LLOG and Seadrill – OMB/OIRA – (RIN) 1014–AA11

Seadrill's concerns with BSEE's proposed rule -2015-0002

Oil and Gas Sulphur Operations in the Outer Continental Shelf- Blowout Preventer and Well Control

Seadrill

Seadrill America's Profile

- Second Largest Deepwater Rig Fleet in the World, Americas Headquarters in Houston
- Employs 969 USA onshore and offshore employees, and 262 US citizens abroad.
- Business Strategy is operate state-of-the-art offshore drilling units using one of the most modern fleets in the industry.
- 5 operating Rigs in the GOM with **8 BOPs**, 2011, 2013, 2013, 2013 (LLOG), 2014 (LLOG)
- All Seadrill rigs in the GOM have 2 annulars, 6+ rams, **2 Blind shear rams and 1 Casing Shear ram**. Exceeding S53 requirements.
- Actively participated in S53 standard development since 2010.
- Use API Standards including S53 as the basis for our BOP, procurement, maintenance and operation standards.

BSEE Proposed Rule – Unaccounted Costs

The proposed rule as publicized for comment on April 03 2015 contains several specific **BOP technical requirements** that are **not phrased in well control goal oriented language** but rather prescriptive language that has the unintended consequence of excluding alternate methods, configurations, or sequences in which to obtain a lower overall risk level.

Most of these requirements are BOP control equipment additions that were underestimated in the published agency economic analysis in both up front capital/engineering costs but also the continuous costs to the operation and equipment owners in terms of

- **Spare parts inventory**
- **Continuous maintenance, monitoring and testing man-hours**
- **Reduced equipment reliability due to increased complexity and increased failure risks**
- Text from BSEE Economic Analysis of additional accumulator requirements

*"The requirement that the surface accumulator system operate all functions for all BOP systems would result in a **one-time equipment and labor cost to industry** "*

REALITY – Cost impact to rig BOP is ongoing and not a one time cost .

Rule Referenced Documents

In the preamble text of the PWCR BSEE references four documents to justify portions of the rule.

A) **DOI/Department of Homeland Security (DHS) Investigation Team-** Report Regarding the Causes of the April 20, 2010 Macondo Well Blowout

B) **National Commission** on the BP Deepwater Horizon Oil Spill And Offshore Drilling's Final Report, January 2011 Council on Foreign Relations

C) **Chief Counsel for the National National Academy of Engineering Commission** -Macondo The Gulf Oil Disaster

D) - Macondo Well Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety

Seadrill sees issues with proposed rules that follow these themes:

1) Many of the BOP changes in the Proposed Rule Text are outside of the same industry standard requirements (API 53, API 16D….) the BSEE seeks to incorporate in the rule.

2) In the reports listed above (A,B,C,D) which are referenced in the Rule preamble, there is no specific *recommendation* covering: expanded ROV intervention, additional BOP side outlet valves, inclusion of two shear rams in every deadman activation.

3) The BOP system cost of compliance was severely underestimated in the economic analysis.

4) Many of the BOP system proposed rules pose risks to the capability of the BOP's primary control system to either control a kick, or contain a well, when called upon in either a controlled or emergency situation.

ROV Intervention (Remote Operated Vehicle)

API Standard 53 -

- The BOP stack shall be equipped with ROV intervention equipment that at a minimum allows the **operation of the critical functions*** (each shear ram, **one pipe ram**, ram locks, and unlatching of the LMRP connector).

BSEE Proposed Rule -

- The ROV must be capable of performing critical functions, including **opening and closing** each shear ram, **choke and kill side outlet valves**, **all pipe rams**, and LMRP disconnect …

Seadrill's Capital/Engineeering Cost Estimate for existing GOM fleet per BOP Stack: $6.48 Million
Estimate of increased yearly maintenance and per BOP Stack: $20 K

BSEE Proposed Rule Estimate per Rig : Included in estimated $25K costs for all New Subsea BOP System Requirements (excluding shear rams). p158

ADDED RISKS:

- Primary BOP controls compromised with additional failure points on the path to operate the BOP- the benefit must outweigh the risk
- Additional BOP Testing, additional testing wear/tear on the BOP
- Increased Visual Obscurity of BOP for ROV inspection.

