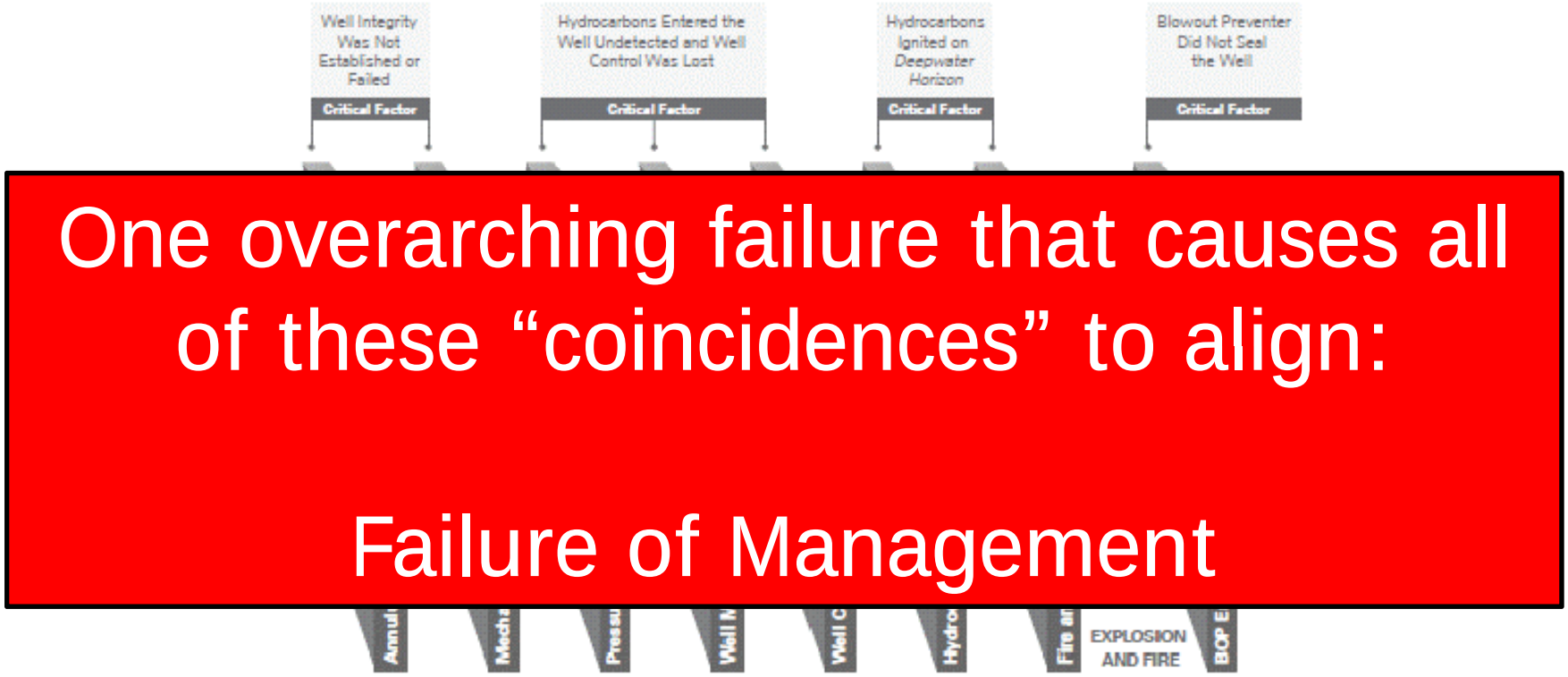
Presentation at Roger Williams University School of Law

LESSONS LEARNED FROM MACONDO

Fred H. Bartlit

April 13, 2011

BP's View of the Blowout



One overarching failure that causes all of these "coincidences" to align:

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.

Overarching Failure of Management

1. Lack of Leadership – Absence of responsibility

2. Set employees up for failure with inadequate training, procedures & resources

3. Inadequate appreciation of low probability, high consequence events

Background

Fred H. Bartlit, Jr.

Background

- Bartlit Beck, founding partner
- B.S., U.S. Military Academy, West Point, New York (engineering)
- Four years military service
  - U.S. Army Rangers, surface-to-air missile systems
- J.D., University of Illinois College of Law

Trial experience

- 90+ business trials
  - In 24 states (CA, CO, CT, DC, DE, FL, GA, HI, IA, IL, KS, LA, MD, MI, MO, MN, NJ, NM, NY, OH, PA, TX, UT, VA) plus the U.S. Virgin Islands and the United Kingdom
  - Most antitrust trials to verdict of any lawyer in history

Public service

- Chief counsel, Presidential Commission on BP Oil Spill
- Represented President George W. Bush in Tallahassee in 2000 election dispute
- Won largest verdict ever for Sierra Club in Four Corners Sulfur Dioxide Pollution case
- Counsel investigating Piper Alpha explosion on North Sea

The Commission – Executive Order

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.

