LESSONS LEARNED FROM MACONDO

Sean C. Grimsley, Bartlit Beck Herman Palenchar & Scott LLP
Deputy Chief Counsel
The National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling
Background

What Happened

Root Causes

Thoughts for Committee

Background

21.b(CD) Lessons Learned from Macondo
Sec. 3. Mission. The Commission shall:

(a) examine the relevant facts and circumstances concerning the root causes of the Deepwater Horizon oil disaster;

... 

(c) submit a final public report to the President with its findings and options for consideration within 6 months of the date of the Commission’s first meeting.
Investigate and identify root causes of the blowout
- Other staff investigated containment and response
- Did not investigate BOP failure post-explosion and blowout

Present preliminary findings at hearing on November 8-9, 2010

Assist in preparing Commission’s Final Report

Prepare and submit Chief Counsel’s Report detailing findings on root causes of blowout
Two Reports Containing Findings on Root Cause of Blowout

Commission’s Report
- Released January 11, 2011
- Chapter 4 sets out Commission’s findings regarding root causes

Chief Counsel’s Report
- Released February 17, 2011
- More detailed explanation of findings contained in Chapter 4 of the Commission’s Report
- Contains some additional information not available at time Commission’s Report written – confirmed findings

21.b(CD) Lessons Learned from Macondo
What Happened: High-Level
The Macondo Well

Sea Floor

Formation

Multiple Pay Sands

21.b(CD) Lessons Learned from Macondo
What Happened – High Level

1. Bottomhole cement was the only “active” barrier when blowout occurred
   - Mud removed (underbalanced) and BOP was open
   - BP chose not to put additional barriers in place prior to displacement of mud from the riser
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   - Unusually tricky cement job – many risk factors
   - Foamed cement slurry was likely unstable as well

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   - Failed to detect influx during displacement – Human Judgment
Failure of Management

Adapted from James Reason (Hampshire: Ashgate Publishing Limited, 1997).

Figure 1. Barriers Breached and the Relationship of Barriers to the Critical Factors.
Overview of Management Failures

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   - Diffuse decision making – within BP and between contractors
   - Ineffective communication
   - Lack of leadership
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Some of the Companies Involved at Macondo

- **Rig and drilling**: Transocean
- **Cementing**: Halliburton
- **Drilling mud**: Mi Swaco
- **Well and cement logging**: Schlumberger
- **Surface data logging**: Halliburton
- **Blowout preventer**: Cameron
- **ROV support**: Oceaneering
- **Wellhead, casing hangers**: Weatherford

Centralizers, float collar, shoe track

21.b(CD) Lessons Learned from Macondo
Onshore Organizational Chart
Cement Job: Example of Problems with Decentralized Decision-Making

- Numerous different risk factors associated with cement job
- Little to no communication of those risks to individuals/contractors conducting the negative pressure test or monitoring well after cement job
- Resulted in looking at risks they knew about one at a time rather than collectively as a group
Recommendation: Make Clear Who is Responsible

- Much finger-pointing after event – saying someone else responsible

- Make clear entity responsible for critical decisions and operations
Did Not Communicate Lessons Learned From Other Events

“drill crew did not consider well control as a realistic event during the...displacement operation as the [downhole barrier] had been successfully tested”

“tested barriers can fail and risk awareness and control measures need to be implemented”

“standard well control practices must be maintained throughout the life of the well”

“specify operations that induce underbalance conditions in the well bore”
Did Not Communicate Lessons Learned From Other Events

“‘It’s in the database’

April 14, 2010 Advisory
Recommendation: Create Centralized System for Communicating Lessons Learned and Best Practices

- Create centralized, industry-wide system for alerting all players to lessons learned and near misses

- Keep better track of procedures used by different companies in order to facilitate study and identification of best practices
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21.b(CD) Lessons Learned from Macondo
The Macondo Well
Barriers to Hydrocarbon Escape

“Active” Barriers
- Mud (drilling fluid)
- Tested physical barriers
  - Bottom-hole cement
  - Cement plugs and other up-hole mechanical barriers
  - Closed BOP

