

U.S. Chemical Safety and Hazard Investigation Board



July 2012 Public Hearing

Offshore Safety Performance

Indicators

**Preliminary Findings on the
Macondo Incident**

July 24, 2012



Process Safety - Personal Safety: Two distinct safety disciplines

	Process Safety	Personal Safety
Scope	Complex technical and organizational systems	Individual injuries and fatalities
Prevention	Management systems: design, mechanical integrity, hazard evaluation, MOC	Procedures, training, PPE
Risk	Incidents with catastrophic potential	Slips, trip, falls, dropped objects, etc.
Primary actors	Senior executives, engineers, managers, operations personnel	Front line workers, supervisors
Safety Indicators: Leading and Lagging Examples	HC releases, inspection frequency, PSM action item closure, well kick response, # of kicks	Recordable injury rate, days away from work, timely refresher training, # of behavioral observations



Key Messages

1. BP and Transocean had multiple safety management system deficiencies that contributed to the Macondo incident
2. Pre-incident, the safety approaches and metrics used by the two companies and US trade associations did not adequately focus on major accident hazards



Key Messages

3. Systems used for measuring safety effectiveness focused on personal safety and infrequent lagging indicators
4. The US offshore regulator can achieve greater impact with major accident prevention through the development of a leading and lagging process safety indicator program



Key Messages

5. Despite some significant progress with indicator implementation in the downstream oil industry, in the offshore sector BP, Transocean, industry associations, and the regulator did not effectively learn critical lessons of Texas City and other incidents



Key Messages

6. Companies and trade associations operating in other regulatory regimes outside the US have developed effective indicator programs, recognizing the value of leading indicators, and using those indicators to drive continuous improvement



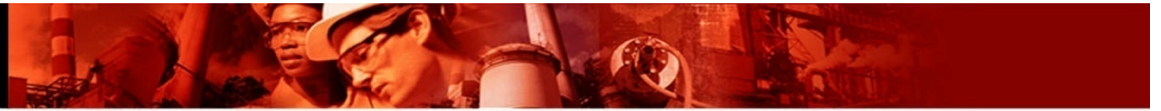
Key Messages

7. Trade associations and many of the same companies that operate in the US are partnering with the regulators in other regimes in advancing these programs
8. Post-incident, companies and trade associations in the US are initiating efforts to advance the development of offshore major accident indicators



Other Major Areas of Investigative Inquiry

- BOP Technical and Risk Management Deficiencies
- Risk Management Approaches
- Human and Organizational Factors
- Safety Responsibilities of the Drilling Contractor
- Workforce Involvement
- Corporate Governance and Sustainability
- Regulatory Reform



CSB Deepwater (“DWH”) Investigation – Unique Contribution

- Independent scientific federal agency
- Lengthy organizational history investigating catastrophic chemical accidents, particularly in oil industry
- PSM and catastrophic accident prevention-unique technical disciplines
- Recommendation follow-up and advocacy



Incident Summary

- April 20th, 2010
- Macondo well #252 in the Gulf of Mexico
- Transocean rig contracted by BP
- 11 deaths
- 17 serious injuries
- ~5 mm barrels of oil spilled in Gulf