Background

Deepwater Horizon & Macondo

What Happened

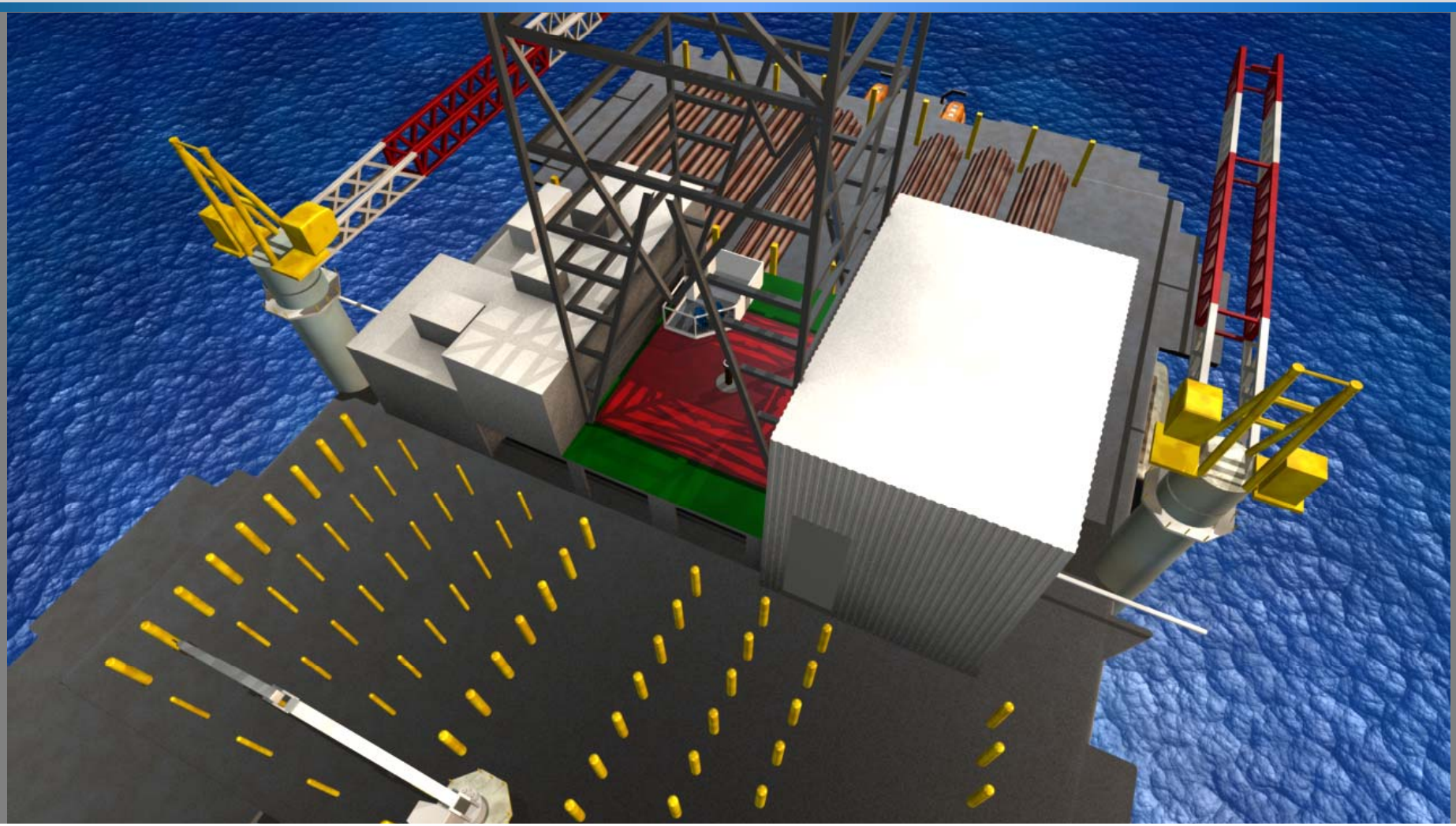
Management Failures

DuPont Safety Culture

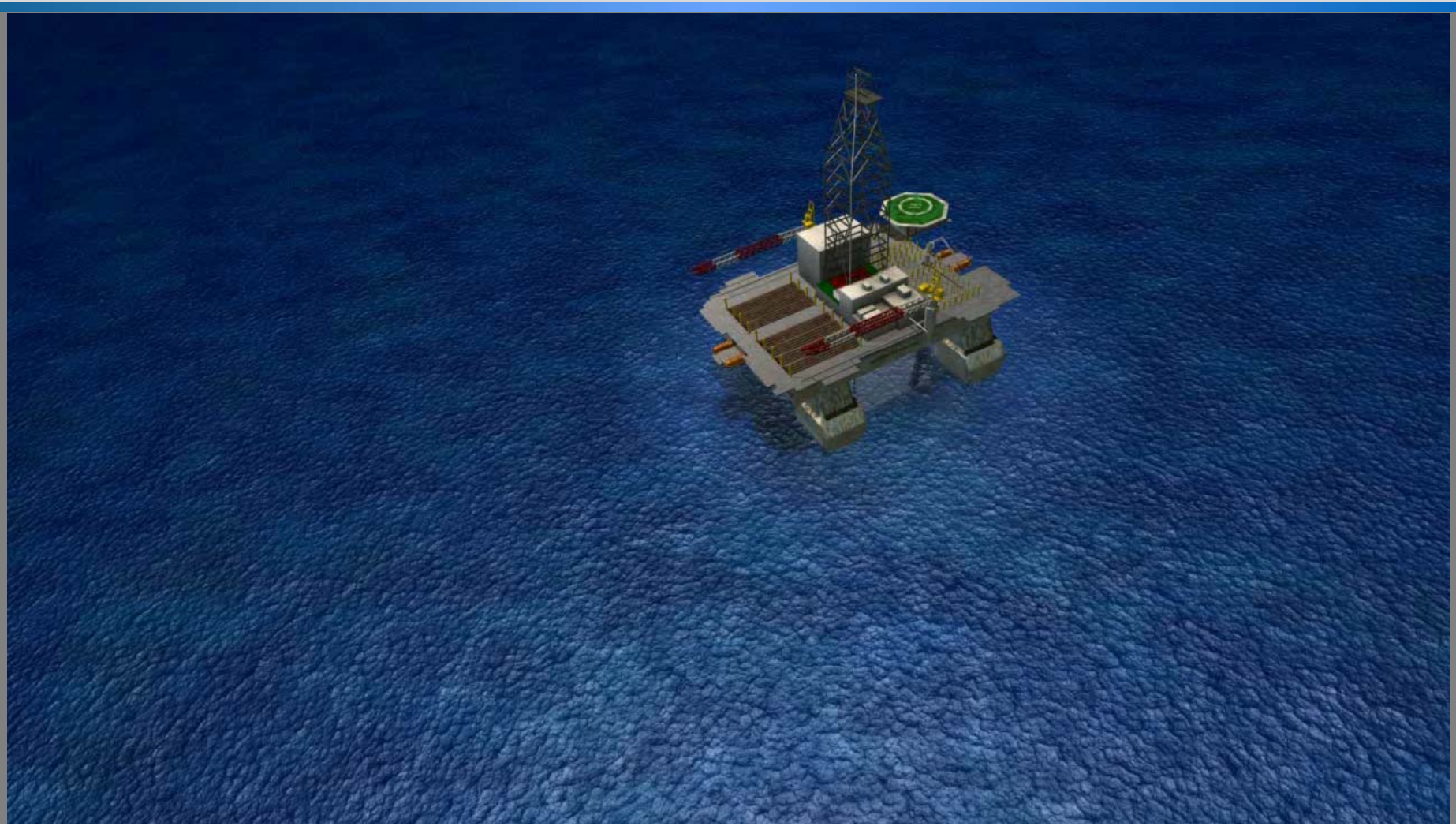
The Deepwater Horizon & Macondo Well

Deepwater Horizon

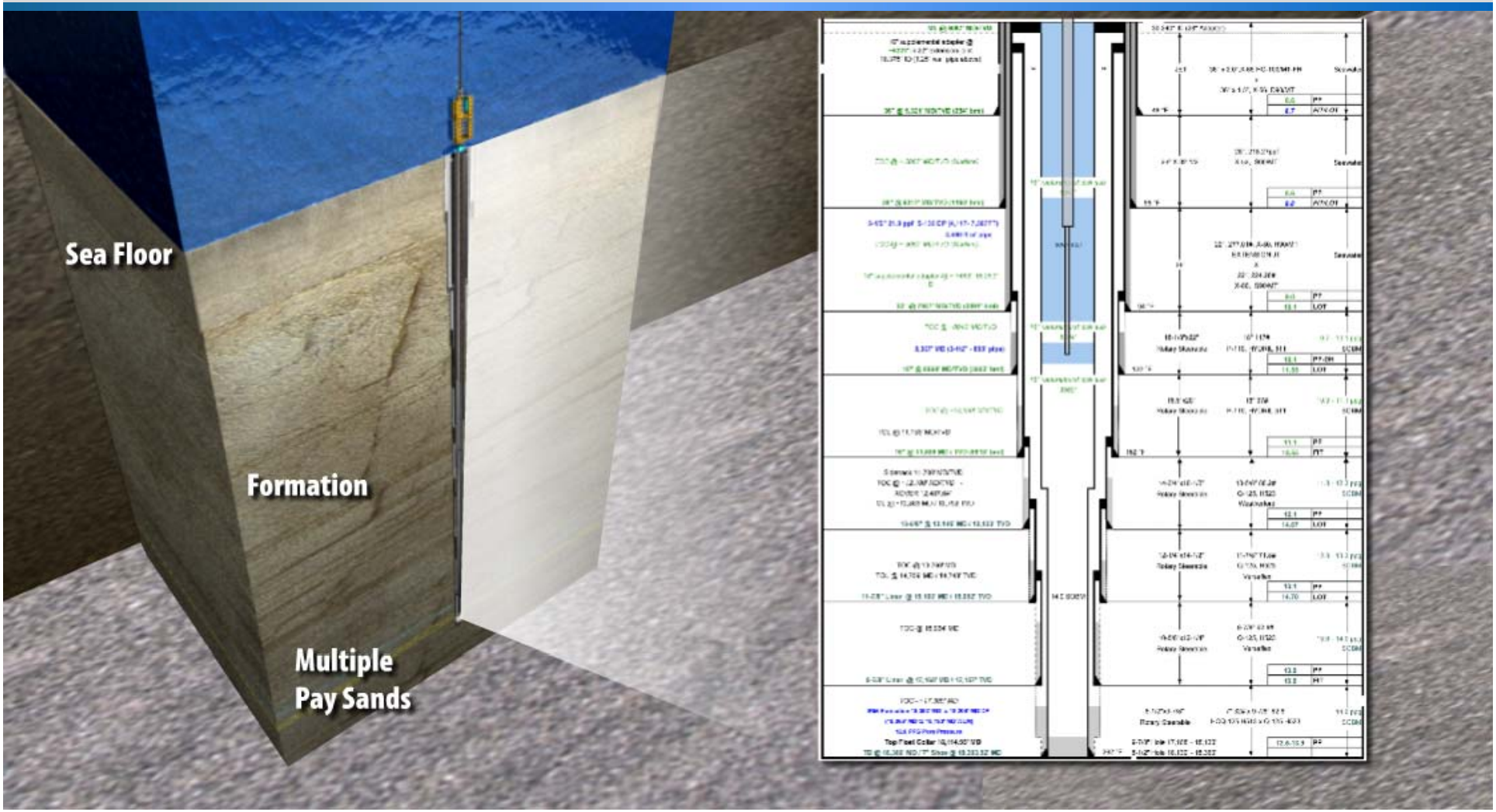
Deepwater Horizon



Deepwater Horizon and Macondo Well



The Macondo Well



Background

Deepwater Horizon & Macondo

What Happened

Management Failures

DuPont Safety Culture

What Happened

Barriers to Hydrocarbon Escape

Active Barriers

- Mud (drilling fluid)
- Physical barriers
  - Bottom-hole cement
  - Cement plugs and other up-hole mechanical barriers
  - Closed BOP

Contingent Barriers (depend on human judgment)

- Integrity tests (*e.g.*, negative pressure test)
- Open BOP

Mud Overbalances Formation Pressure

What Happened – High Level

1. Bottomhole cement was only active barrier when blowout occurred
   - Mud removed (underbalanced) and BOP open
   - BP chose not to put additional barriers in place prior to displacement

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   - Tricky cement job – many risk factors
   - Cement slurry likely unstable

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2. Bottomhole cement job failed
   - Tricky cement job – many risk factors
   - Cement slurry likely unstable

3. Nobody detected failure until too late
   - Negative pressure test (human judgment)
   - Kick detection (human judgment)

Background

Deepwater Horizon & Macondo

What Happened

Management Failures

DuPont Safety Culture

Management Failures

Overview of Management Failures

1. Absence of responsibility
   - Diffuse decision making – within BP and between contractors
   - Ineffective communication and email culture
   - Lack of leadership
2. Setting employees up for failure
   - Inadequate instruction and untimely procedures
   - Poor management of staffing – personnel not fungible
   - Inadequate training and procedures for emergency situations
   - Overreliance on human judgment
3. Inadequate risk assessment
   - Ad hoc and tunnel vision decision making during critical operations
   - Problems with safety metrics and process safety
   - Focus on efficiency biases decisions toward cost savings

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Some of the Companies Involved at Macondo