“Contingent” Barriers
- Open BOP – depends on human judgment
- Untested physical barriers – tests often depend on human judgment (e.g., negative pressure test)
Single Physical Barrier During Displacement: Placed Unnecessary Reliance on Human Judgment

21.b(CD) Lessons Learned from Macondo
Inadequate Focus on Technology

- One of biggest surprises in whole investigation

- Antiquated sensors, data presentation and very few automated safety systems or checks

- Appears to lag behind other industries when comes to safety-related technologies (*e.g.*, airline industry) particularly where no drilling efficiency payoff
Example: How Driller Sees Data
Recommendation: Eliminate Human Judgment as Much as Possible Where Mistake Could Have Huge Consequences

- Require redundant “dumb” safety barriers – for instance must have at least two “active” barriers when underbalanced

- Incentivize development of technology to eliminate reliance on human judgment where possible
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Evolution of Temporary Abandonment Procedure

April 14 E-Mail From Morel to R. Sepulvado

- Run RSWC #3
- Make clean-out run to 18,360’ / short trip and CBU at 18,360’
- POOH and retrieve wear bushing
- Run tapered tong string
- POOH with landing string
- RH set wear bushing continue to 8367’ set 300’ cement plug
- Wait on cement / tag TOC with 15k
- Negative test with base oil in kill/choke line to the wellhead
- POOH to 6000’
- Displace to seawater
- POOH and wash wellhead on the way out
- Run lead impression
- Run lockdown sleeve
- Pull Riser

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Evolution of Temporary Abandonment Procedure

April 16 Application for Permit to Drill Sent to MMS

Temporary Abandonment Procedure: (estimated start time: Sunday, April 18, 2010)

1. Negative test casing to seawater gradient equivalent for 30 min. with kill line.
2. Trip with a 3-1/2” stinger to 8,367’.
3. Displace to seawater. Monitor well for 30 min.
4. Set a 300’ cement plug (125 cu.ft. of Class H cement) from 8,367’ to 8,067’.
   The requested surface plug depth deviation is for minimizing the chance for damaging the LID sealing area, for future completion operations.
   This is a Temporary Abandonment only.
   The cement plug length has been extended to compensate for added setting depth.
5. POOB.
6. Set 9-7/8” LID (Lock Down Sleeve)

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21.b(CD) Lessons Learned from Macondo
# Evolution of Temporary Abandonment Procedure

## April 20 Operations Note

From Morel to Rig

### April 14

**Morel E-Mail**

- Reduce API to 2000
- Withdraw 200' above the top of the cement
- Set a 300' cement plug in mud
- Blowout

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### April 16

**MMS Permit**

- Trip in hole to 8,367'
- Displace mud with seawater from 8,367' to above wellhead (BOP)
- Displace mud in well and riser from 8,367' with seawater

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### April 20

**Ops Note**

- Blowout
- Displace mud in riser with seawater
- Displace mud in riser with seawater

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Evolution of Temporary Abandonment Procedure

April 28 Interview of Bob Kaluza

The permit was modified for the surface cement plug. It was a different sequence. While running in the hole I was in the office and Haffie called to ensure I had seen the modified APM. Brian was on the rig sleeping as he was on the cement job. Mark called to go through the ADP – said I should talk to Brian so I went to wake up Brian. The team in town wanted to do something different - Mark was on vacation. They decided we could do the displacement and negative test together - don’t know why - maybe trying to save time. At the end of the well sometimes they think about speeding up.

April 14
Morel E-Mail

April 16
MMS Permit

April 20
Ops Note

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21.b(CD) Lessons Learned from Macondo
**Recommendation: Require Earlier Submission of Procedures for Approval**

- BP did not submit temporary abandonment plan with original permit requests – did not develop until last 10 days before blowout.

- Requiring earlier submission would allow greater time for agency review and force companies to develop procedures before last minute.
Recommendation: Require Strict Adherence to Approved Procedures

BP altered the temporary abandonment procedure from those approved by MMS – said believed was safer procedure so no need to re-submit.

