

## Well Integrity/Shut-In Discussion

July 19, 2010  
7:00pm CDT



7/19/2010

10.0 Daily Meetings\10 : Well Integrity\19 07 1100

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### Topics for Discussion July 19, 7:00pm CDT

1. Reservoir and Flow Model Questions and Timelines for Answers – Tina Behr-Andres, Ron Dykhuizen, Wayne Miller
2. Seismic Monitoring Options, Scenarios, and Trade-offs – Marcia McNutt
3. Sonar Data – Kate Moran

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Data Anomaly Investigation Log							
Event:	Time/Date:	Location:	Description:	Actions:	Observation:	Interpretation: BP	Interpretation: Science Team
4	18 July 10	Vertical plume 223m, 129deg to 44m, 44deg from wellhead	13:15 Through water column plume reported from Pisces, up to 1000m above seabed	17:00 Investigated SE end of area with ROV UHD, Boca Subsea M36: 4 sector sonar scan and seabed survey.  Investigation by ROV @ 100m intervals through water column to 1000m above seabed	No visual or sonar anomalies observed in water column cutting through vertical extent of "plume"  No visual or sonar anomalies observed in water column cutting through vertical extent of "plume"	No observed plume  No observed plume	A plume of gas bubbles in the water column. We cannot determine the source of these bubbles but two potential sources have been identified: gas from the cement return line or methane from the leaking flange on the cap.
5	18 July 10 16:00	36" conductor housing (mudline)	Bubbles observed, 1.5 seconds per bubble	2 Samples obtained	Sample 1 analyzed on Enterprise, 16% methane Sample 2 expediting to onshore lab for analysis		Awaiting lab analysis
6	19 July 10	Cement: return valve	Bubbles observed	Obtaining bottle to take sample			Likely off-gassing from cemented annular -- typical of subsea wellheads
7	19 July 10 02:00	Capping stack connector to stack gasket	Leak, hydrate formation	Hydrate monitoring			Capping stack and associated hardware was hydrostatically tested to over 11,000psi, build up of gas inside stack likely producing leak at metal to metal seal downstream of flex connector.

## 1. Reservoir and Flow Model Questions and Timelines for Answers – Tina Behr-Andres, Ron Dykhuizen, Wayne Miller

### Pending Decisions Requiring Technical Input

- What are the monitoring priorities?
- If, and when, to stop the shut-in?
  - Hurricane or observed leak?
- Conditions needed to initiate the Hydrostatic Control Plan (mud stabilization)?

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### Well Integrity Data/Evidence to Consider

- **Temperature vs. Time data at well head**
  - Temperature has cooled and is stable at ~40°F indicating static conditions at the well head
- **Pressure vs. Time data at BOP and Kill Line**
  - \* – BOP Pressure is not necessarily reliable but trends without discontinuities may be useful
  - BP is providing detailed chronology of well head and riser conditions post incident to help interpret BOP pressure history
  - Kill Line Pressure are similar to past results from conventional shut in tests (e.g., Thunder Horse data); no remarkable features
  - Reservoir modeling does not differentiate between cases of high reservoir depletion and no or little leakage, or low reservoir depletion and high leakage
- **Acoustic, Sonar and Seismic data**
  - Important for assessing gas leakage rate from the sea floor
  - Current results indicate no anomalies (Use these data to bound a maximum case for leakage?)
- **Oil Flow at well head (pre shut-in)**
  - Reservoir analyses and analyses of potential leaks are being conducted using previously published estimates of flow rate based on measured collection
- **Fluid Properties**
  - Gas volume fraction estimated at 65% at 2250psi; multiphase flow to be considered in these analyses

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*UNRELIABLE*

### Pending Follow Up Actions

- Analyzing BOP pressure during June 4-15 when there were no changes in the well head configuration to determine indication of reservoir depletion
- Working with BP on Horner plot data to resolve different interpretations
- Investigating effect of temperature change on shut-in pressure

*Tony Lau*  
*Armed*  
July 1  
*Tony Lau*

### 2. Seismic Monitoring Options, Scenarios, and Trade-offs – Marcia McNutt, Cathy Enomoto, Bill Shedd

## Shallow Hazard Monitoring During Well Shut-in

Comparison: 3D data vs July 18 line 2C seismic  
profile (note: lines 2 & 2B aborted)

3D-seismic data were acquired in 1999, and  
reprocessed in 2008.