Rig and drilling — Transocean

HALLIBURTON | Sperry Drilling — Surface data logging

Cementing — HALLIBURTON

CAMERON — Blowout preventer

Drilling mud — MI SWACO, A Schlumberger Company

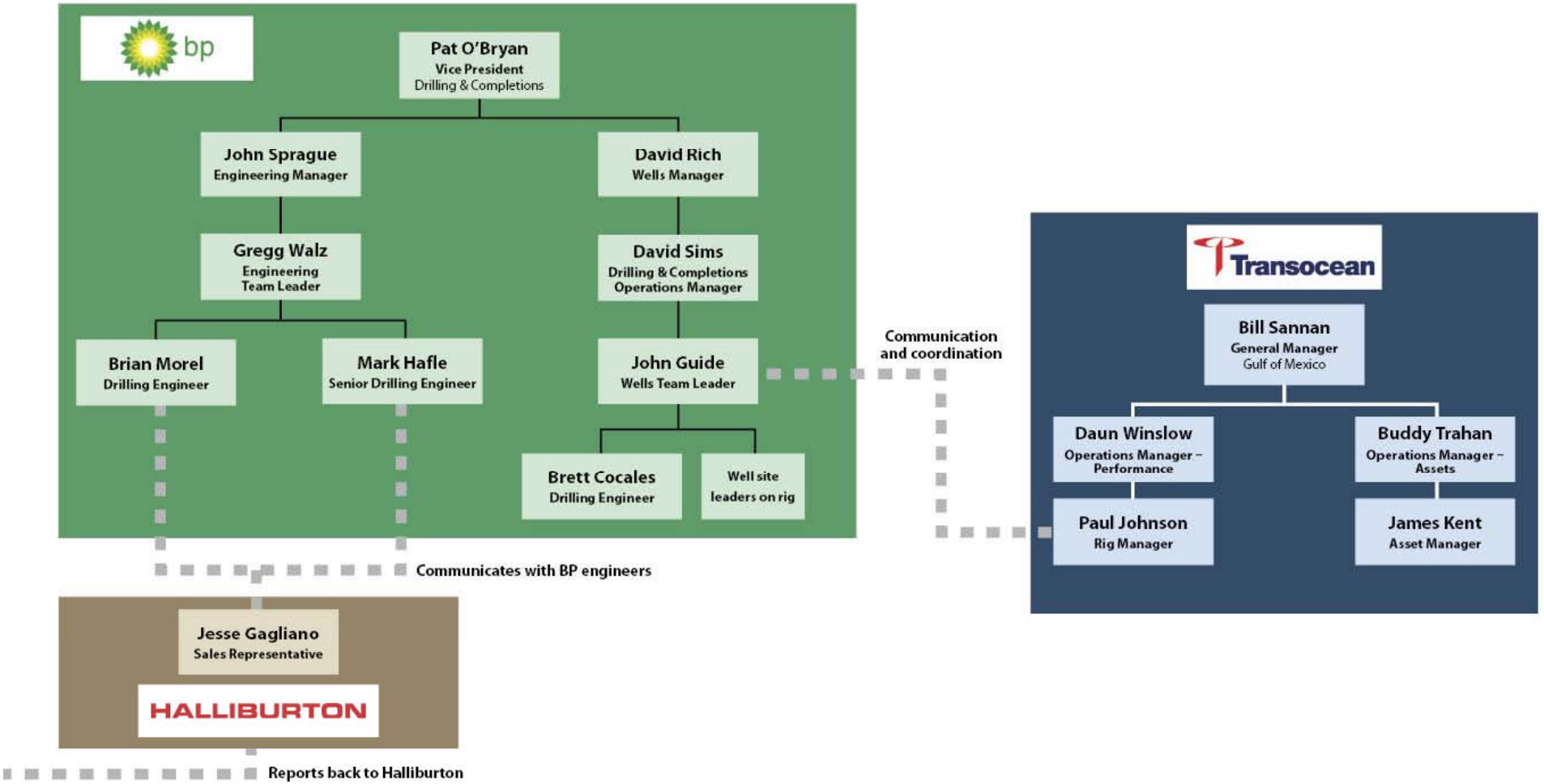
OCEANEERING — ROV support

Well and cement logging — Schlumberger

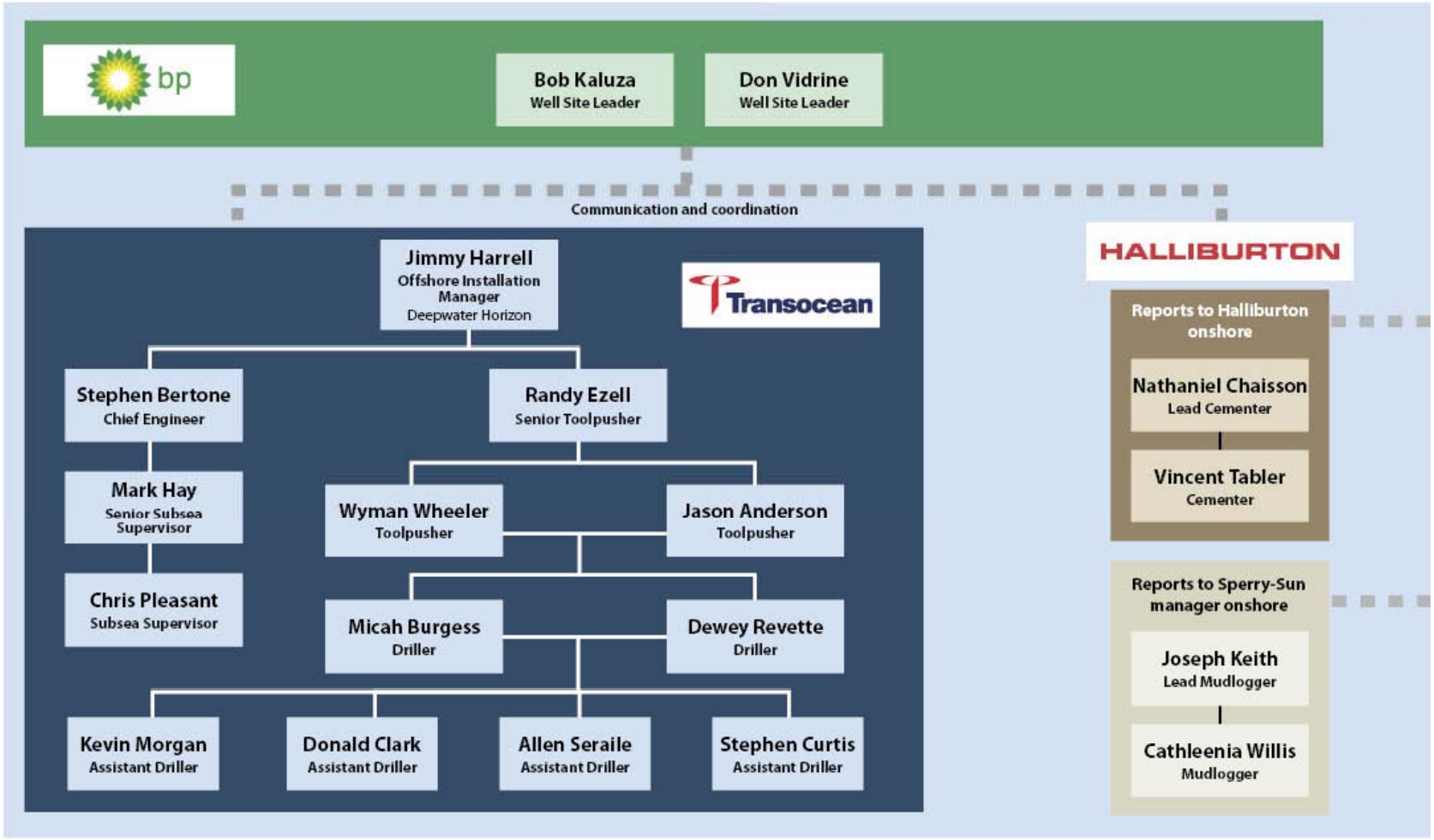
Setting a global standard — DRIL-QUIP — Wellhead, casing hangers

Weatherford — Centralizers, float collar, shoe track

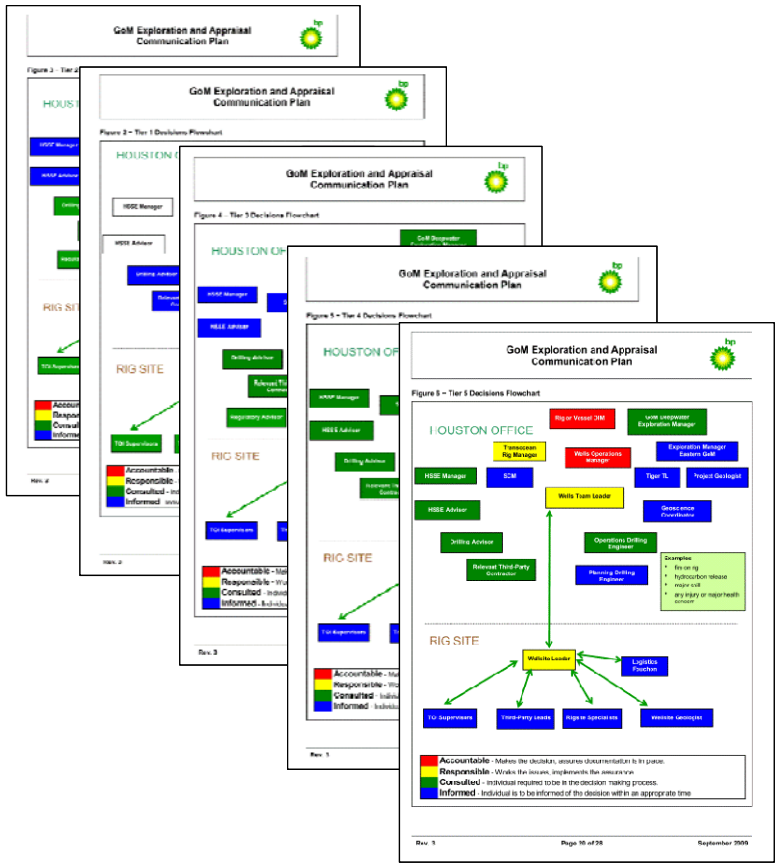
Onshore Organizational Chart

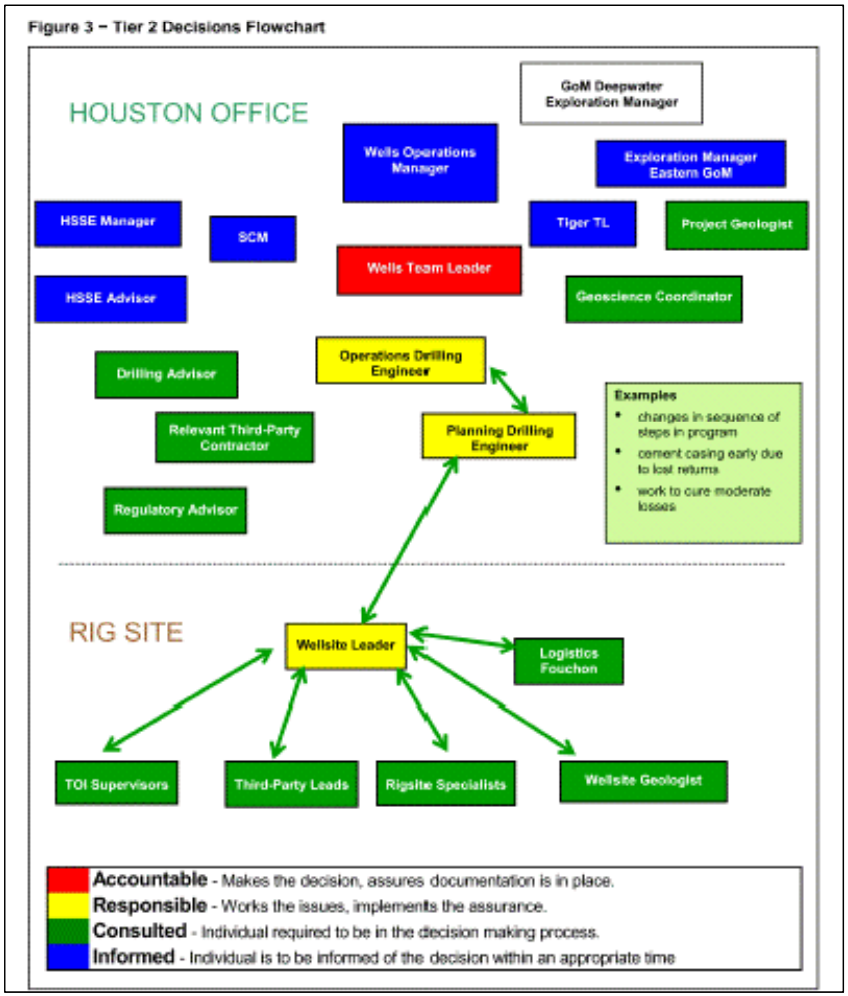


Rig Crew Organizational Chart



Diffuse and Unclear Responsibilities Even Within BP





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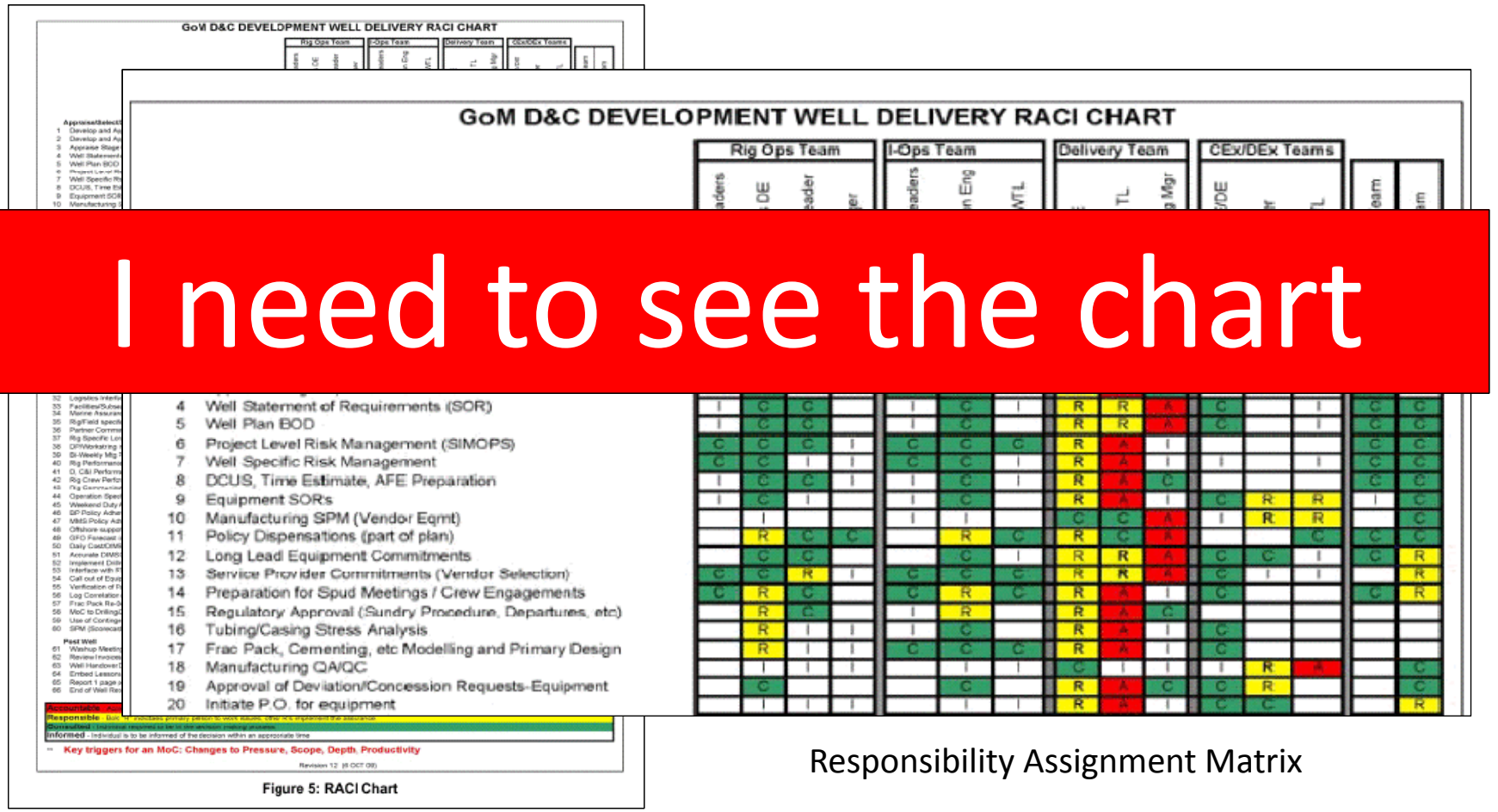