Incident Description

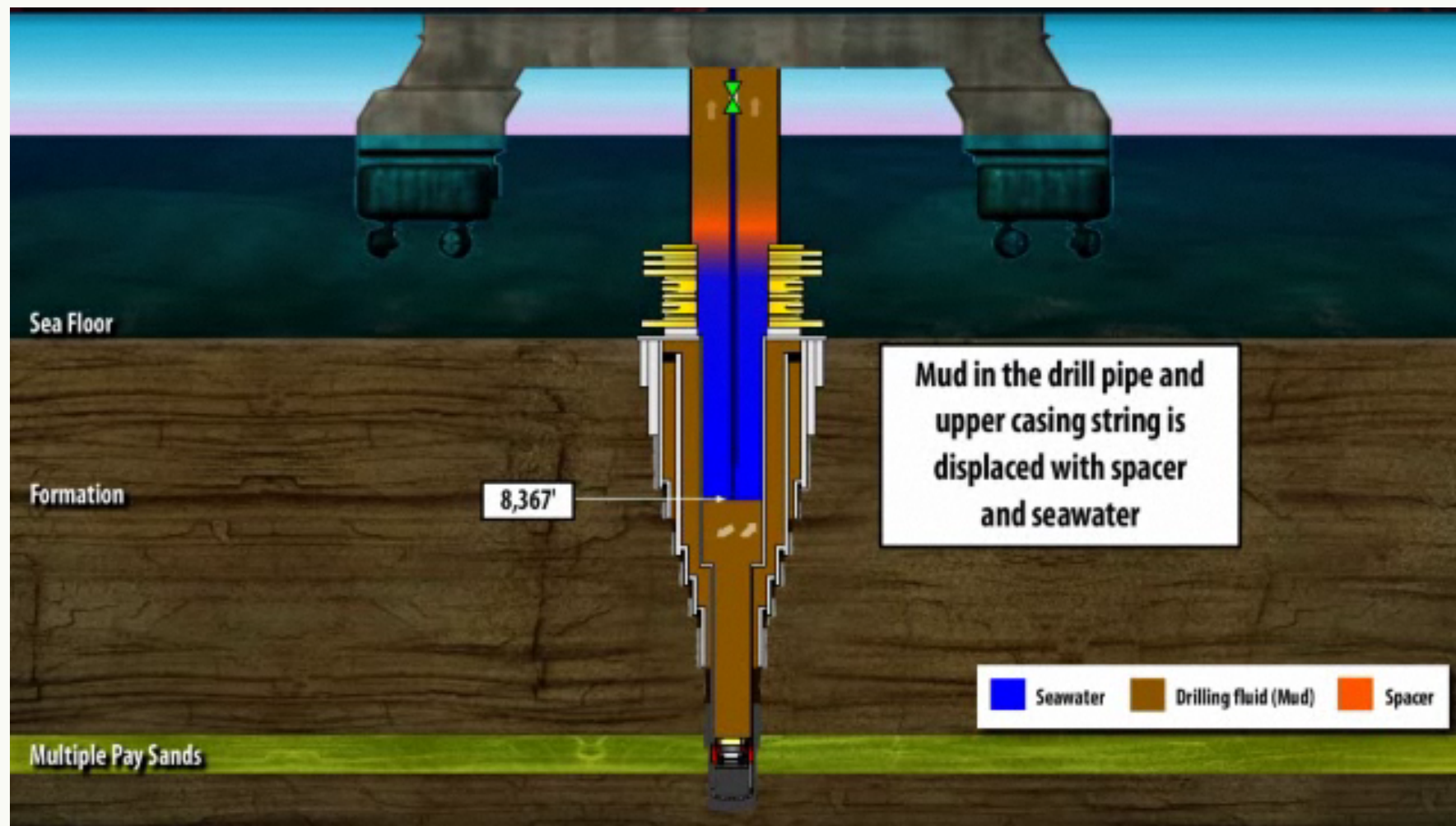


Image taken from Presidential Oil Spill Commission video: <http://www.oilspillcommission.gov/media/the-event/index.html>



Incident Description

- Diversion system activated; system aligned by default to the mud-gas separator on the rig; no action to divert overboard
- Hydrocarbons released onto the rig in the vicinity of ignition sources
- Initial explosions and fire occur
- BOP fails to successfully seal the well
- Final consequences: 11 fatalities, sinking of DWH rig, and oil spill lasting 87 days

