Agenda

- Who is Anadarko Petroleum Corporation?
- What does Anadarko Monitor in Real Time
- Why does Anadarko Value Real Time Monitoring (RTM) at the Wellsite
- How does Anadarko Manage Fluid Volumes at the Wellsite
- Why does Anadarko Utilize a Real Time Monitoring Center (RTMC) for Deep Water Drilling Operations
- Floor Layouts and Photos
- Summary
Who is Anadarko Petroleum Corporation?

- Among the World’s Largest Independent Oil and Natural Gas E&P Companies
- Included in the S&P 100 Index with 6000+ Employees Worldwide
- Headquartered in The Woodlands, Texas
- Has Operations in 15+ Countries
- Volumes – 849 MBOE/d
  - US Onshore – 673 MBOE/d
  - US GoM – 77 MBOE/d
  - Intl & Alaska – 99 MBOE/d
- Has 8 Deep Water Rigs under Long Term Contract
- Gulf of Mexico
  - Focused in the Deep Water Environment
  - On Average Operates 3-4 DW Drilling Rig Operations Daily
What Does Anadarko Monitor in Real Time
**GoM Deep Water Operations**

<table>
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<tr>
<th>Operation</th>
<th>Offshore Facilities</th>
<th>Office Based</th>
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<td>Drilling (Subsea BOPs)</td>
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<td>Drilling (Surface BOPs)</td>
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<td>*Targeted Operations</td>
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<td>Completions</td>
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<td>Production</td>
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<td>Facilities</td>
<td>24/7</td>
<td>*Targeted Operations</td>
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*Targeted Operations = Cementing; Logging; Perforating; Fracturing; Well Start Ups; Hydrate and Chemical Injection; Monitoring Producing Wells
Why does Anadarko Value RTM at the Wellsite

Deep Water Drilling Operations

- Real Time Data is Monitored and Analyzed 24/7 by the Onsite Personnel
- Allows for an Immediate Response to …
  - Well Control Events
  - Changes in Well Volumes
- Data is easily Communicated on the Rig between Personnel via WITS
- Allows for Events to be Escalated immediately to the Anadarko PIC
How does Anadarko Manage Fluid Volumes at the Wellsite

**Deep Water Drilling Operations**

- **Manned** Mud Logging Unit during all Operations
- **Require** Mud Logging Personnel to be trained in Well Monitoring
- **Installation** of Coriolis Flow Meters on all Deep Water Rigs
  - Provides Early Kick Detection
  - Differentiates Well Control Events from Ballooning
    - Fingerprint Connections
    - Flow Rate Accuracy ±0.1%
- **Use of Constant Volume Extractors in the Suction Pit & Diverter Box**
  - Analyzes Drilling Mud-Contained gases
    - Gas is extracted from each Extractor and sent to the Unit for analysis
- **Installation** of 2 Sonic Sensors in each Active Pit
  - Provides more reliable Volume Measurements
    - Each Sensor yields a Signal; the System calculates the Mud Level and Volume
    - Software corrects for pitch and roll
- **Installation** of Monitor Systems in the Pit Room and Rig Floor
  - Displays Volumes from all pits with sensors
  - Shows all Fluid Transfers from the above pits
Why Does Anadarko Utilize a RTMC for Deep Water Drilling Operations

- **Provides** an Additional Level of Well Monitoring for...
  - Drilling Uncertainties & Risks
  - Casing Tolerances and Cementing Challenges
  - Ballooning Issues

- **Allows** for an Independent Team to Monitor Critical Operations by ....
  - Focusing on Well Events and/or Abnormal Trends
  - Quality Checking the Well Data to Ensure Accuracy

- **Utilizes** Predictive Software Packages for Modeling the Current Condition of the Well(s)

- **Allows** for Consistent Data Analysis among Wells

- **Provides** for the Development of a Knowledge Database to ...
  - Apply Operational Efficiencies
  - Improve Operational Performance
  - Apply Lessons Learned
  - Reduce Unplanned Events

- **Use** of a Communication Protocol to Escalate Well Events
Floor Layout
RTMC, War Room and APC Operations Personnel
Real Time Monitoring Center

- Secured Entry
- 4, 60” Horizontal Monitors
- 5, 55” Vertical Monitors
- 11 Personnel
  - 6 Specialists + Supervisor for 24/7 Real Time Operations
  - 3 Specialists + Supervisor for Populating Knowledge Database and Analyzing Well Performance
  - Space for a 3rd RTM Cell if Rig Activity Increases
- Designated Land Line, Mobile Phone, and Email Address allow for access to the offshore rig teams
- Glass Partition for Visibility to APC Personnel
RTMC & War Room Accessibility

- RTOC
- War Room
- Secured Entry
- Data Wall / Screens

Diagram showing the layout of the RTMC & War Room, highlighting secured entry points and the location of the RTOC, War Room, and Data Wall / Screens.
- Secured Entry
- Daily Drilling & Completion Operations Meetings
- Pre-Casing / Cementing Meetings
- Peer Review / HAZID Meetings
- Technical Discussions
War Room
Supervisory Control & Data Acquisition (SCADA) Room

- Secured Entry
- Allows for Access to Well, Platform, Pipeline, and Subsea Infrastructure Information
- Does not Allow for Remote Office Intervention
  - Manned Facilities Utilize Human-Machine Interface (HMI) combined with a SCADA System to Respond to an Event
- Utilized by Production Engineers for Targeted Operations
Real Time Monitoring of Data should be Done at the Wellsite
  - Allows for an Immediate Response to Well Control Events; and/or,
  - Changes in Well Volumes

The Operator should determine the Data to be Monitored based on Performance

The Operator should determine if a Designated Space to Remotely Monitor Real Time Data should be made Available

Upgrades of Well Monitoring Equipment on Anadarko’s Deep Water Rigs have brought Positive Feedback from Wellsite Personnel

Mud Logging Personnel should be Trained in Well Monitoring
Thank You ...

Questions?