I need to see the chart

Responsibility Assignment Matrix

Overview of Management Failures

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3. Inadequate risk assessment
   - Ad hoc and tunnel vision decision making during critical operations
   - Problems with safety metrics and process safety
   - Focus on efficiency biases decisions toward cost savings

Did Not Communicate Risks Surrounding Cement Job

- **14 different risk factors associated with cement job**

Risks Surrounding Cement Job

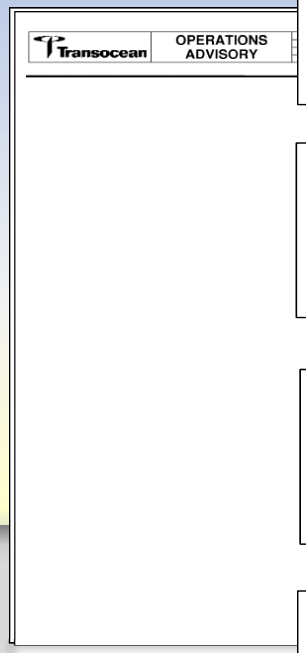
(Slide from Hearing)

- Difficult drilling conditions
- Serious lost returns in the zone to be cemented
- Forced to stop drilling earlier than planned
- Difficulty converting float equipment
- Low circulating pressure after conversion
- No bottoms up circulation
- Cement jobs are known to occasionally need further work
- Cement modeling perceived as unreliable by BP
- Complicated cement job
- Low rate of cement flow
- Low cement volume
- Uncertain centralization
- No direct indicators of cementing success and no cement evaluation log

Did Not Communicate Risks Surrounding Cement Job

- **14 different risk factors associated with cement job**
- **Little to no communication of those risks to individuals performing the negative pressure test or monitoring well after cement job**
- **Looked at risks they knew about one at a time rather than collectively as a group**

Did Not Communicate Lessons Learned From Other Events



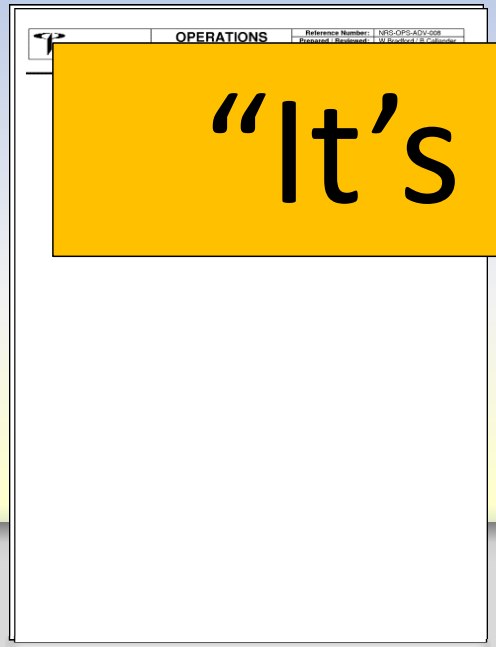
"drill crew did not consider well control as a realistic event during the…displacement operation as the [downhole barrier] had been successfully tested"

"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"

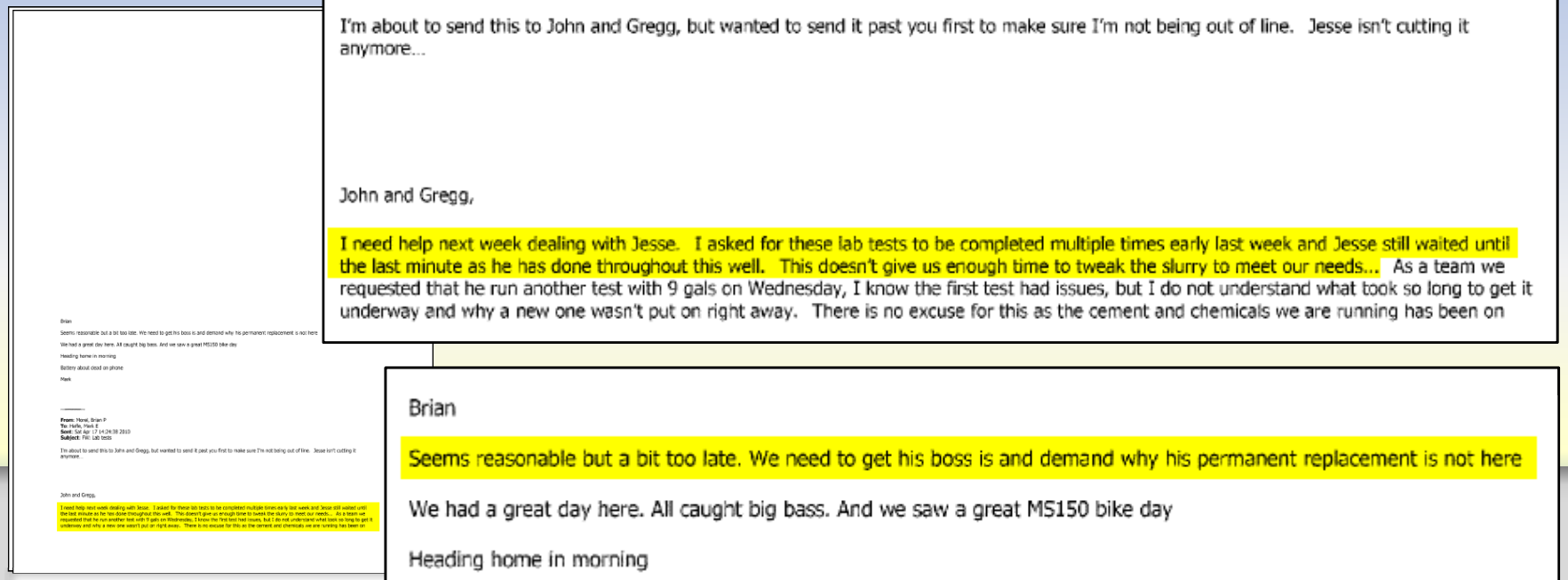
Did Not Communicate Lessons Learned From Other Events



"It's in the database"

April 14, 2010 Advisory

Inadequate Supervision of Contractors



From: Morel, Brian P
To: Hafle, Mark E
Sent: Sat Apr 17 14:24:38 2010
Subject: FW: Lab tests

I'm about to send this to John and Gregg, but wanted to send it past you first to make sure I'm not being out of line. Jesse isn't cutting it anymore...

John and Gregg,

I need help next week dealing with Jesse. I asked for these lab tests to be completed multiple times early last week and Jesse still waited until the last minute as he has done throughout this well. This doesn't give us enough time to tweak the slurry to meet our needs... As a team we requested that he run another test with 9 gals on Wednesday, I know the first test had issues, but I do not understand what took so long to get it underway and why a new one wasn't put on right away. There is no excuse for this as the cement and chemicals we are running has been on

Brian

Seems reasonable but a bit too late. We need to get his boss is and demand why his permanent replacement is not here

We had a great day here. All caught big bass. And we saw a great MS150 bike day

Heading home in morning

Battery about dead on phone

Mark

April 17, 2010 Email

Email Culture

- Say your piece then forget about it
  "It's off my plate"
- Must take ownership and follow through until resolved

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3. Inadequate risk assessment
   - Ad hoc and tunnel vision decision making during critical operations
   - Inattention to process safety and problem with safety metrics
   - Focus on efficiency biases decisions toward cost savings

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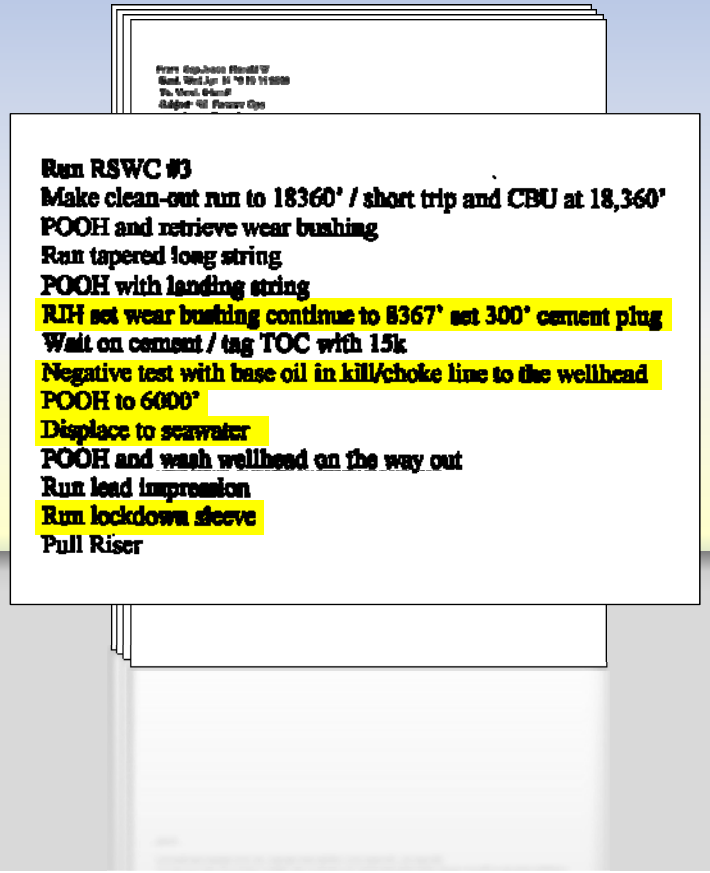
Evolution of Temporary Abandonment Procedure