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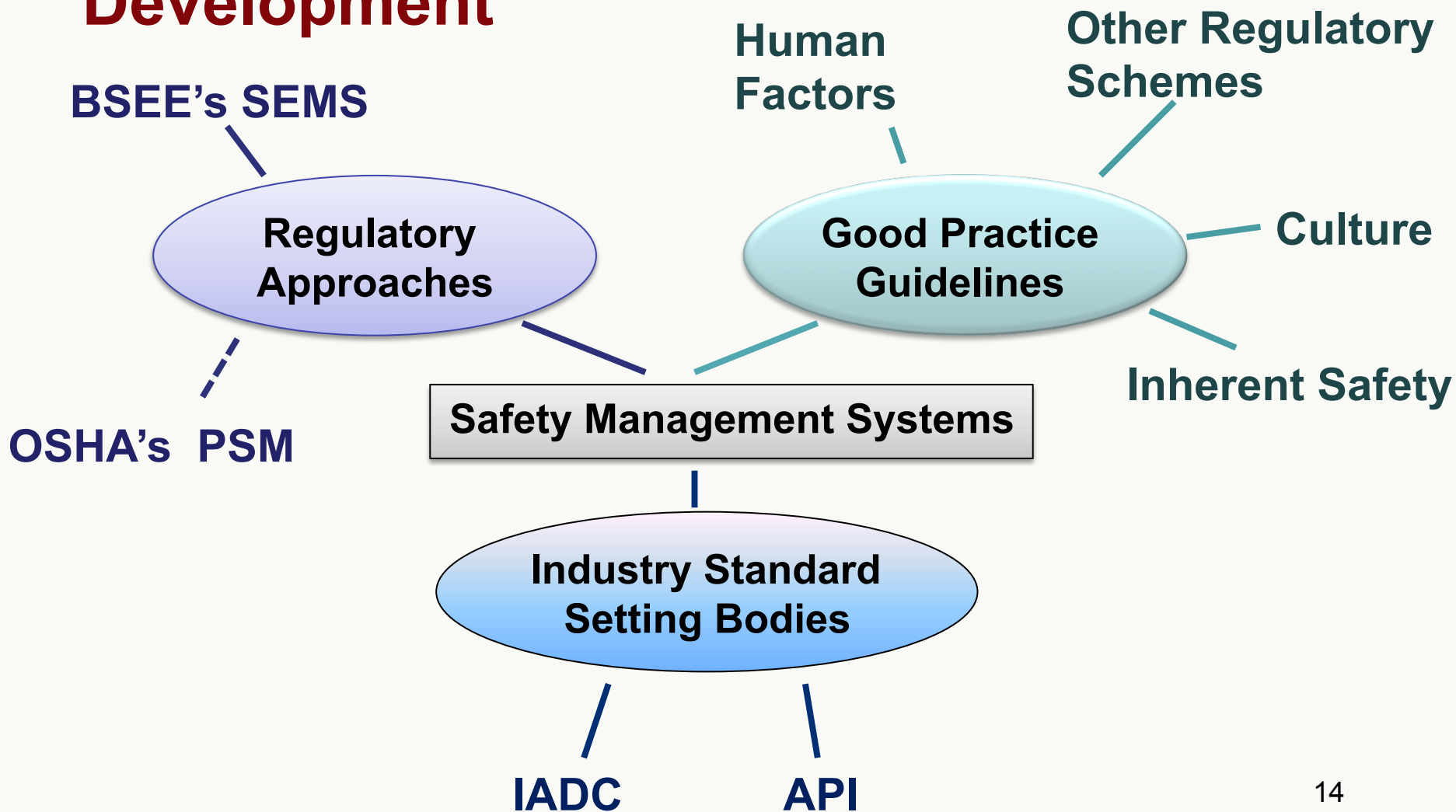


