

Opinions Regarding the BOP Failure

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▶ IMPORTANT TO SPECIFY TIME

◦ AMF TIME

- April 20, 2010 -- At or near the time of explosion or within a few minutes

◦ AUTOSHEAR TIME

- April 22, 2010, 2 days later

AMF TIME – April 20, 2010

- ▶ **BSR DID NOT FUNCTION AT TIME OF AMF**
 - 27 Volt battery in Blue Pod was Dead
 - Solenoid 103 in Yellow Pod was Miswired

AMF TIME – April 20, 2010

- ▶ **PROPER MAINTENANCE WOULD HAVE ENSURED BLUE 27V BATTERY WAS SUFFICIENTLY CHARGED**
 - Follow Cameron's recommended replacement schedule
 - Track battery change-outs to properly execute replacements
 - Check battery voltage every time Pods were on surface

AMF TIME – April 20, 2010

- ▶ **PROPER MAINTENANCE WOULD HAVE ENSURED BLUE 27V BATTERY WAS SUFFICIENTLY CHARGED** (cont'd)
 - Run AMF sequence to check function
 - Use a battery voltage monitoring system
 - Use rechargeable batteries with a charging system

AMF TIME – April 20, 2010

- ▶ **PROPER MAINTENANCE WOULD HAVE ENSURED SOLENOID 103 WAS FUNCTIONAL**
 - **Faulty wiring easily detected**
 - Follow Cameron's recommended solenoid refurbish/check procedures
 - Follow Transocean's required solenoid refurbish/check procedures

AUTOSHEAR – April 22, 2010

- ▶ BSR ACTIVATED AT THE TIME OF AUTOSHEAR
 - BSR was Unable to Shear and Seal because of Off-Center Pipe
 - SBR-type blades had little ability to center the drill pipe once it moved off-center

AUTOSHEAR – April 22, 2010

- ▶ Alternative Ram Design Would Have Ensured that BSR Would Cut Off-Set Pipe
 - Double “V” rams – either DVS or cDVS
 - 2 “V” shaped blades provide more centering capability than 1
 - Requires less pressure to cut pipe
 - Either was a “plug-and-play” ram block replacement

Shearing Capacity of BSR

- ▶ Shearing Capacity of the Blind Shear Ram was Marginal at Best
 - Marginal for 5 1/2" Pipe:
 - Predicted shearing pressure for the 5 1/2" pipe greatly exceeded the 3000 psi main system pressure
 - Predicted shearing pressure for the 5 1/2" pipe was too close to the 4000 psi high pressure limit
 - Wholly Inadequate for 6 5/8" Pipe:
 - Predicted shearing pressure greatly exceeded both the 3000 psi main system pressure and 4000 psi high pressure limit

Shearing Capacity of BSR

- ▶ BP knew 6.625" pipe was in use
- ▶ Simple check of shearing capacity using Cameron tools would have shown inadequacy

RIG MAINTENANCE

- ▶ MAINTENANCE ON RIG WAS INADEQUATE AND CAUSAL TO BOP FAILURE
 - Condition of Blue Pod battery & Yellow Pod solenoid 103 problems prove lack of adequate maintenance.
 - Maintenance history records difficult to follow
 - Could not follow battery history for pods in maintenance records

RIG MAINTENANCE

- ▶ **BP WAS AWARE OF MAINTENANCE PROBLEMS**
 - BP knew of maintenance problems on the DWH for years
 - Rig Audits noted, since at least 2005, poor maintenance records
 - Rig audits were commissioned by BP
 - BP's own expert opined that maintenance problems contributed to the BOP failure