April 14 E-Mail From
Morel to R. Sepulvado

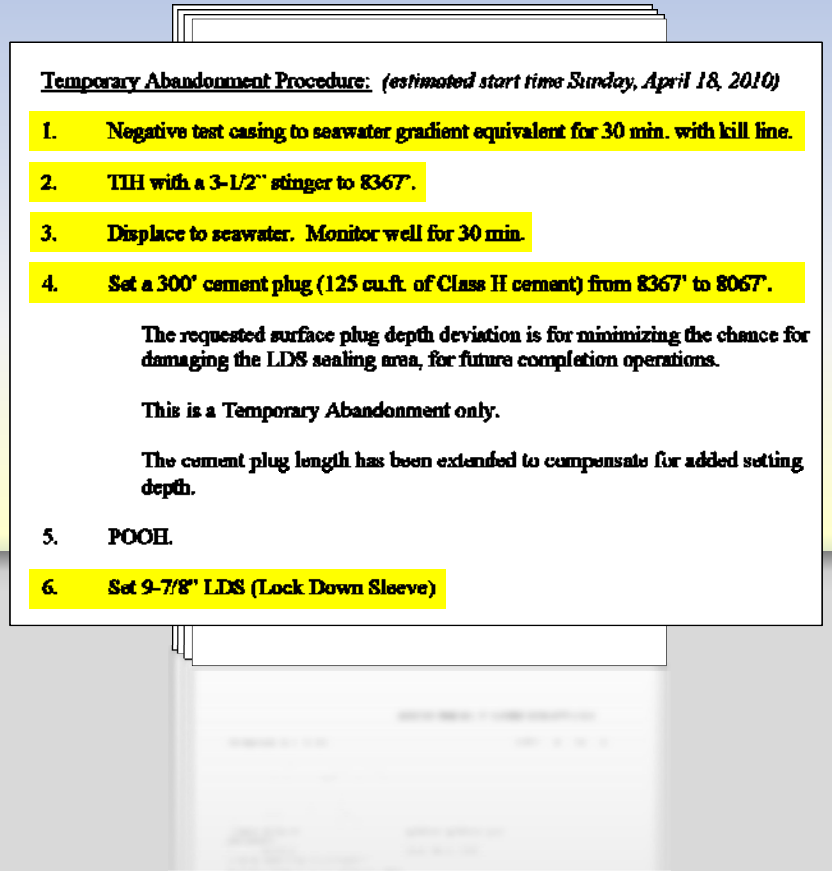


Run RSWC #3
Make clean-out run to 18360' / short trip and CBU at 18,360'
POOH and retrieve wear bushing
Run tapered long string
POOH with landing string
RIH set wear bushing continue to 8367' set 300' cement plug
Wait on cement / tag TOC with 15k
Negative test with base oil in kill/choke line to the wellhead
POOH to 6000'
Displace to seawater
POOH and wash wellhead on the way out
Run lead impression
Run lockdown sleeve
Pull Riser

April 14 Morel E-Mail	April 16 MMS Permit	April 20 Ops Note
Run in hole to 8,367'		
Set 300' cement plug in mud BARRIER		
Negative pressure test with base oil to wellhead		
Displace mud in well and riser from 6,000' with seawater		
Set lockdown sleeve		

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. TIH with a 3-1/2" stinger to 8367'.
3. Displace to seawater. Monitor well for 30 min.
4. Set a 300' cement plug (125 cu.ft. of Class H cement) from 8367' to 8067'.

   The requested surface plug depth deviation is for minimizing the chance for damaging the LDS sealing area, for future completion operations.

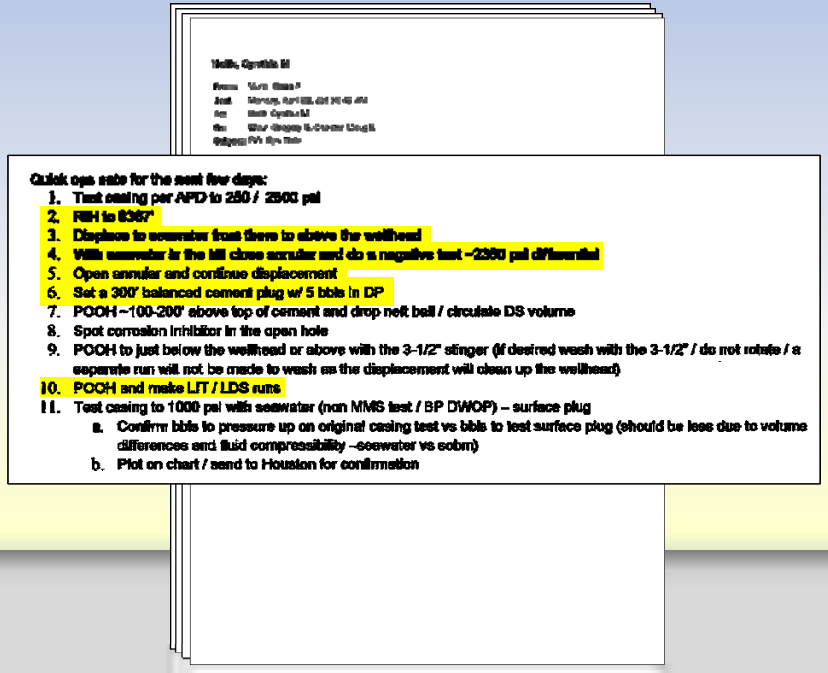
   This is a Temporary Abandonment only.

   The cement plug length has been extended to compensate for added setting depth.
5. POOH.
6. Set 9-7/8" LDS (Lock Down Sleeve)

April 14 Morel E-Mail	April 16 MMS Permit	April 20 Ops Note
Trip in hole to 8,367'	Negative pressure test to seawater gradient (with base oil to wellhead)	
Set 300' cement plug in seawater BARRIER		
Negative pressure test with base oil to wellhead	Displace mud in well and riser from 8,367' with seawater	
Displace mud in well and riser from 6,000' with seawater	Monitor well for 30 minutes to ensure no flow	
Set lockdown sleeve		

Evolution of Temporary Abandonment Procedure

April 20 Operations Note From Morel to Rig



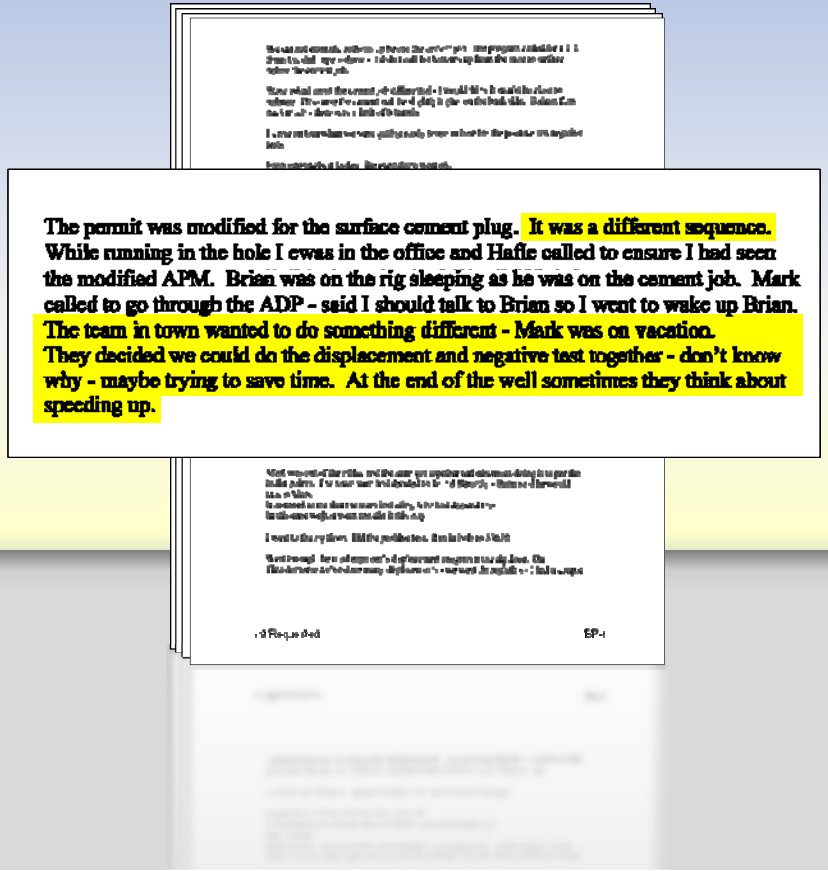
Quick ops note for the next few days:

1. Test casing per APD to 250 / 2503 psi
2. RIH to 8367'
3. Displace to seawater from there to above the wellhead
4. With seawater in the hill close annular and do a negative test ~2350 psi differential
5. Open annular and continue displacement
6. Set a 300' balanced cement plug w/ 5 bbls in DP
7. POOH ~100-200' above top of cement and drop nerf ball / circulate DS volume
8. Spot corrosion inhibitor in the open hole
9. POOH to just below the wellhead or above with the 3-1/2" stinger (if desired wash with the 3-1/2" / do not rotate / a separate run will not be made to wash as the displacement will clean up the wellhead)
10. POOH and make LIT / LDS runs
11. Test casing to 1000 psi with seawater (non MMS test / BP DWOP) – surface plug
    a. Confirm bbls to pressure up on original casing test vs bbls to test surface plug (should be less due to volume differences and fluid compressibility –seawater vs sobm)
    b. Plot on chart / send to Houston for confirmation

April 14 Morel E-Mail	April 16 MMS Permit	April 20 Ops Note
Run in hole to 8,367'	Negative pressure test to seawater gradient (with base oil to wellhead)	
Set 300' cement plug in mud **BARRIER**	Trip in hole to 8,367'	Displace mud with seawater from 8,367' to above wellhead (BOP)
Negative pressure test with base oil to wellhead	Displace mud in well and riser from 8,367' with seawater	Negative pressure test with seawater to depth 8,367' rather than with base oil to wellhead
Displace mud in well and riser from 6,000' with seawater	Monitor well for 30 minutes to ensure no flow	Displace mud in riser with seawater **Blowout**
	Set 300' cement plug in seawater **BARRIER**	
Set lockdown sleeve	Set lockdown sleeve	

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 ewas in the office and Hafle 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.

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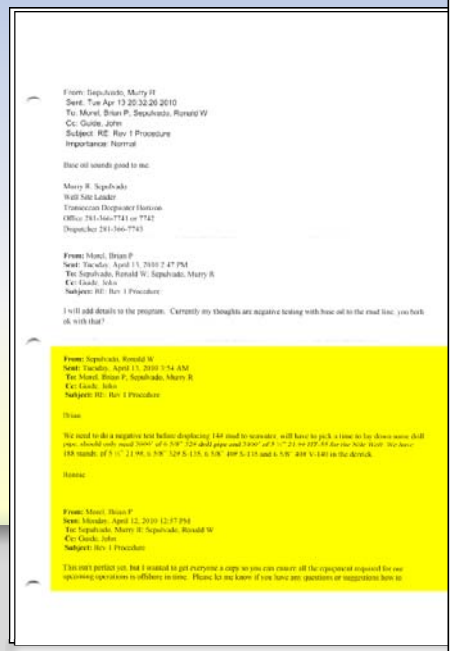
Set lockdown sleeve	Set lockdown sleeve	

No Training on Negative Pressure Test



April 12-13, 2010 Emails

From: Sepulvado, Ronald W
Sent: Tuesday, April 13, 2010 3:54 AM
To: Morel, Brian P; Sepulvado, Murry R
Cc: Guide, John
Subject: RE: Rev 1 Procedure