Safety Management System Deficiencies



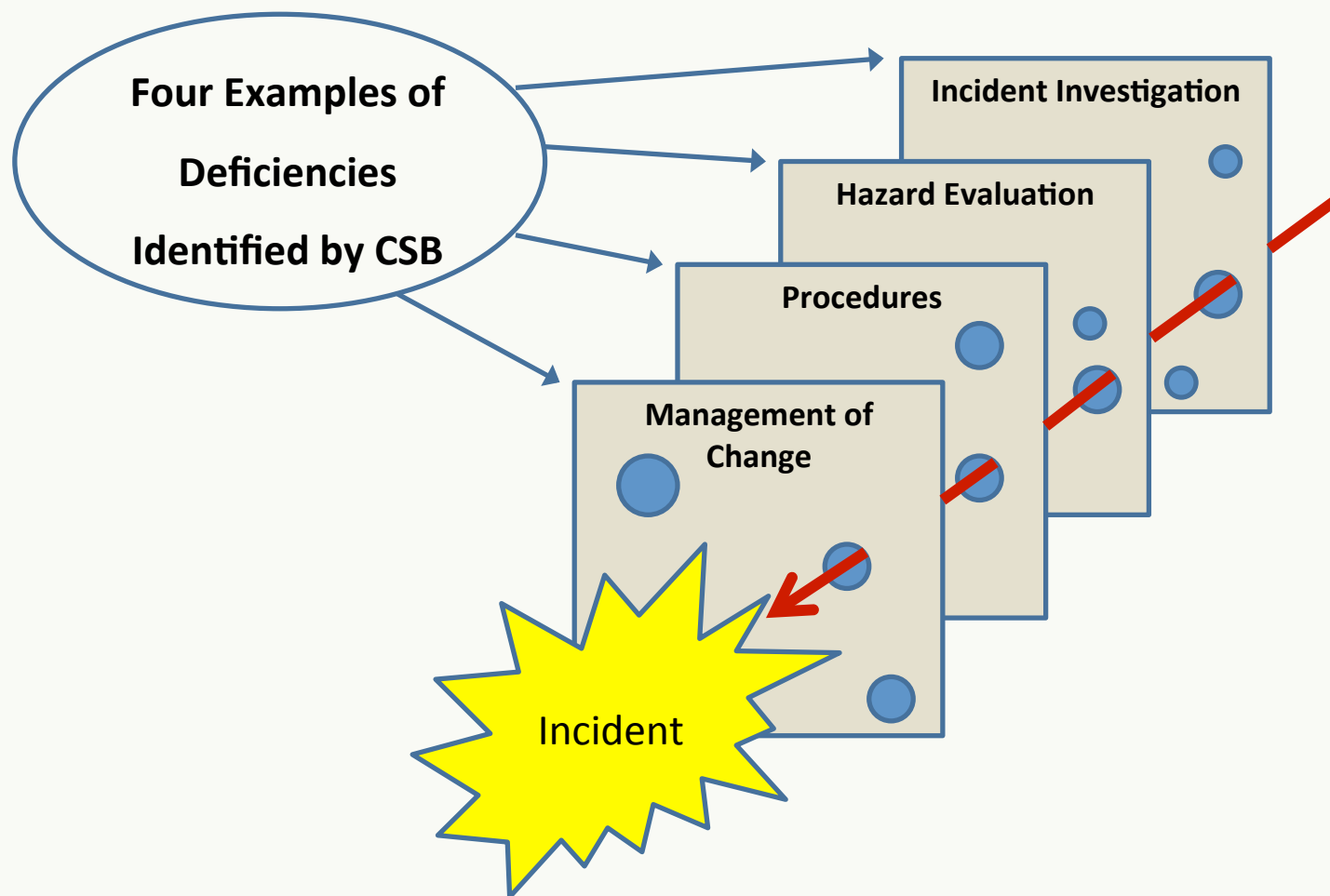


Safety Management System Development





DWH Safety System Deficiencies





Safety System Deficiencies

1. Hazard Assessment: Bridging Document

- Bridging Document: meant to consolidate differences in safety management systems
- Contained just 6 personal safety issues
- Did not address major accident prevention, such as control methods specific to the Macondo well
- TO and BP did not define key process limits and controls required for the drilling project