USGS Geologic Team, July 19, 2010, 19:00

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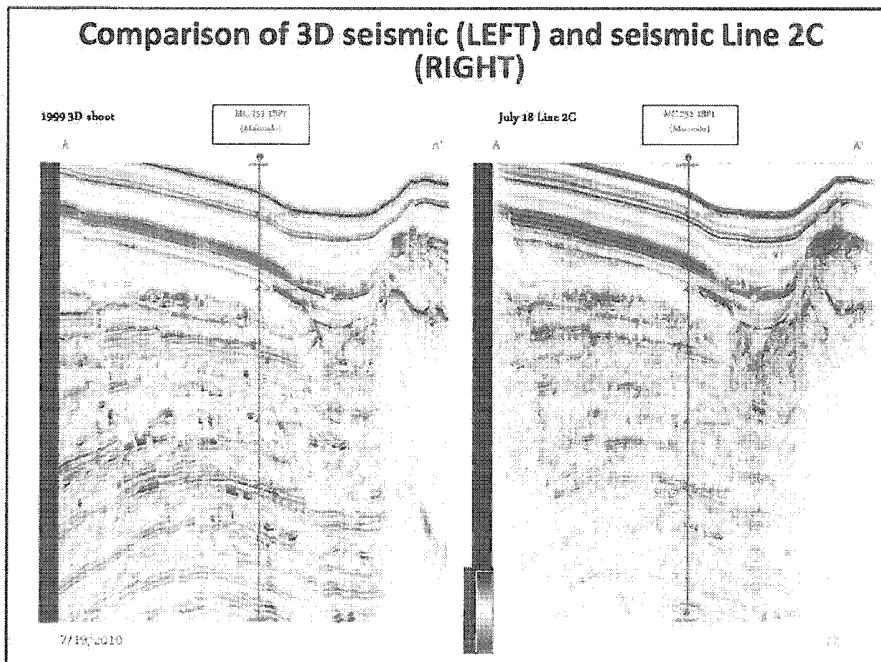
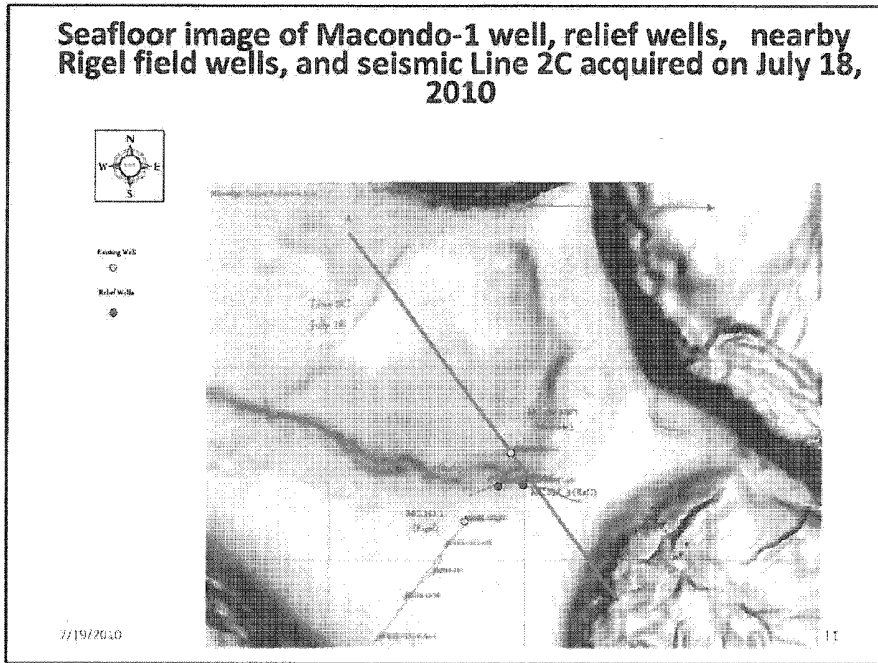
## Shallow Hazard Monitoring During Well Shut-in