Brian

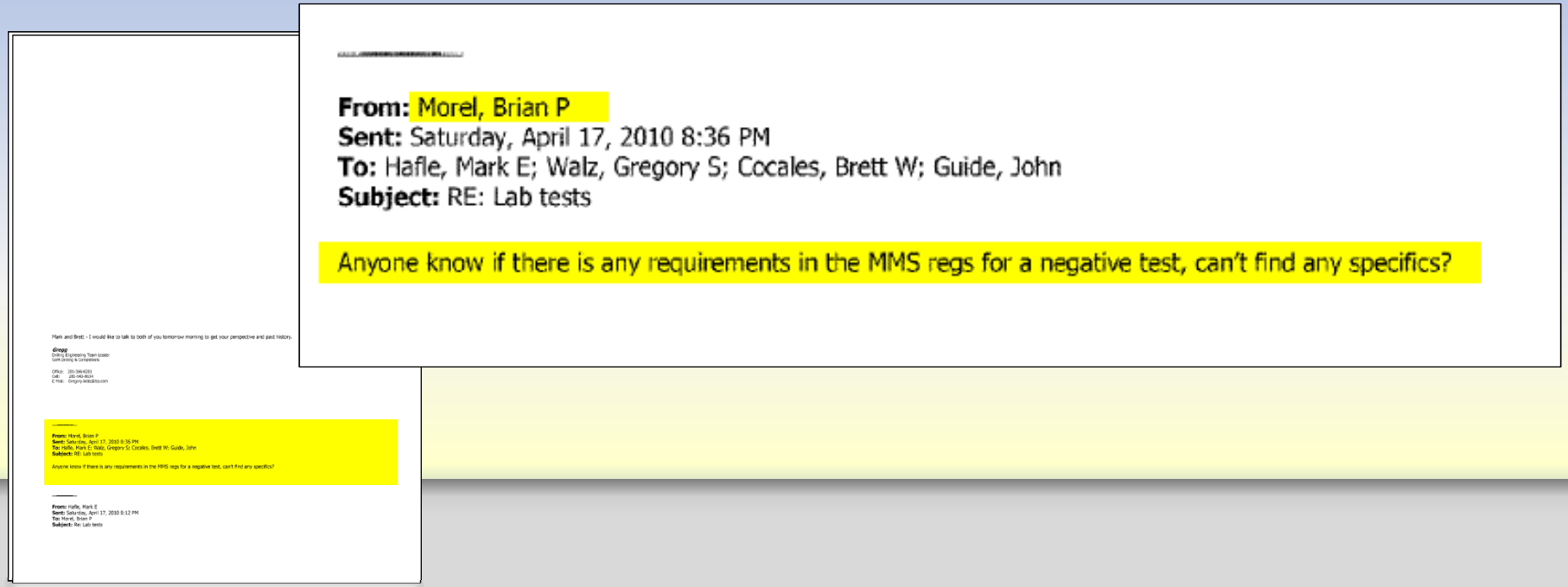
We need to do a negative test before displacing 14# mud to seawater, will have to pick a time to lay down some drill pipe, should only need 3600' of 6 5/8" 32# drill pipe and 3400' of 5 ½" 21.9# HT-55 for the Nile Well. We have 188 stands. of 5 ½" 21.9#, 6 5/8" 32# S-135, 6 5/8" 40# S-135 and 6 5/8" 40# V-140 in the derrick.

Ronnie

From: Morel, Brian P
Sent: Monday, April 12, 2010 12:57 PM
To: Sepulvado, Murry R; Sepulvado, Ronald W
Cc: Guide, John
Subject: Rev 1 Procedure

This isn't perfect yet, but I wanted to get everyone a copy so you can ensure all the equipment required for our upcoming operations is offshore in time. Please let me know if you have any questions or suggestions how to

No Training on Negative Pressure Test



From: Morel, Brian P
Sent: Saturday, April 17, 2010 8:36 PM
To: Hafle, Mark E; Walz, Gregory S; Cocales, Brett W; Guide, John
Subject: RE: Lab tests

Anyone know if there is any requirements in the MMS regs for a negative test, can't find any specifics?

April 17, 2010 Email

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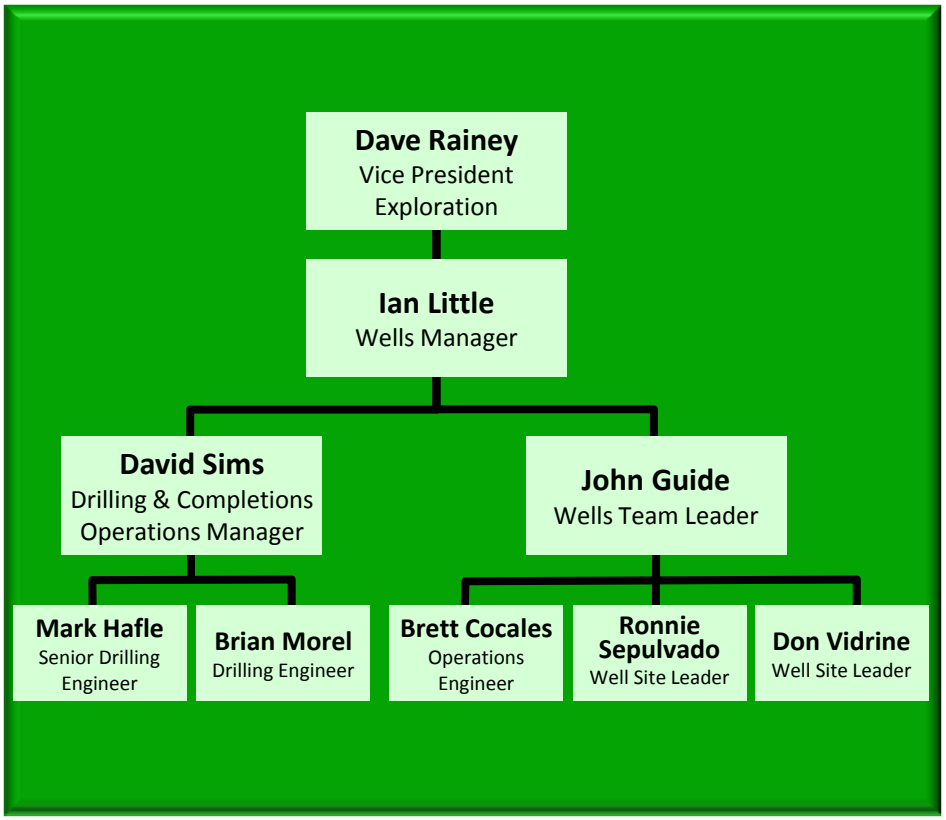
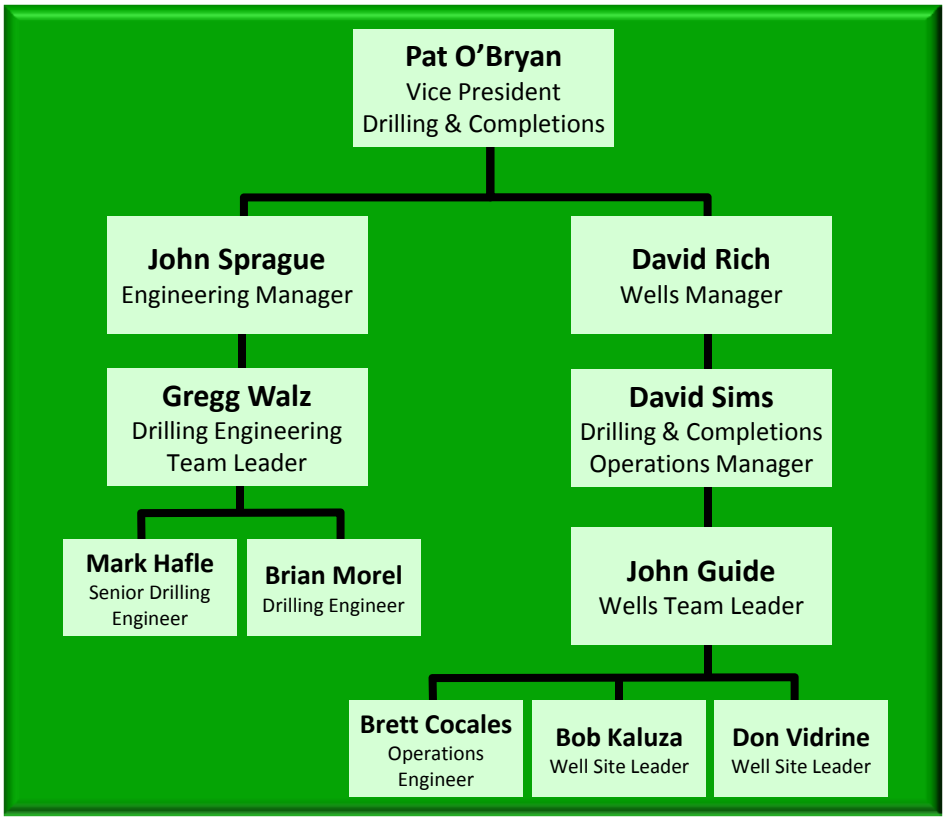
BP Reorganization

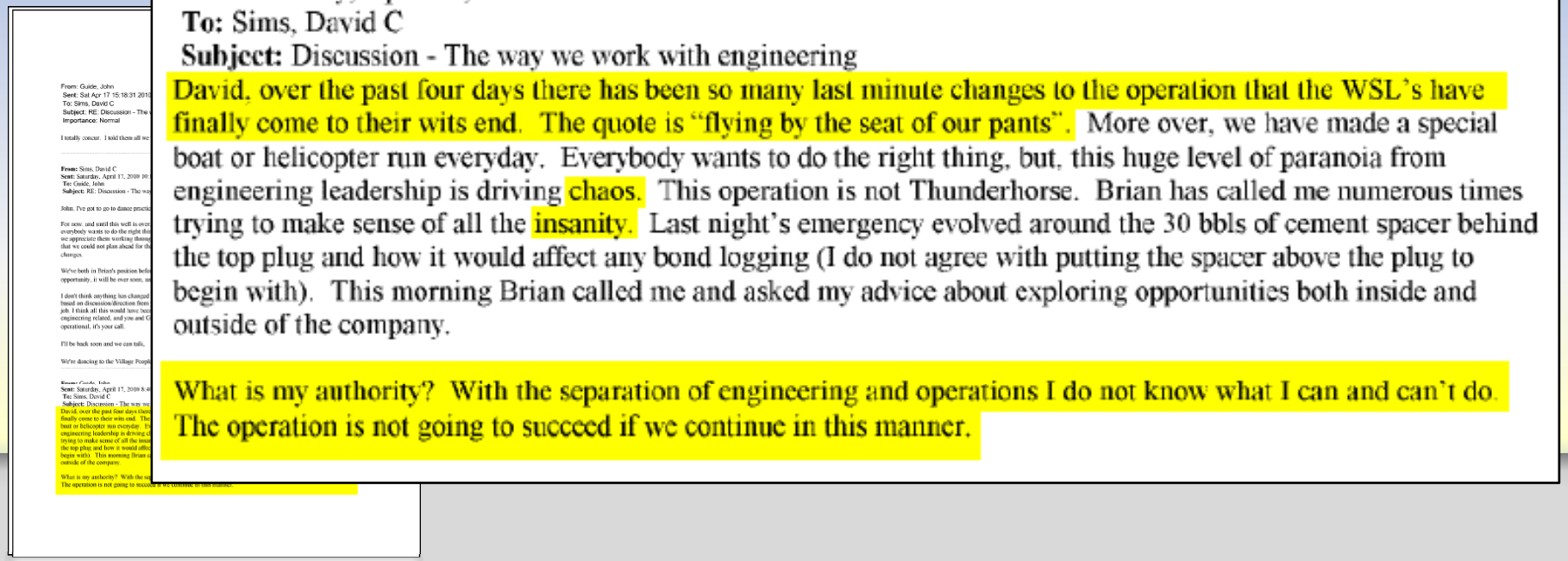
January 2010



April 2010



Poor Handling of Reorganization and Management



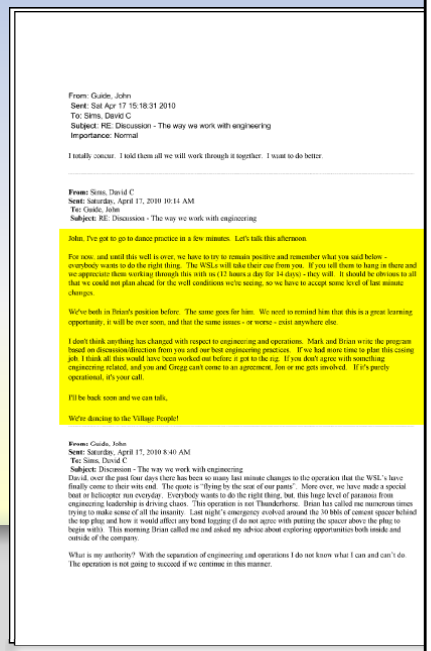
From: Guide, John
Sent: Saturday, April 17, 2010 8:40 AM
To: Sims, David C
Subject: Discussion - The way we work with engineering

David, over the past four days there has been so many last minute changes to the operation that the WSL's have finally come to their wits end. The quote is "flying by the seat of our pants". More over, we have made a special boat or helicopter run everyday. Everybody wants to do the right thing, but, this huge level of paranoia from engineering leadership is driving chaos. This operation is not Thunderhorse. Brian has called me numerous times trying to make sense of all the insanity. Last night's emergency evolved around the 30 bbls of cement spacer behind the top plug and how it would affect any bond logging (I do not agree with putting the spacer above the plug to begin with). This morning Brian called me and asked my advice about exploring opportunities both inside and outside of the company.