Safety System Deficiencies

1. Hazard Assessment: Manual Intervention

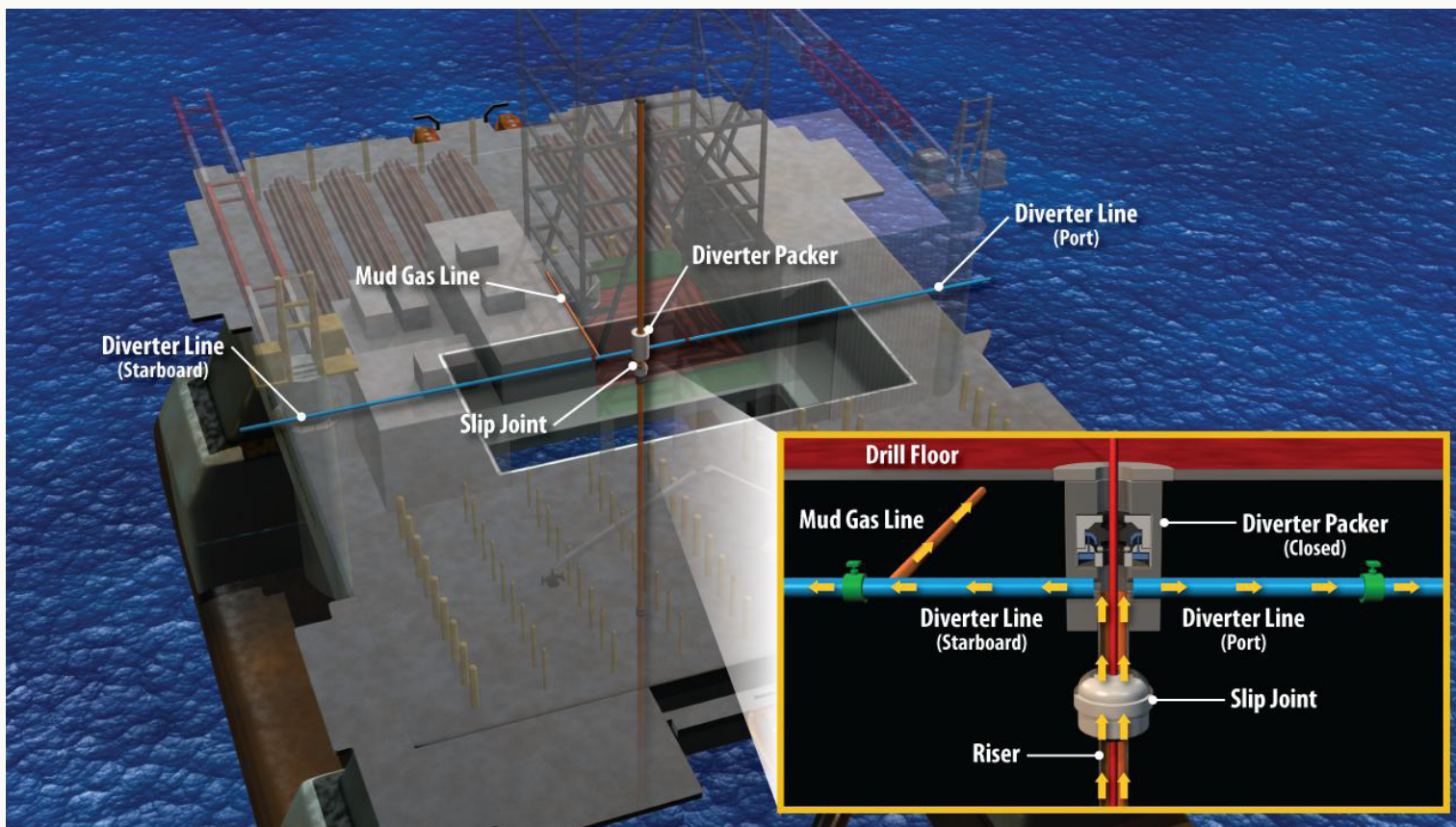


Illustration from the Presidential Oil Spill Commission



Safety System Deficiencies

2. Procedures: Negative Pressure Test

- The Negative Pressure Test is vital verification of the integrity of the cement meant to seal the hydrocarbons at bottom of the well
- No written procedures
- No criteria for success or safe limits defined
- Confusion about how to proceed
- Test was executed multiple times in multiple ways
- Success incorrectly assumed, based on an unsubstantiated theory



Safety System Deficiencies

3. Management of Change (MOC): Temporary Abandonment

- Temporary abandonment plan changed at least 5 times in a week without formal risk assessment
- Various options of the cement plan lacked formal risk identification
- The final cement job was not fully tested.
- The requirements for the Negative Pressure Test were not described



Safety System Deficiencies

4. Incident Investigation: Sedco 711

- Occurred in North Sea a few months prior to Macondo
- Same drilling contractor; different operator
- Delayed response to kick indicators
- Mud and hydrocarbons reached the rig floor
- Unlike Macondo
 - There was no ignition and no loss of life
 - The BOP sealed the well; there was no spill
- Incident advisory by Transocean not shared with DWH rig crew or others outside the North Sea



