Effects of Water Depth Workshop

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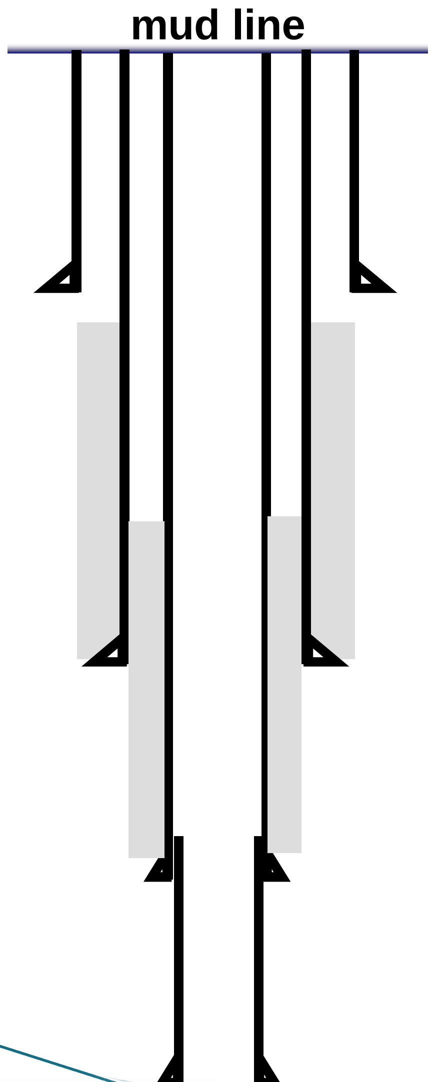
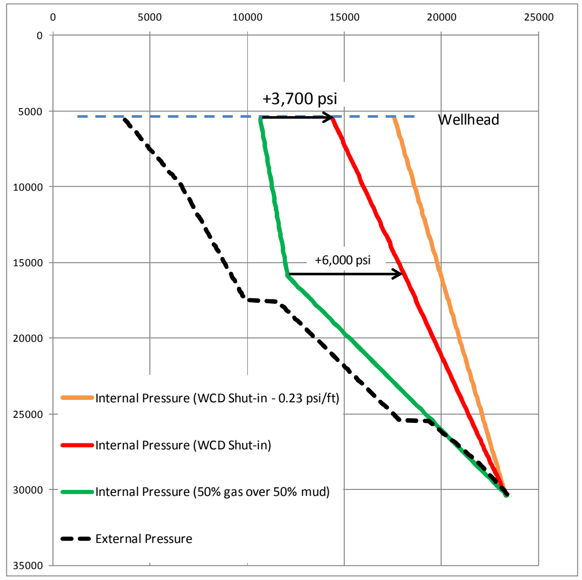
Topic 3 – Well Drilling & Completion Design and Barriers

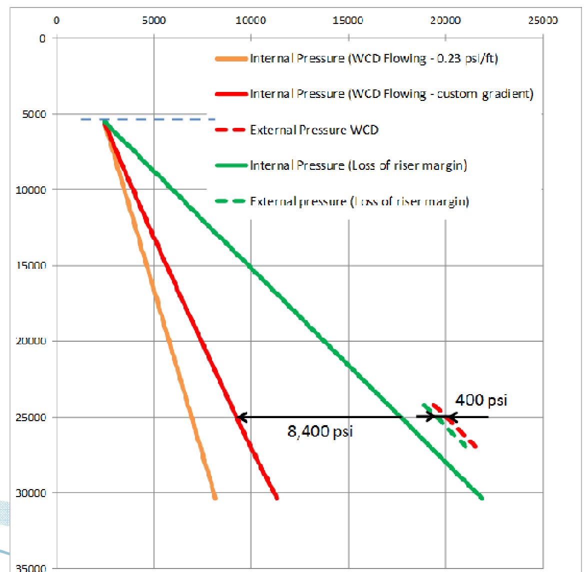
Jim Raney

Well Design

Deepwater Well







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Mechanical integrity

Collapse – Loss of riser margin
Burst – Kick Tolerance (50/50, other)

Formation integrity

Frac at Shoe, gas to surface
Frac at shoe broaching to the mudline

BOEMRE issued NTL 10 on Nov 8, 2010

The title of NTL 10 is —"Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources"

Although not explicitly stated in the NTL 10 notice, the BOEMRE requires that the operator demonstrates in the APD that the well design is adequate to contain an uncontrolled flow.