What is my authority? With the separation of engineering and operations I do not know what I can and can't do. The operation is not going to succeed if we continue in this manner.

April 17, 2010 Email

Poor Handling of Reorganization and Management



April 17, 2010 Email

From: Sims, David C
Sent: Saturday, April 17, 2010 10:14 AM
To: Guide, John
Subject: RE: Discussion - The way we work with engineering

John, I've got to go to dance practice in a few minutes. Let's talk this afternoon.

For now, and until this well is over, we have to try to remain positive and remember what you said below - everybody wants to do the right thing. The WSLs will take their cue from you. If you tell them to hang in there and we appreciate them working through this with us (12 hours a day for 14 days) - they will. It should be obvious to all that we could not plan ahead for the well conditions we're seeing, so we have to accept some level of last minute changes.

We've both in Brian's position before. The same goes for him. We need to remind him that this is a great learning opportunity, it will be over soon, and that the same issues - or worse - exist anywhere else.

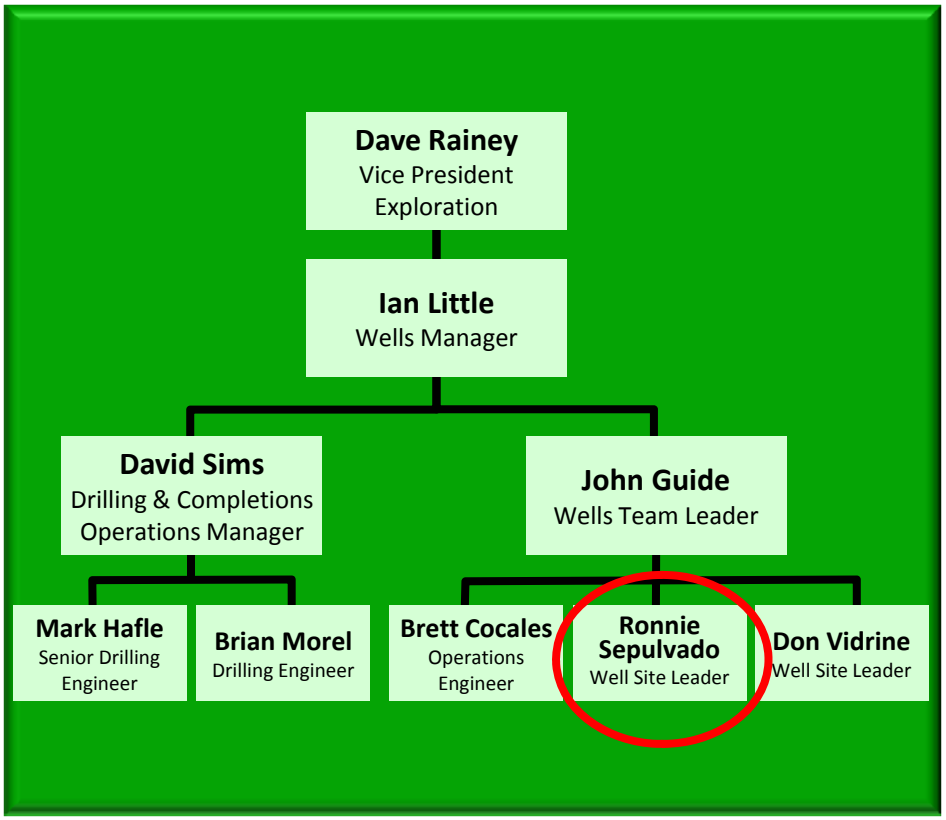
I don't think anything has changed with respect to engineering and operations. Mark and Brian write the program based on discussion/direction from you and our best engineering practices. If we had more time to plan this casing job, I think all this would have been worked out before it got to the rig. If you don't agree with something engineering related, and you and Gregg can't come to an agreement, Jon or me gets involved. If it's purely operational, it's your call.

I'll be back soon and we can talk,

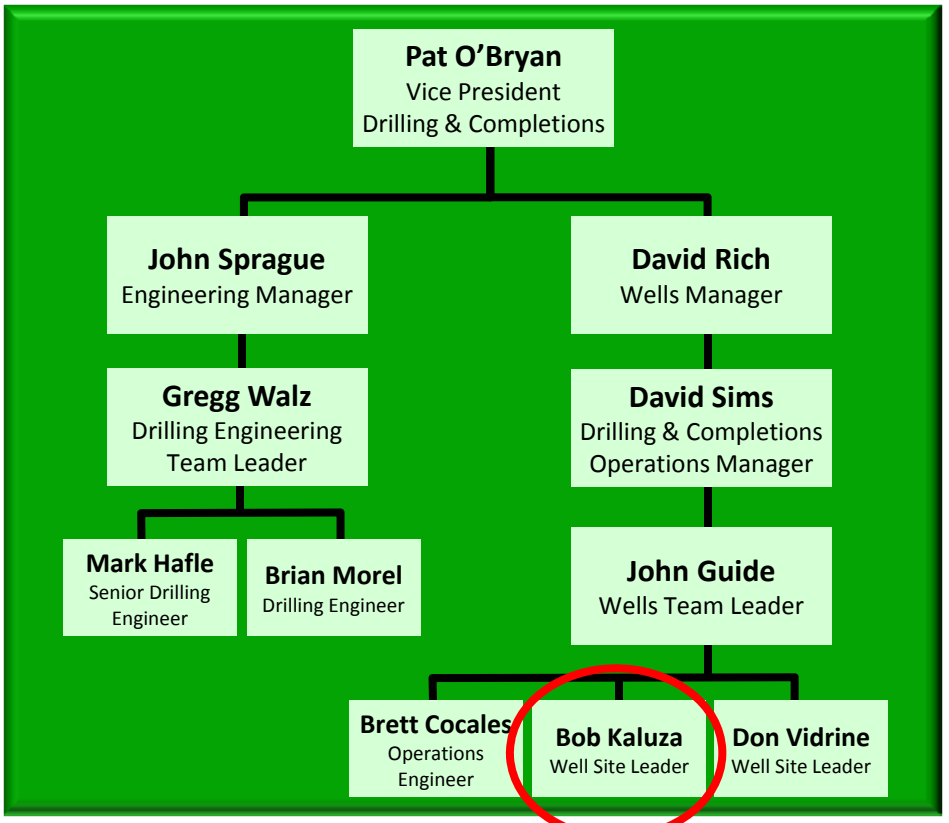
We're dancing to the Village People!

One Staffing Decision May Have Prevented Blowout

January 2010



April 2010



Overview of Management Failures

1. Absence of responsibility
   - Diffuse decision making – within BP and between contractors
   - Ineffective communication and email culture
   - Lack of leadership
2. Setting employees up for failure
   - Inadequate instruction and untimely procedures
   - Poor management of staffing – personnel not fungible
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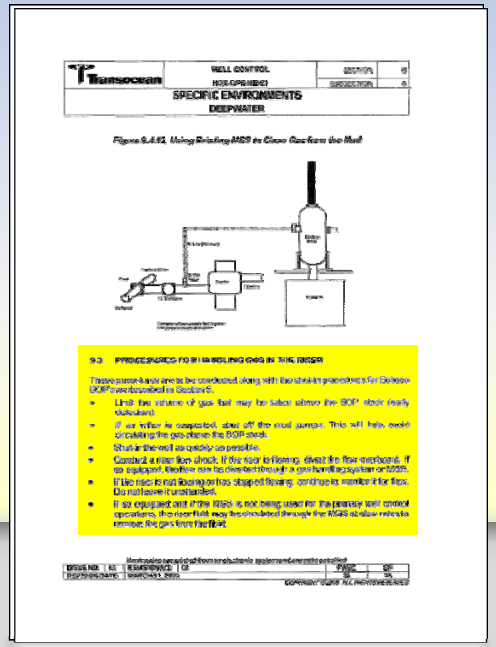
Inadequate Training on Low Probability Emergency Events



Well Control Handbook

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 m_3) 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 stages 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.

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Overreliance on Human Judgment

- Depended on “right person reading right information at right time and making right decision”
- Should eliminate reliance on human judgment where possible when dealing with high consequence events
- Put “dumb” safety redundancies in place
- If must rely on human judgment, ensure right decision-maker and adequate training, resources and information to make right decision

Inadequate Focus on Technology

- One of biggest surprises in whole investigation
- Antiquated sensors, data presentation and very few automated safety systems or checks
- Must consistently invest in and improve technology to eliminate reliance on human judgment where lives at stake

How Driller Sees Data

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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*

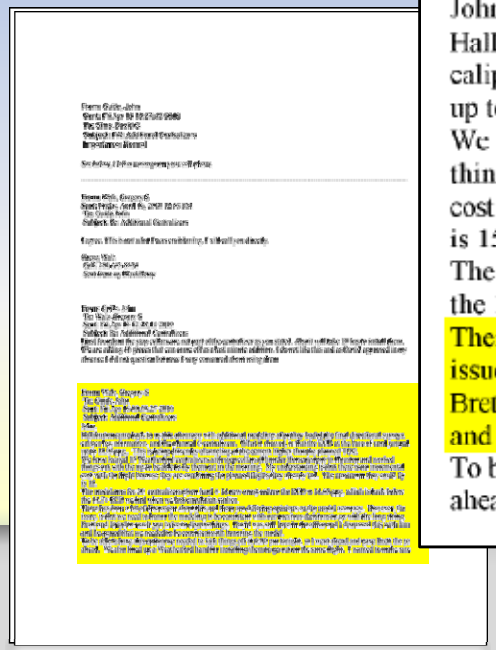
Results in *ad hoc* decision-making on key decisions

- 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

Centralizers

Centralizer Decision



April 16, 2010 Email

From: Walz, Gregory S
To: Guide, John
Sent: Fri Apr 16 00:50:27 2010
Subject: Additional Centralizers

John,

Halliburton came back to us this afternoon with additional modeling after they loaded the final directional surveys, caliper log information, and the planned 6 centralizers. What it showed, is that the ECD at the base of sand jumped up to 15.06 ppg . This is being driven by channeling of the cement higher than the planned TOC.