* In API 53 Critical functions defined as "close" functions in Table 6 and 7, not open & close.

Bleed Valves below the Lower Annular

API Standard 53 -

- Location of the choke and kill line openings on the BOP stack depends on the particular configuration of the preventers and the operator's preferred flexibility for well control operations. (All of Seadrill's units have a gas bleed line under the **upper** annular.)

BSEE Proposed Rule –

- If you have dual annulars, where one annular is on the LMRP and one annular is on the lower BOP stack, **you must install a gas bleed line** on **each annular**.

Seadrill's Capital/Engineeering Cost Estimate for existing GOM fleet per BOP Stack : $400 K (pending feasibility)
Estimate of yearly maintenance and per unit: $5 k

BSEE Proposed Rule Estimate per Rig : Included in estimated $25 K costs for all New Subsea BOP System Requirements. (p158)

RISKS-

- Additional leak paths from the well bore-
- Additional maintenance (manual handling)-
- Additional controls/ control pod complexity- more panel buttons and pod valves

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Shear Ram Requirements-

- **Seadrill is not opposed to dual Shear Ram requirements** but is opposed to prescriptive language that describes how they will be configured and sequenced which may be counter to the conclusions of a risk assessment for a specific project phase.
- Depending on the drilling string in use (drill pipe, casing, wireline, test assembly, etc) both the shear-ability and tension in the pipe will make **some shear sequences safer** than the prescribed sequence at different phases.
- BSEE preamble acknowledges there may be times when two shear rams cannot be used but requires the use of CFR 250.141 for alternative compliance.

Shear Ram – Timing Circuit Replacements

Seadrill

Standard 53 Shear Ram and Controls Requirements:

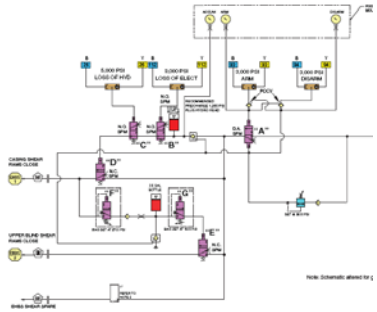
- A minimum of two sets of shear rams for shearing the drill pipe and tubing in use, of which at least one shall be capable of sealing for DP rigs.
- EDS sequence specific to rig operation. Deadman/Autoshear systems required.
- Autoshear/Deadman systems required to be armed unless risk assessed and managed by operating procedures.

BSEE Shear Ram and Controls Requirements:

- Each emergency function must **close at a minimum, two shear rams in sequence** and be capable of performing their expected shearing and sealing action under MASP conditions as defined for the operation.

Seadrill's Capital/Engineeering Cost Estimate for existing GOM fleet per unit: $550 K

BSEE Proposed Rule Estimate per Rig : Included in estimated $25 K costs for all New Subsea BOP System Requirements. p158



RISKS- Activation of **both blind** shear rams **during an unplanned event** such as a deadman activation in which an unshearable drill collar is across both shear rams would **damage both rams** disallowing the ROV activation of one after the well bore had been cleared to safely seal the well therefore **prolonging containment**. The solution is a risk based approach to shear ram activation modes based on total systems capability.