Mechanical integrity

Collapse
- Assumption = uncontrolled flow of Hydrocarbons to the mudline
- No flow restriction at mudline; pressure at wellhead is equal to seawater hydrostatic

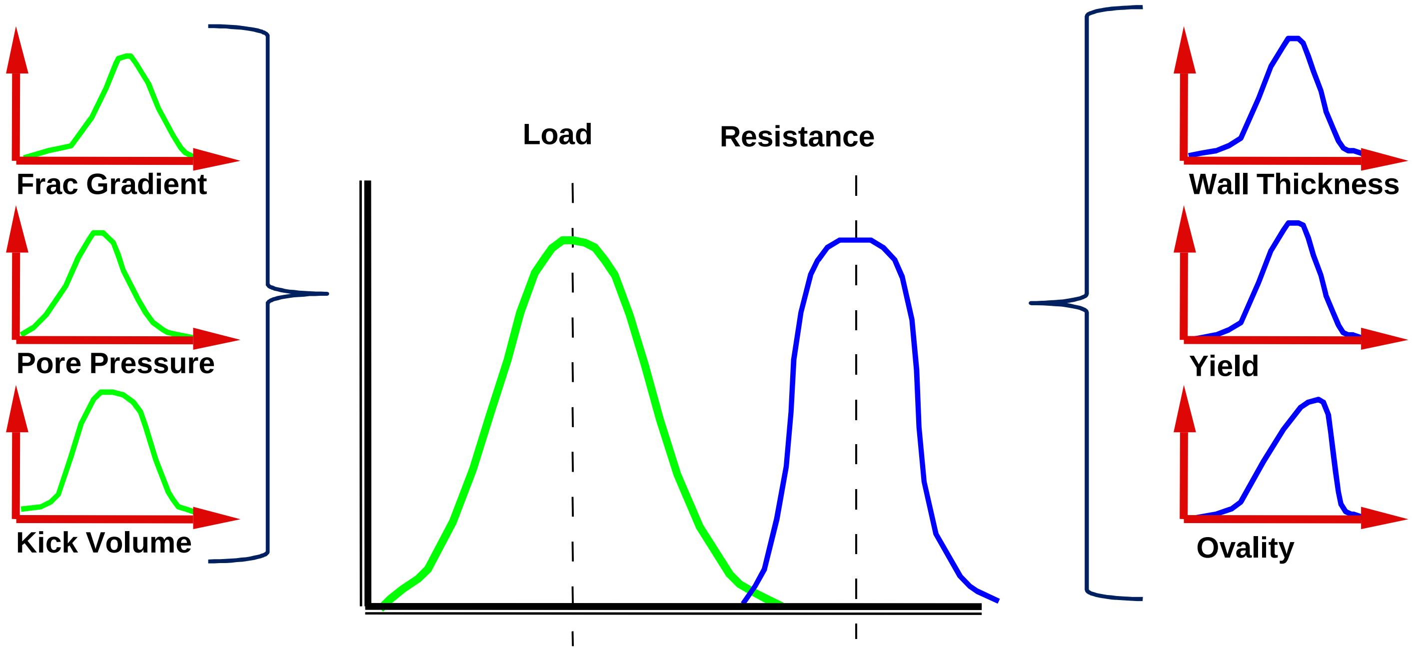
Burst (Shut-in, or Cap & Flow)
- Shut-in = well full of produced fluids
- Cap & Flow = partial flowback to reduce maximum pressures in well