We have located 15 Weatherford centralizers with stop collars (Thunder Horse design) in Houston and worked things out with the rig to be able to fly them out in the morning. My understanding is that there is no incremental cost with the flight because they are combining the planned flights they already had. The maximum they could fly is 15.

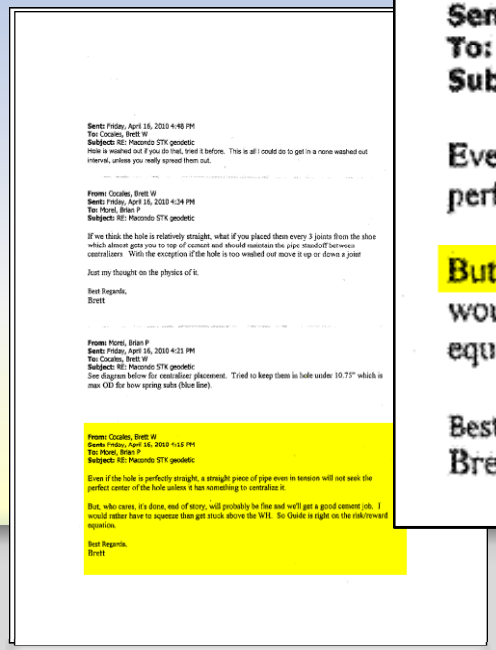
The model runs for 20 centralizers (6 on hand + 14 new ones) reduce the ECD to 14.65 ppg, which is back below the 14.7+ ECD we had when we lost circulation earlier.

There has been a lot of discussion about this and there are differing opinions on the model accuracy. However, the issue, is that we need to honor the modeling to be consistent with our previous decisions to go with the long string. Brett and I tried to reach you twice to discuss things. David was still here in the office and I discussed this with him and he agreed that we needed to be consistent with honoring the model.

To be able to have this option we needed to kick things off at 6:00 pm tonight, so I went ahead and gave Brett the go ahead. We also lined up a Weatherford hand for installing them to go out on the same flight. I wanted to make sure

Guide decides not to use more centralizers because he does not like ones sent to rig

Centralizer Decision



From: Cocales, Brett W
Sent: Friday, April 16, 2010 4:15 PM
To: Morel, Brian P
Subject: RE: Macondo STK geodetic

Even if the hole is perfectly straight, a straight piece of pipe even in tension will not seek the perfect center of the hole unless it has something to centralize it.

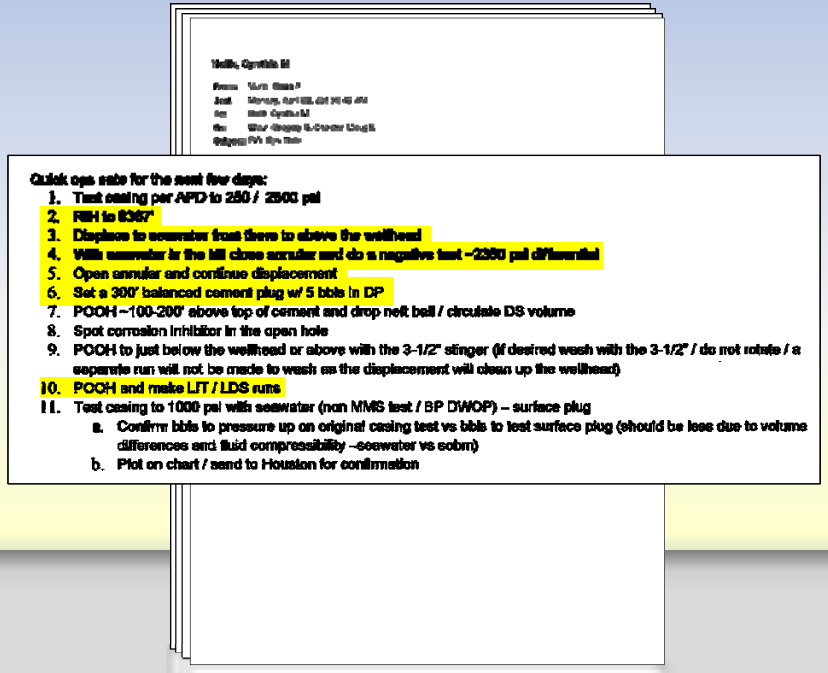
But, who cares, it's done, end of story, will probably be fine and we'll get a good cement job. I would rather have to squeeze than get stuck above the WH. So Guide is right on the risk/reward equation.

Best Regards,
Brett

Later April 16, 2010 Email

Temporary Abandonment Procedure

April 20 Operations Note From Morel to Rig



Quick ops note for the next few days:

1. Test casing per APD to 250 / 2503 psi
2. RIH to 8367'
3. Displace to seawater from there to above the wellhead
4. With seawater in the hill close annular and do a negative test ~2350 psi differential
5. Open annular and continue displacement
6. Set a 300' balanced cement plug w/ 5 bbls in DP
7. POOH ~100-200' above top of cement and drop nerf ball / circulate DS volume
8. Spot corrosion inhibitor in the open hole
9. POOH to just below the wellhead or above with the 3-1/2" stinger (if desired wash with the 3-1/2" / do not rotate / a separate run will not be made to wash as the displacement will clean up the wellhead)
10. POOH and make LIT / LDS runs
11. Test casing to 1000 psi with seawater (non MMS test / BP DWOP) – surface plug
    a. Confirm bbls to pressure up on original casing test vs bbls to test surface plug (should be less due to volume differences and fluid compressibility –seawater vs sobm)
    b. Plot on chart / send to Houston for confirmation

April 14 Morel E-Mail	April 16 MMS Permit	April 20 Ops Note
Run in hole to 8,367'	Negative pressure test to seawater gradient (with base oil to wellhead)	
Set 300' cement plug in mud **BARRIER**	Trip in hole to 8,367'	Displace mud with seawater from 8,367' to above wellhead (BOP)
Negative pressure test with base oil to wellhead	Displace mud in well and riser from 8,367' with seawater	Negative pressure test with seawater to depth 8,367' rather than with base oil to wellhead
Displace mud in well and riser from 6,000' with seawater	Monitor well for 30 minutes to ensure no flow	Displace mud in riser with seawater **Blowout**
	Set 300' cement plug in seawater **BARRIER**	
Set lockdown sleeve	Set lockdown sleeve	

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; Cocales, 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 base oil to the wellhead the shoe will see about 360 psi less after the hole is displaced. Thoughts?

Thanks
Brian

April 15-16, 2010 Emails

Take Aways on Process Safety

- Must emphasize process safety throughout life of project
- Decisions that unnecessarily increase risk of low probability, high consequence event = unsafe act
  - Even if doesn't result in negative event
  - Real and meaningful audits
- Create culture where decision-makers seek second opinion; failure to do so = unsafe act
  - But must provide resources and training
- Eliminate reliance on human judgment; failure to do so = unsafe act
  - Requires serious, constant investment in technology

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BP Performance Evaluations

Heavy emphasis on financial performance

- Metrics easy to understand and apply

Heavy emphasis on safety and zero-incident culture

- Safety metrics = injuries and downtime
- No auditing or evaluation of process safety

Biases decisions in favor of cost savings and financial performance over process safety

- Especially with regard to low-likelihood, high-consequence events

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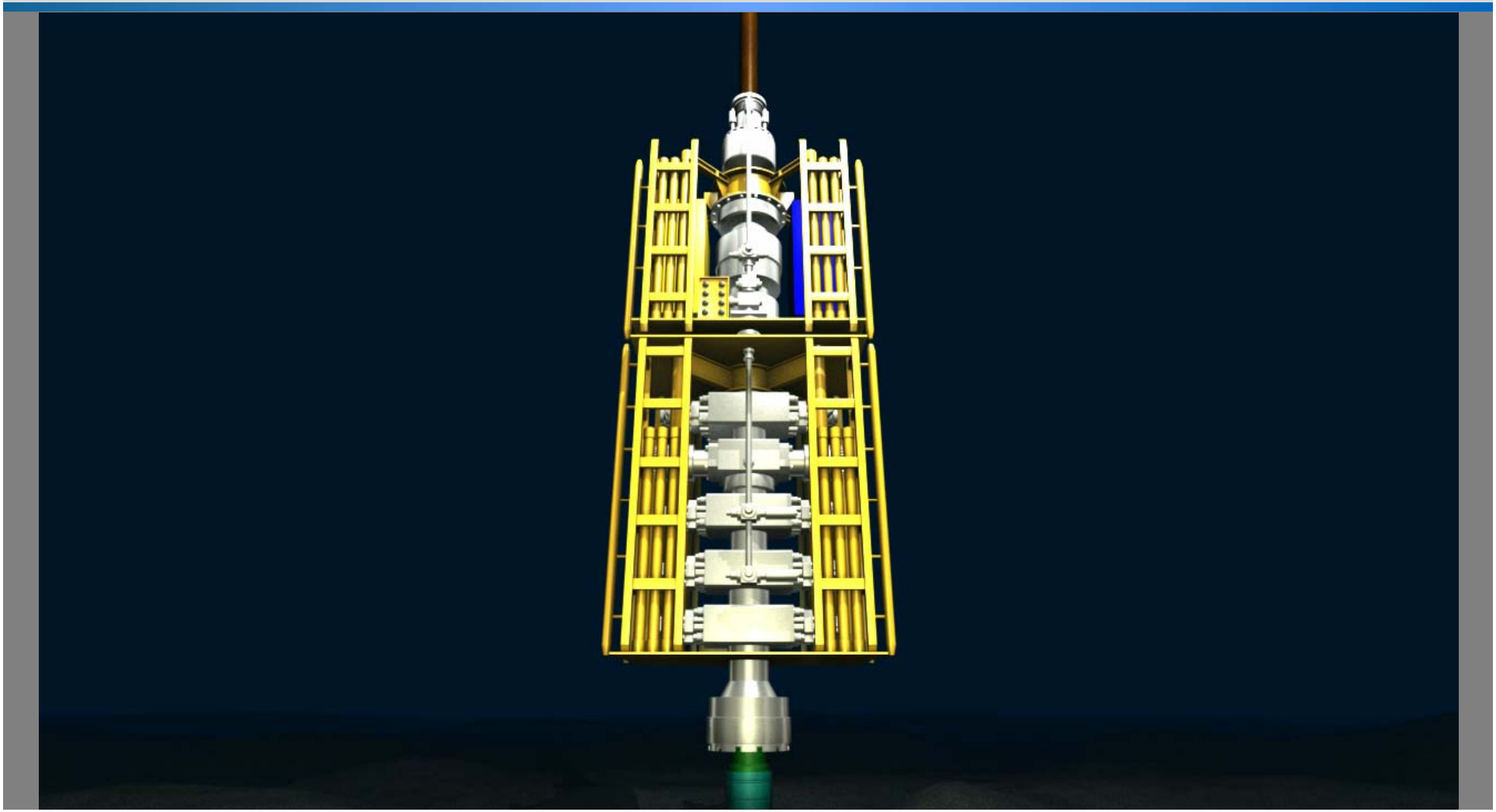
EXTRA SLIDES

Drilling a Well

Blowout Preventer (BOP) Shuts in Well



Deepwater Horizon