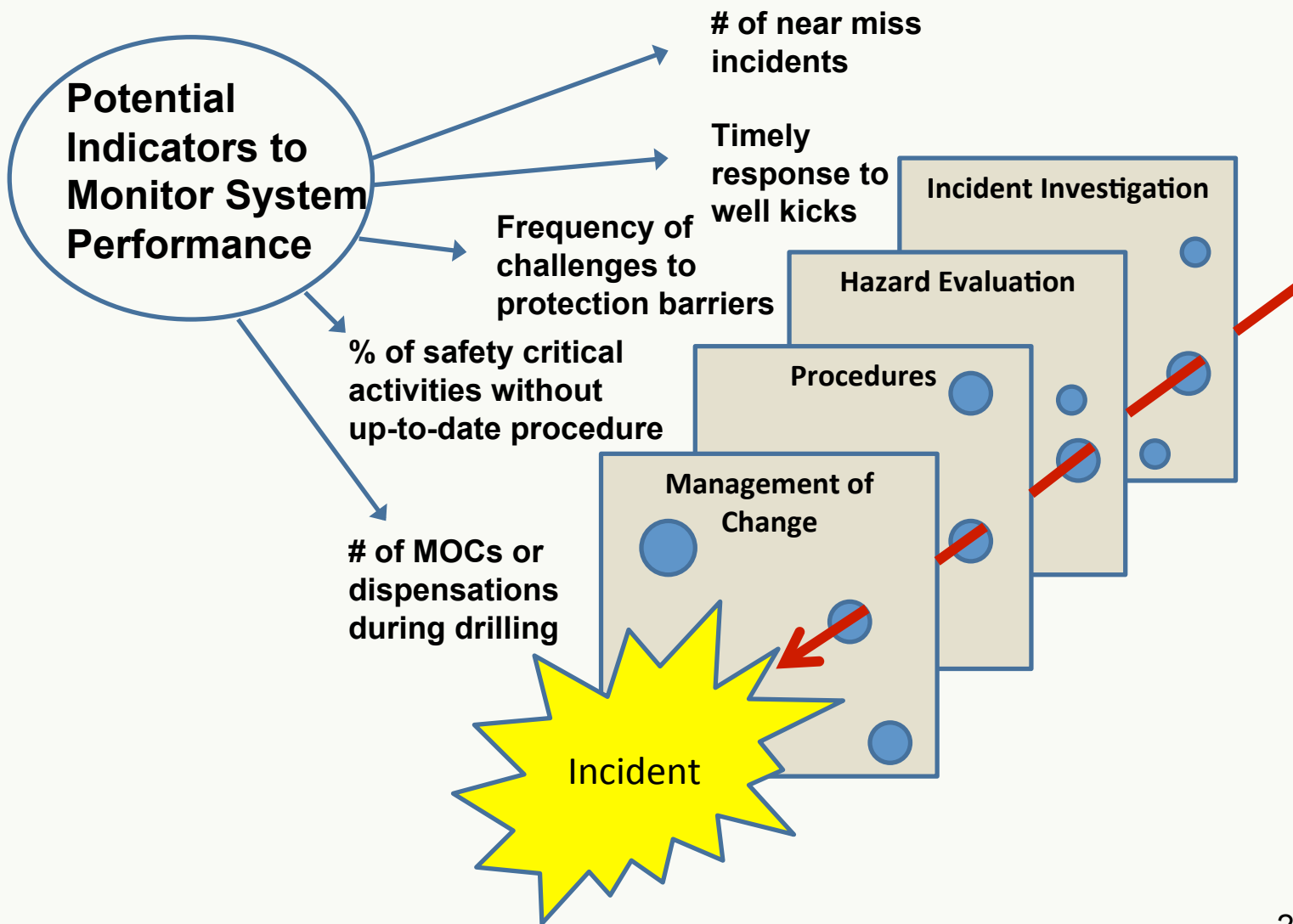
Safety System Deficiencies

4. Incident Investigation: DWH March 8

- March 8, 2010, a little over a month before Macondo
- Delay in response to kick indicators
- BP investigated the incident, but only from a geological perspective. The goal: Reduce lost drilling time.
- Discussions with Transocean were verbal and informal.
- However, evidence indicates that Transocean did not implement changes based on findings



Safety Indicators Monitor System Performance



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Safety Approaches and Key Metrics Used by BP and Transocean





A Company's Approach to Safety is Defined by Where it Focuses Attention

- Site and business unit goals given to its employees
- Personnel performance contracts with responsibilities to achieve those goals
- Reward structures that promote those goals
- Leadership's focus in meetings, company performance reports, and benchmarking activities
- Specific focus of hazard assessments, audits, and inspections



Personal Safety Metrics are not Sufficient to Measure Major Accident Risk

- Days Away From Work (“DAFW”)
- Total Recordable Injury Rate (“TRIR”)
- DAFW and TRIR represent personal injuries – they are personnel safety metrics
- Typically capture the high frequency, low consequence events – slips, trips and falls
- Major accidents are rare and do not significantly contribute to personal safety metrics