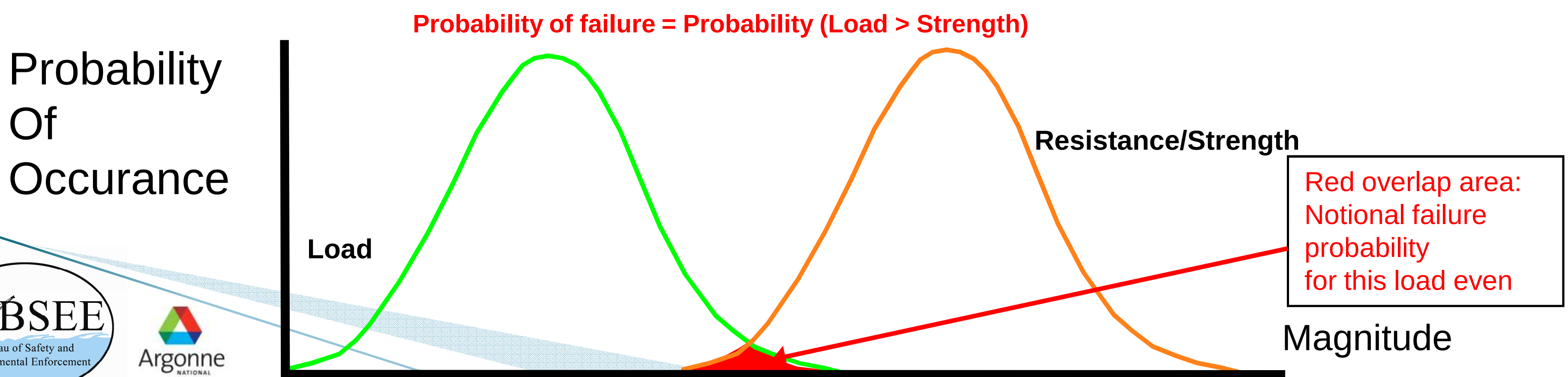
Formation integrity

Shut-in pressures could frac exposed formation and result in hydrocarbons broaching to the mudline