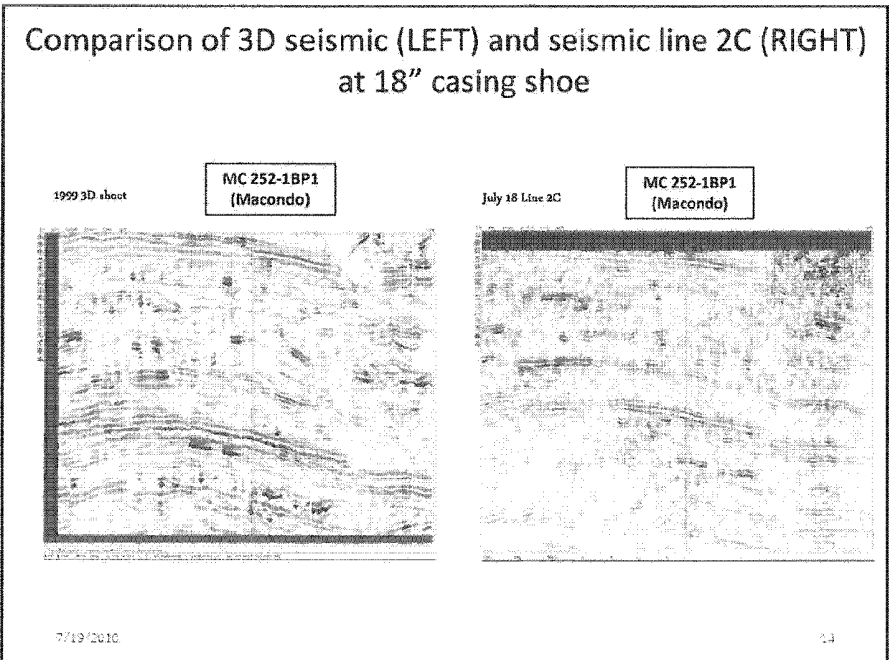
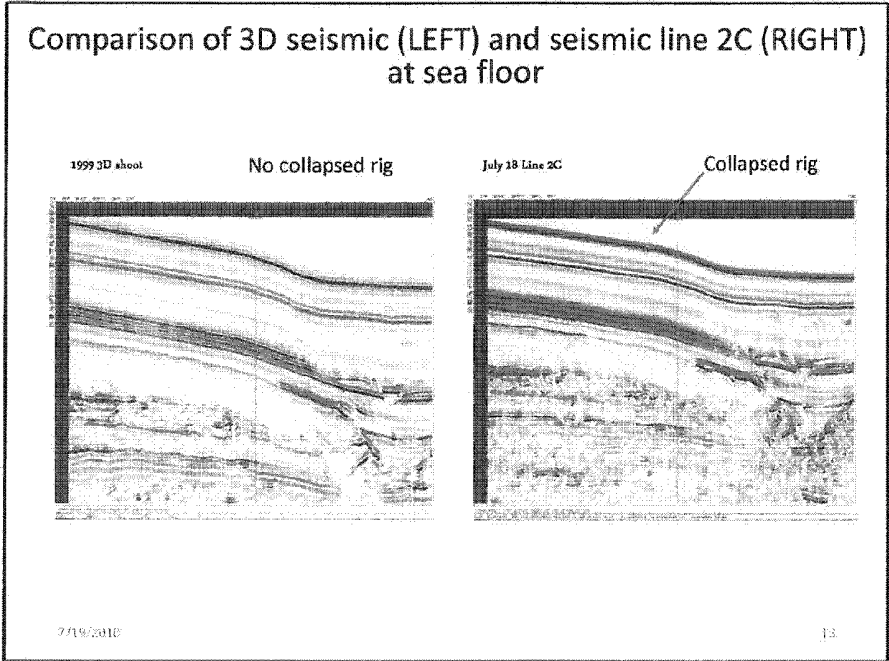
We are looking for:

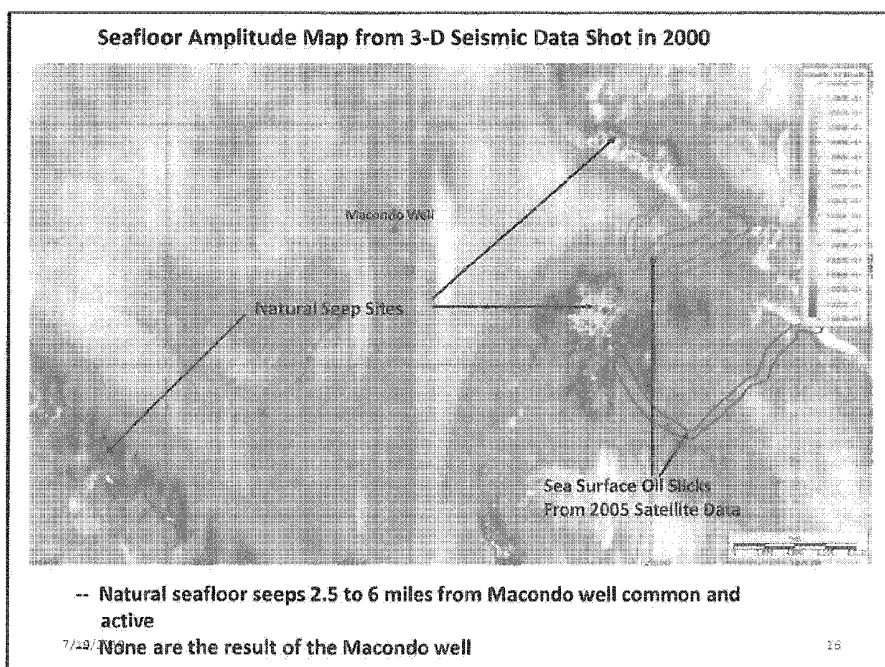
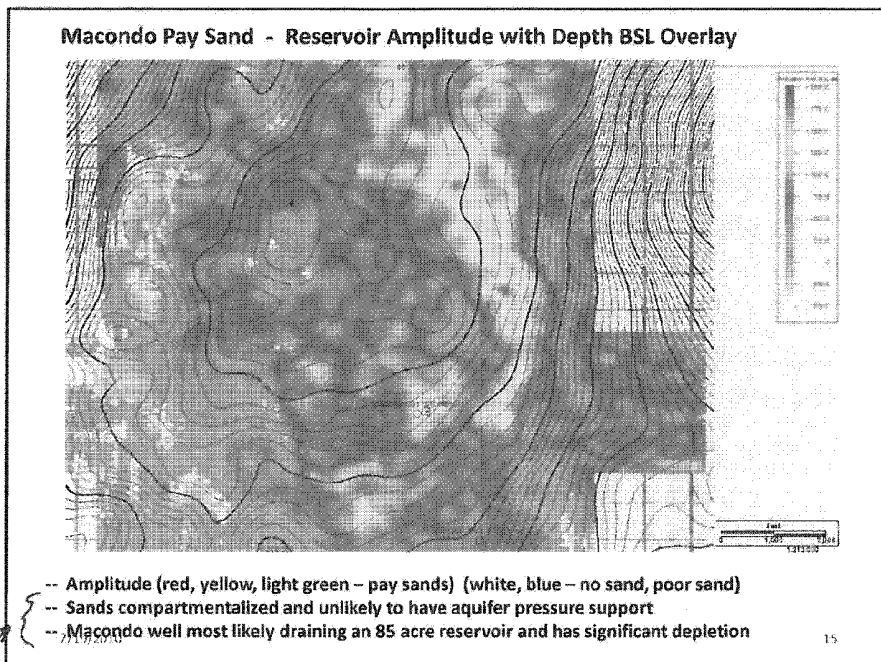
- 1) phase reversals of events
- 2) increased amplitudes
- 3) velocity pull down in events
- 4) acoustic disruption (i.e., newly-discontinuous areas)

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## USGS Interpretation (July 19, 2010)

We have not identified any of the following from our examination of seismic line 2C:

- 1) phase reversals of events
- 2) increased amplitudes
- 3) velocity pull down in events
- 4) acoustic disruption

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## Prioritizing Operations

- Status Quo
  - Two seismic runs during daylight hours
  - NOAA *Pisces* operates near well zone during remainder of daylight hours
  - All other operations limited to the 9 hours of darkness
- Issues
  - Build-out for additional containment still 8-10 days out and cannot be accommodated in 9-hour blocks
  - Current capacity (*Helix Producer* and *Q4000*) cannot contain entire flow
  - Never any guarantee that well remains shut in

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## Proposal

- Provide for dedicated containment mobilization days with 36 hour blocks
  - Would require foregoing seismic coverage during that daytime period
  - NOAA *Pisces* would be required to coordinate with and engage in planning with the other vessels to optimize survey pattern and avoid interference
  - Must ensure active and engaged ROV surveillance subsea during build

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## Timeline

- Before 1630 of day 1, make go/no go decision for seismic acquisition on day 2
- If no go, 1700 Ops meeting plans for build out of additional containment through to dawn of day 3.
- NOAA *Pisces* is included in 1930 SimOps planning for her daylight survey on day 2
- By 1630 of day 2, make go/no go decision for seismic acquisition on day 3....

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Wed - NO Seismic

Ryan  
Chew

## Suggestion

- NOAA *Pisces* needs to return to port shortly
- Walter Mooney is returning to California for a few days
- Weather will be sub-optimal for seismic data and acoustic data acquisition on Wednesday
- Should we try this at 1630 on Tuesday? (with potentially a substitute vessel for the NOAA *Pisces*?)

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## 3. Sonar Data – Kate Moran

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