BP's Safety Management System Program

- OMS was BP's major safety initiative in the wake of Texas City, replacing the old system that focused largely on personal safety
- In 2007, BP made commitments to implement OMS in its exploration and production operations
- OMS, which contained process safety elements, was only partially implemented in the GoM Drilling and Completions (D&C) organization at the time of the April 20, 2010 incident
- A high level BP manager stated to the CSB: "we were just getting started" (with implementing OMS)



BP's Focus on Personal Safety

- BP drilling and well completions managers and engineers stated that BP's safety focus in audits, reviews and safety score cards primarily addressed personal safety issues
- The offshore BP staff interviewed were generally unfamiliar with process safety management concepts or the need to have a specific focus on major accident prevention
- Witnesses stated that personnel contracts just prior to the incident focused on personal safety criteria and the implementation of OMS



BP's Focus on Personal Safety

- In the week prior to the Macondo incident, the BP drilling completions executive leadership team meeting focused their review of safety trends on injury and fatality statistics as well as other personal safety statistics
- Industry benchmarking by BP focused on production performance without significant focus on major accident metrics
- Post-incident, BP's investigation report contained a number of recommendations for process safety improvement including: the establishment of leading and lagging indicators for well integrity, well control, and rig safety critical equipment



BP Major Accident Risk Evaluations

- BP did not conduct an effective comprehensive hazard evaluation of major accident risks for the activities of the DWH or the Macondo well
 - Major Accident Risk Assessment for Gulf of Mexico only examined its own facilities, not the ones it leased
 - BP's use of Risk Ranking Matrices in the well planning process primarily focused on financial risk (cost and schedule)



BP Audits of Transocean Rigs Focused on Personal Safety & Lagging Indicators

- BP's 2009 performance review of Transocean's rigs' safety performance, including DWH, focused on operational performance, dropped object incidents, and equipment failure
- TRIR and Serious Incident Rate were highlighted
- In its 2007 audit of the DWH, BP focused almost all of its recommendations on personal safety issues, including: waste handling, scaffolding, and appropriate tank container labeling



BP Safety Performance Metrics

- BP personnel performance contracts did not typically contain process safety metrics other than completion targets for OMS implementation
- Personal safety was rewarded, overshadowing focus on major accident hazards
 - BP and Transocean VIPs were on rig at time of incident to celebrate 7 years of zero lost time incidents
 - Despite having drilling expertise, the VIPs review focused attention on personal safety hazards
- Post-incident, BP developed a more rigorous process safety indicators program



Transocean's Safety Program Focused on Personal Safety

- Two worker behavioral observation programs, THINK and START, were the centerpiece of activity
- These programs focused on watching and documenting how workers carry out their tasks
- Daily START card completions were a key safety performance indicator and were included as a corporate measure for rig performance



Transocean Major Accident Hazard Risk Assessment (“MAHRA”)

In 2004, Transocean’s MAHRA made 27 recommendations for safety improvements— almost all addressed personal safety issues:

- 23 pertained to improvements to warning signs, PPE, storage lockers and disposal containers
- 3 pertained to needed equipment improvements (smoke detectors and public address systems)
- 1 pertained to the need for more training
- No recommendations addressed major accident risks



Transocean Risk Assessment of DWH

- While the scenarios of blowouts or gas in the riser were rated as high severity, they were rated as negligible to low in likelihood
- The preventions listed for blowouts and gas in the riser focused on procedures, training, instrumentation and BOP controls that largely required manual activation
- Procedures, training, and operator action are the least effective means of safety prevention in the commonly accepted hierarchy of controls



Transocean Key Performance Indicators: Targeting Personal Safety

- HSE training compliance
- START card daily completion numbers
- Potential and actual severity rate of personal injuries
- TRIR
- Serious incident/injury case



2010 Transocean Safety Bonuses

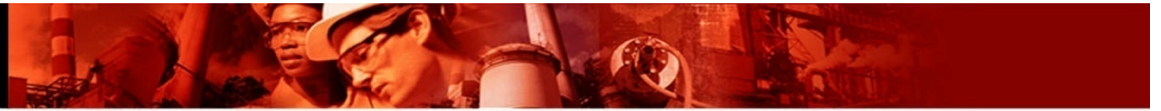
- Transocean reports safety performance to the public and calculates financial bonuses via two metrics:
 1. TRIR
 2. Total potential severity rate (“TPSR”)
- After 11 fatalities, the TRIR score was set to zero
- Even so, the proprietary TPSR score was so high, top-level Transocean executives were awarded bonuses
- Safety was rewarded despite the catastrophic consequences of the blowout on the DWH