Example – Rule Additional Compliance Cost per BOP - Current Seadrill Rigs Working for LLOG

	BSEE 2015-0002-0002	SEADRILL
Surface Accumulator Volume Increase – Standard 53 allows for 1 annular and 4 rams, BSEE proposes 1.5 x the capacity to open and close ALL rams and valves.	**US$ 25,000**	**US$ 5, 970, 000**
Subsea Accumulator Volume Increase- Separation of subsea volumes and inclusion of other non-deadman functions such as LMRP disconnect.	**~Not Published in Rule**	**US $ 8, 090, 000**
ROV Intervention – open and close ALL BOP & GATE VALVES- Costs of panels, valves, installation,	**~Not Published in Rule**	**US $ 6, 480,000**
Shear Ram Deadman Sequencing - Engineering , testing , installation, integration testing, and commissioning	**~Not Published in Rule**	**US $ 550,000**
Bleed line and valve installation (N/A for LLOG)- Engineering, capital costs, structural modifications, controls additions, control panel changes, additional testing and maintenance	**~Not Published in Rule**	**US $ 400,000**

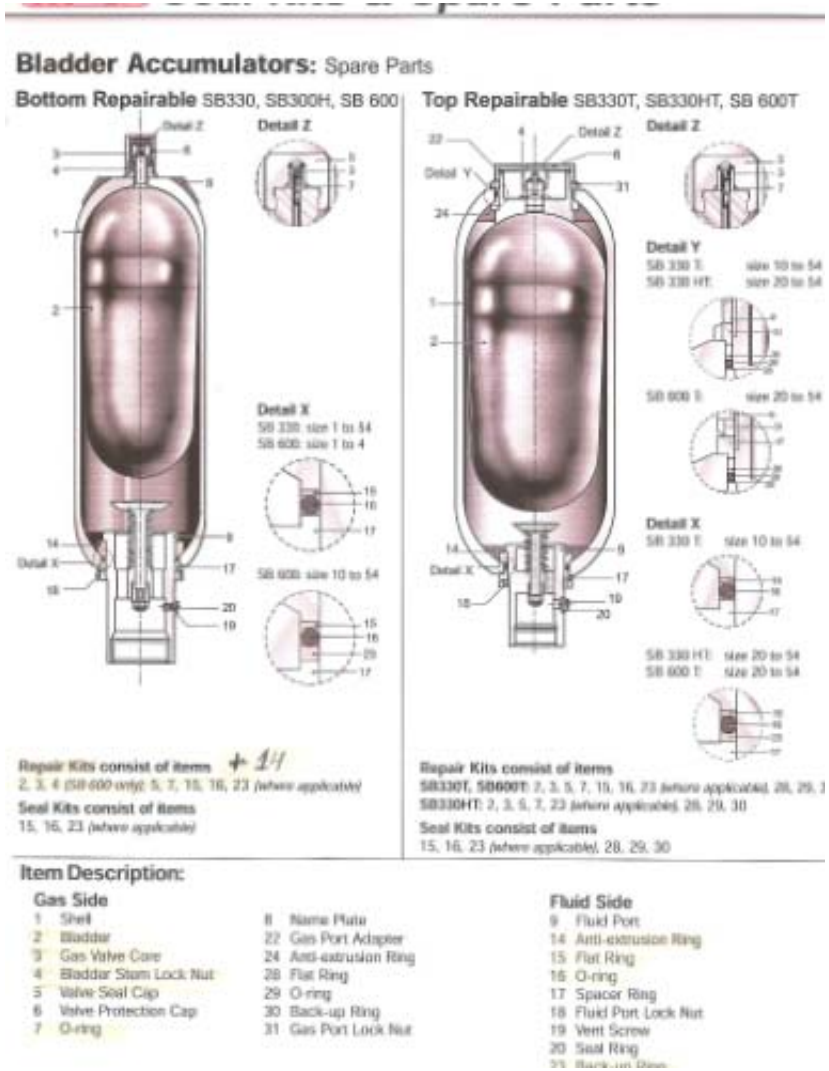
Values are based on costs of actual post rig delivery projects completed by Seadrill between 2012 and 2015 to expand accumulator capacity, add failsafe valves, add ram cavities, install S53 compliant ROV functionality . Costs include engineering, project management, labor, parts and rig day rate costs. Does NOT include recurring costs of preventative and corrective maintenance, monitoring and certification

Seadrill requests the modified rule be re-opened for discussion with the purpose of:

- Resolving ambiguous language to create a clear path to compliance
- Tightening the rule to focus resources on measures that reduce identified risks
- Revising the proposed rules to reduce unintended consequences
- Gaining consensus on realistic compliance timelines

Back-Up Slides

Accumulators Require Maintenance



Bladder Accumulators: Spare Parts

Bottom Repairable SB330, SB300H, SB 600

Top Repairable SB330T, SB330HT, SB 600T

Repair Kits consist of items
2, 3, 4 (SB 600 only), 5, 7, 15, 16, 23 (where applicable)

Seal Kits consist of items
15, 16, 23 (where applicable)

Repair Kits consist of items
SB330T, SB600T: 2, 3, 5, 7, 15, 16, 23 (where applicable), 28, 29, 30
SB330HT: 2, 3, 5, 7, 23 (where applicable), 28, 29, 30

Seal Kits consist of items
15, 16, 23 (where applicable), 28, 29, 30

Item Description:

Gas Side

1 Shell
2 Bladder
3 Gas Valve Core
4 Bladder Stem Lock Nut
5 Valve Seal Cap
6 Valve Protection Cap
7 O-ring
8 Name Plate
22 Gas Port Adapter
24 Anti-extrusion Ring
28 Flat Ring
29 O-ring
30 Back-up Ring
31 Gas Port Lock Nut

Fluid Side

9 Fluid Port
14 Anti-extrusion Ring
15 Flat Ring
16 O-ring
17 Spacer Ring
18 Fluid Port Lock Nut
19 Vent Screw
20 Seal Ring

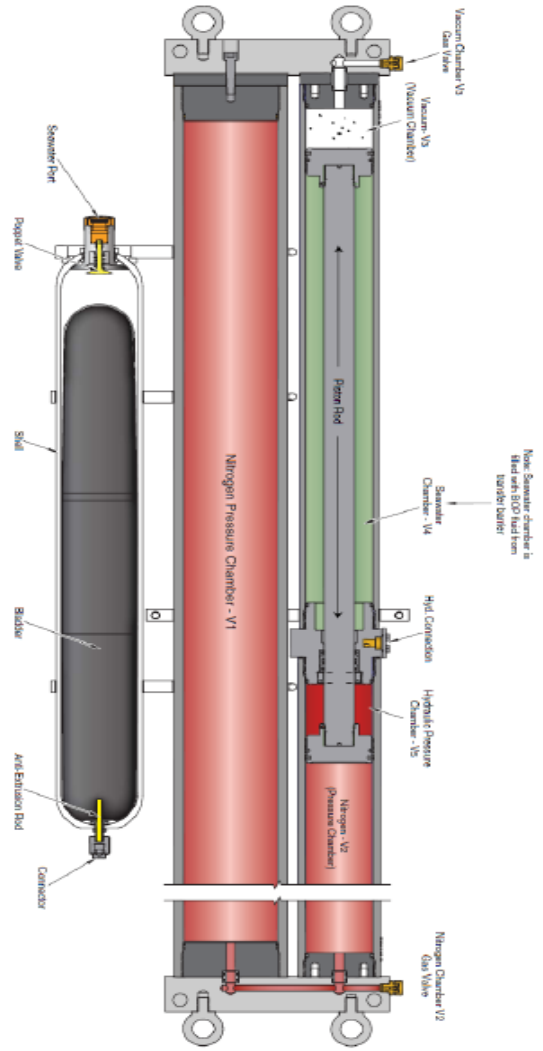


Figure 1: Gen 1 DCB showing location of Nitrogen chamber gas valve.

Summary of ROV Comments

- ROV intervention is practical for secondary well containment and emergency disconnect functions but not for well kill operations, as such out fitting ALL functions adds impractical and unneeded complication, additional maintenance and significant upfront engineering and capital costs to the BOP control system without achieving appreciable improvements in well control outcome.

Shuttle Stack

Stack with Just 2 ROV functions