Requiring strict adherence to approved procedures will prevent ad hoc decision-making and force companies to do real risk assessment.
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21.b(CD) Lessons Learned from Macondo
Inadequate Training on Low Probability Emergency Events

9.3 PROCEDURES FOR HANDLING GAS IN THE RISER

These procedures are to be conducted along with the shut-in procedures for Subsea BOP’s as described in Section 5.

- Limit the volume of gas that may be taken above the BOP stack (early detection).
- If an influx is suspected, shut off the mud pumps. This will help avoid circulating the gas above the BOP stack.
- Shut-in the well as quickly as possible.
- Conduct a riser flow check. If the riser is flowing, divert the flow overboard. If so equipped, the flow can be diverted through a gas handling system or MGS.
- If the riser is not flowing or has stopped flowing, continue to monitor it for flow. Do not leave it unattended.
- If so equipped and if the MGS is not being used for the primary well control operations, the riser fluid may be circulated through the MGS at slow rates to remove the gas from the fluid.
- Circulate the riser at slow rates. Stop circulation and conduct a riser flow check after every 100 bbls (16 m³) pumped or equivalent volume to +/- 250 ft (75 m) of riser.
- If gas is seen at surface, stop pumping and watch for flow. Allow the flow to deplete before continuing.
- If the flow rate increases, be prepared to open up the diverter line to send the mud overboard.
- Continue to circulate in staggoo at slow rate until the complete riser volume has been circulated.
- After killing the well and removing any gas trapped in the BOP stack, as described in Section 6, there is still the possibility that some gas trapped under the BOP stack may be released into the riser after opening the BOP. If this occurs, then the above procedures should be repeated.
Recommendation: Require and Approve Training, Procedures and Drills for Various Potential Emergencies

- Require that companies train and drill for various emergency scenarios, such as blowout.
- Require companies to submit emergency procedures and training plans.
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21.b(CD) Lessons Learned from Macondo
Major Process Safety Gaps at BP

BP’s “Stage Gate” Process

- **Robust** risk analysis/peer review during **design stage**
- Little to no risk analysis/no peer review during **execute stage**
  - **BUT major procedural and other decisions made**
  - **BP actually put off certain design decisions until execute stage**

**Results in ad hoc decision-making on key decisions**

- No formal structure for evaluating risk or peer review
- Decisions often one person on the fly without full information
  - **Centralizer decision**
  - **Temporary abandonment procedures**

**Inadequate post-execution audit for evaluating decisions that increase risk of low probability, high consequence event**
No Formal Risk Assessment of Temporary Abandonment Procedures

From: Hafle, Mark E  
**Sent:** Fri Apr 16 02:15:36 2010  
**To:** Morel, Brian P  
**Subject:** Re: Negative Test  
**Importance:** Normal

**Seems ok to me.** I really don't think mms will approve deep surface plug. We'll see

Did permit look ok?

---

From: Morel, Brian P  
**To:** Walz, Gregory S; Cocalés, Brett W; Hafle, Mark E; Guide, John  
**Sent:** Thu Apr 15 20:53:40 2010  
**Subject:** Negative Test

**Recommendation out here is to displace to seawater at 8300’ then set the cement plug. Does anyone have issues with this?**

If we do a negative test prior to this with baseline to the wellhead the shoe will see about 360 psi less after the hole is displaced. Thoughts?

Thanks  
Brian
Recommendation: Require Robust Internal Risk Assessment Procedures Throughout All Phases of Well

- Ensure companies have risk assessment regimes that do not have gaps in critical areas – particularly process safety

- Failure to adhere to own risk assessment procedures could be regulatory violation – hard to know how to enforce/check
Some Thoughts for Committee

- Make Clear Who is Responsible
- Eliminate Human Judgment as Much as Possible Where Mistake Could Have Huge Consequences
- Incentivize Investment in Safety-Related Technology
- Create Centralized System for Communicating Lessons Learned and Best Practices
- RequireEarlier Submission of and Strict Adherence to Procedures
- Require and Approve Training, Procedures and Drills for Various Potential Emergencies
- Require Robust Internal Risk Assessment Procedures Throughout All Phases of Well
Questions?