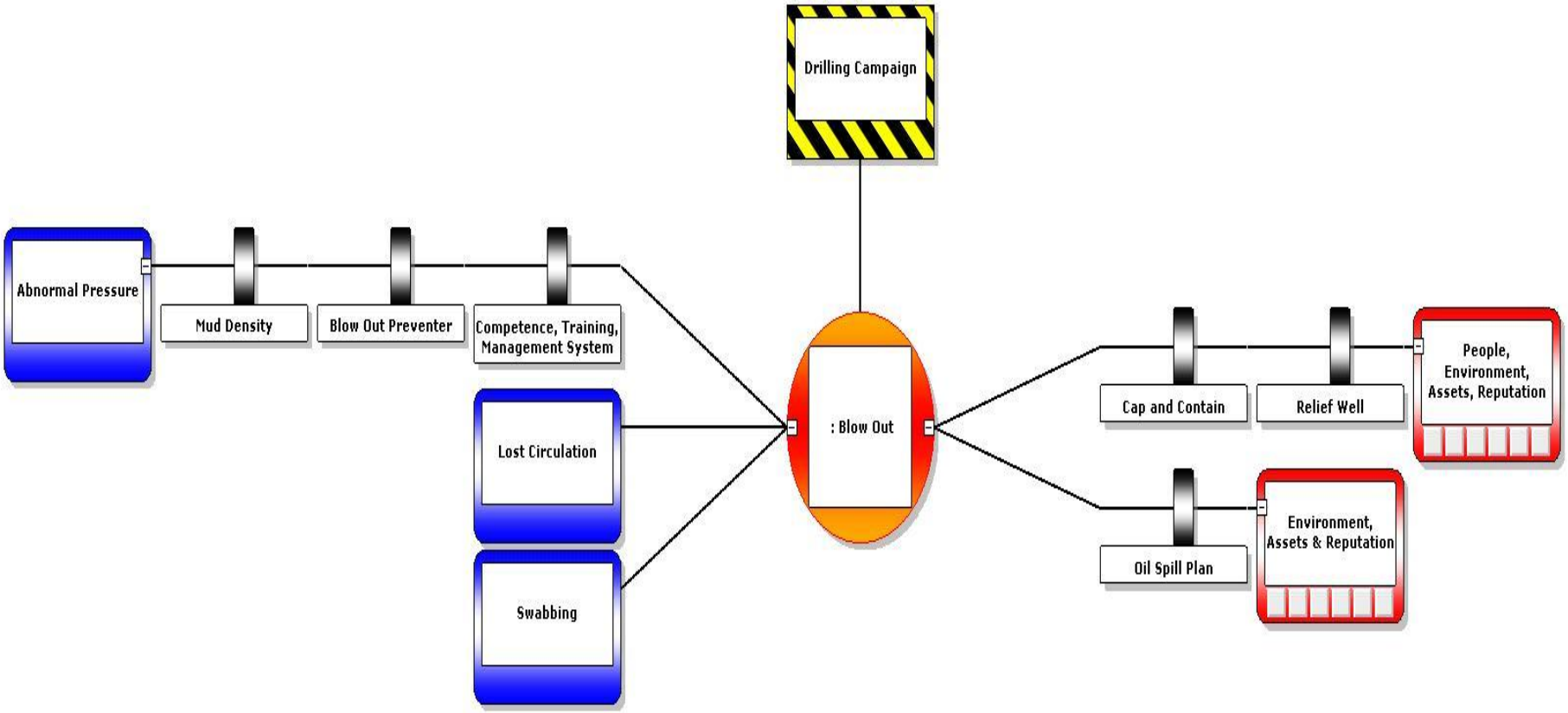
Montara and Macondo occurred during operations other than drilling or tripping.

Future - Risk Assessment and Mitigation Tools

Both the Montara and the Macondo reports mention the lack of proper risk assessment as factors in the incidents.

Risk identification and mitigation is absolutely fundamental to safe drilling and a core competence requirement.

Future - Blowout Bowtie – Illustration Only



Global Industry Response Group

The International Association of Oil and Gas Producers (OGP) formed the Global Industry Response Group (GIRG) in July 2010 in the aftermath of the tragic accident in the Gulf of Mexico on the Macondo prospect, Montara in Australia, and other similar incidents.

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.

OGP – Global Industry Response Group

- OGP Governed Wells Expert Committee (WEC)
- Capping response consortium – 9 major oil companies
- Joint Industry Project (JIP) – oil spill response

APPEA – Drilling Steering Committee

- Self audit check list
- Mutual aid MoU
- Cap and contain workgroup

APPEA has been asked about providing a well expert nominee to the OGP WEC

- INPEX activities explained

  committed to cooperate and focused on prevention

- Historical Perspective Presented

  The O&G industry has been working on well control for at least 129 years

- Innovations Listed

  There are multiple options available for capping and containment

- Future Directions Pointed Out

  an increased emphasis is required on prevention, training and competence as well as implementation and application of existing regulations, management systems, risk mitigation tools, etc. to make sure we don’t have another Montara or Macondo.

References

Report of the Montara Commission of Inquiry
Commissioner David Borthwick AO PSM June 2010

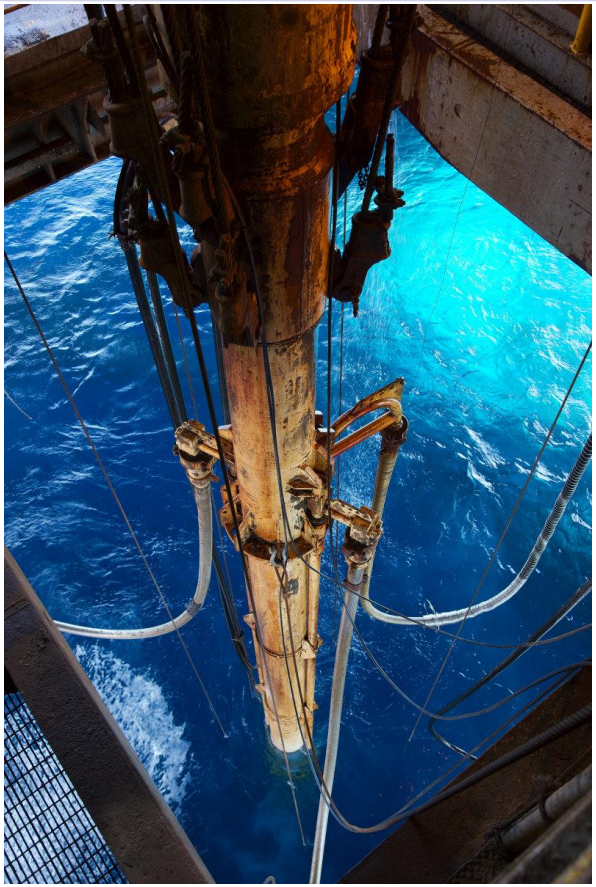
DEEP WATER – The Gulf Oil Disaster and the Future of Offshore Drilling
Report to the President January 2011
National Commission on the BP Deepwater Horizon Oil spill and Offshore Drilling

Capping and Containment – OGP
Global Industry Response Group recommendations
Report No. 464 May 2011

International recommendations on well incident prevention, intervention and response – OGP
Global Industry Response Group recommendations

Deepwater Wells – OGP
Global Industry Response Group recommendations
Report No. 463 May 2011

Questions



Thank you for your attention

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