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Key Metrics Used and Promoted by Offshore Industry Associations





American Petroleum Institute (API)

- API RP 754 is a positive step forward for establishing onshore safety performance indicators, it is not intended for use offshore
- Focus on infrequent, lagging indicators
- Need for leading indicators to proactively measure safety system performance before an incident occurs
- API SEMP RP 75 addresses offshore performance measures in an optional appendix that focus on personal safety or infrequent lagging events



International Association of Drilling Contractors (IADC)

- Rig safety recognition program is based on personal safety statistics
- Program recognizes rigs with:
 - Zero Lost Time Incidents Rate (“LTIR”)
 - Zero TRIR
- IADC’s safety case refers to the need for “reactive” and “proactive” indicators but provides no guidance

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Role Of The Regulator In Measuring and Driving Offshore Safety Performance



MMS Safety Awards

- BP was a finalist for a MMS safety award at time of Macondo incident
- BP received 9 MMS awards from 1989 to 2009; Transocean received 6 awards from 1999 to 2008
- Criteria to determine SAFE award candidates primarily focused on personal safety
- Criteria did not give an accurate measure of safety management system performance to control major accident hazards



MMS Incident Reporting and Performance Measures Program

- Pre-incident, the MMS incident reporting rule required lease holders to report incident data that were primarily personal safety-related or were lagging, infrequent indicators
- MMS also requested lease holders to report certain Outer Continental Shelf performance measures on a *voluntary* basis
- Voluntary reporting also focused on infrequent incidents and personal safety metrics



Losses of Well Control in the Gulf of Mexico

Type of loss of well control	2007	2008	2009	2010	2011	2012 to date
Flow underground	1	1	0	0	0	0
Flow surface	3	3	2	1	1	0
Diverter flow	0	1	0	0	0	0
Surface equipment failure	3	3	4	3	1	0
Total losses of well control in Gulf of Mexico	7	8	6	4	2	0

Source: BSEE Incident Reporting Statistics



Un-ignited Gas Releases in the Gulf of Mexico

Type of gas release	2007	2008	2009	2010	2011	2012 to date
Gas releases*	9	16	17	12	10	2
H ₂ S releases	2	3	4	2	0	0

Source: BSEE Incident Reporting Statistics

*Includes only un-ignited gas releases; ignited gas releases are considered fires/explosions and must be reported separately



BSEE OCS Performance Measures: New Reporting Requirements

Post-incident, additional OCS performance metrics reporting became mandatory; however...

- It exemplifies reactive risk management - measures mostly lagging indicators
- Very similar to Appendix E - Performance Measures in API RP 75
- Infrequent data is not useful for identifying trends, agency priorities, or performance improvement efforts
- No new predictive, leading indicators added to collection requirements



International Examples of Indicators Development and Reporting

- International companies and trade groups have indicator programs that recognize the value of leading indicators and using those indicators to drive continuous improvement
- Other regulatory regimes partner with trade associations to advance these programs
 - UK HSE, Oil & Gas UK, and Step Change in Safety
 - Norway PSA and industry groups



Process Safety Indicators Currently In Use

- Availability of safety critical equipment
- Unplanned shutdowns
- Hydrocarbon releases
- Number and duration of out-of-service equipment or use of temporary equipment
- Management follow-up on safety recommendations



Contractor Responsibility for Reporting and Regulatory Compliance

- Policy issue of placing regulatory responsibility on offshore parties, including contractors, to ensure consistent and accurate reporting of data
- Contractor legal accountability for compliance with regulations disputed
- DOI issued citations directly to contractors for the first time post-incident
- However, new regulatory requirements still focused on the operator, not the drilling contractor



Conclusions

1. Since the release of the CSB's BP Texas City and Baker reports, progress has been made onshore to focus on process safety and the use of leading and lagging indicators
2. The offshore oil trade associations, companies like Transocean and BP, and the regulator, however, have not sufficiently learned nor effectively implemented these vital safety lessons from the two reports
3. Industry management, the regulator and the workforce must work together to develop more effective process safety and indicators programs for offshore energy operations

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