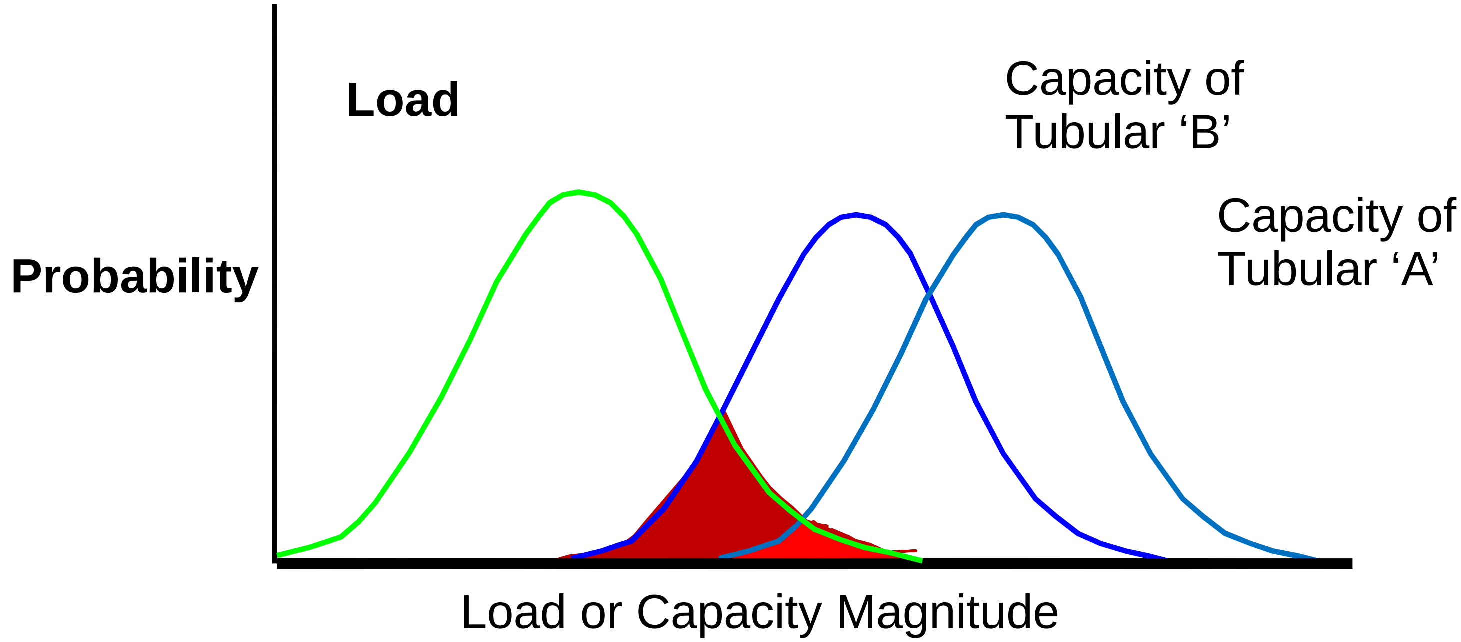
Design Loads

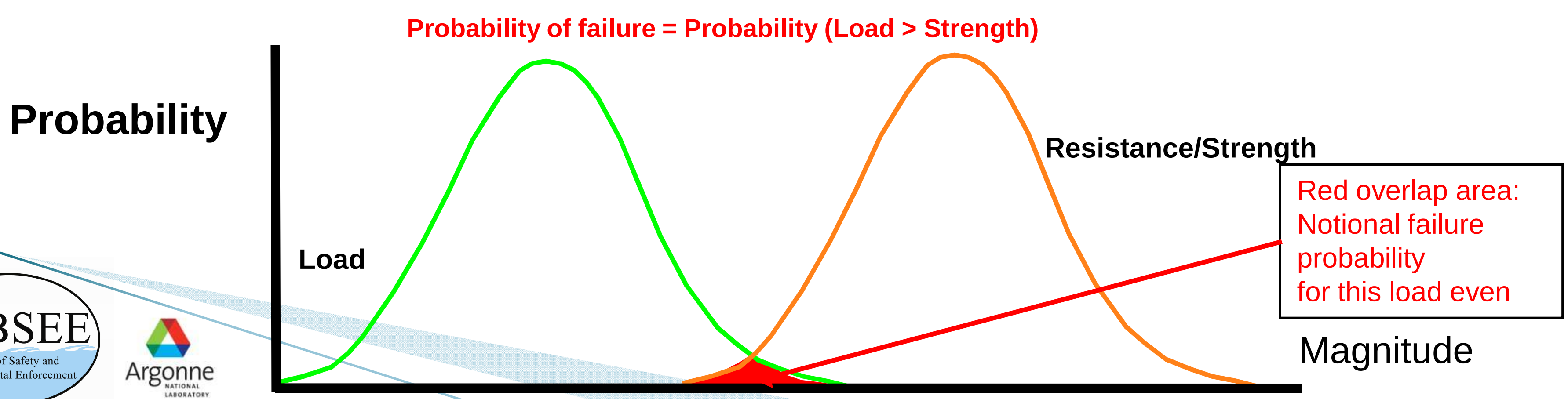
Design


Frac Gradient
Pore Pressure
Kick Volume
Load
Resistance
Wall Thickness
Yield
Ovality


Probability of failure = Probability (Load > Strength)
Probability
Of
Occurance
Load
Resistance/Strength
Red overlap area:
Notional failure
probability
for this load even
Magnitude

Design





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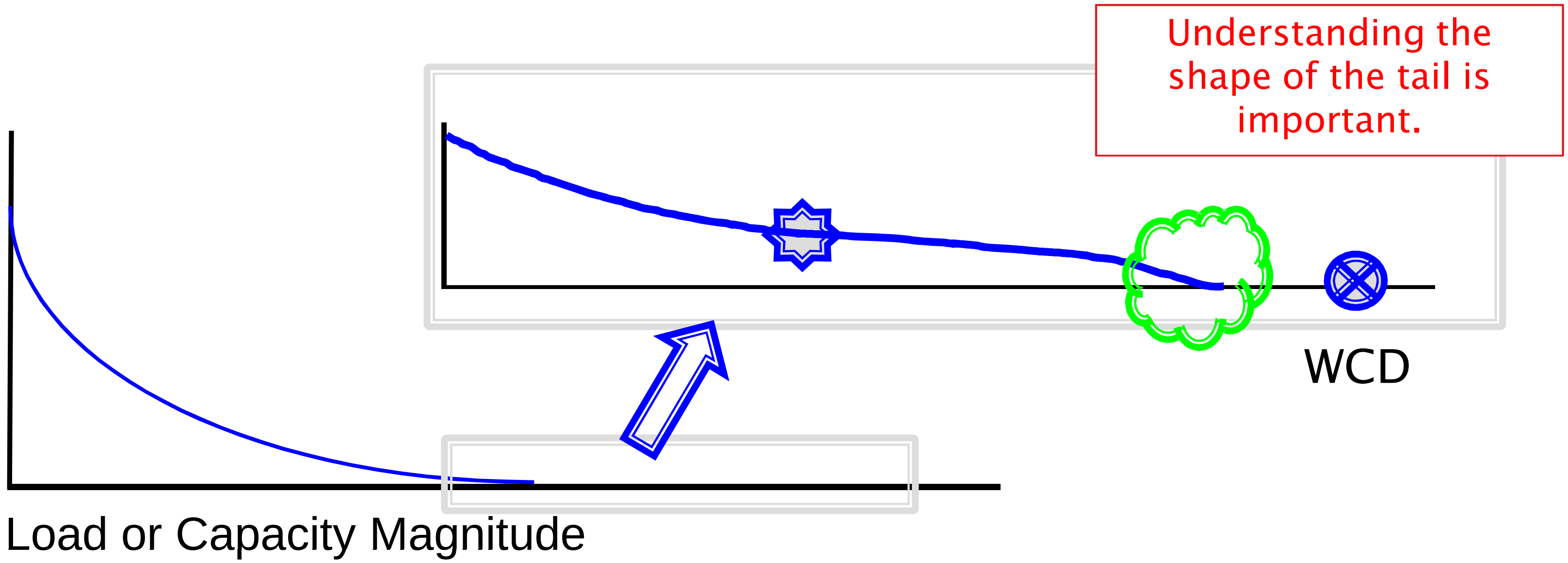
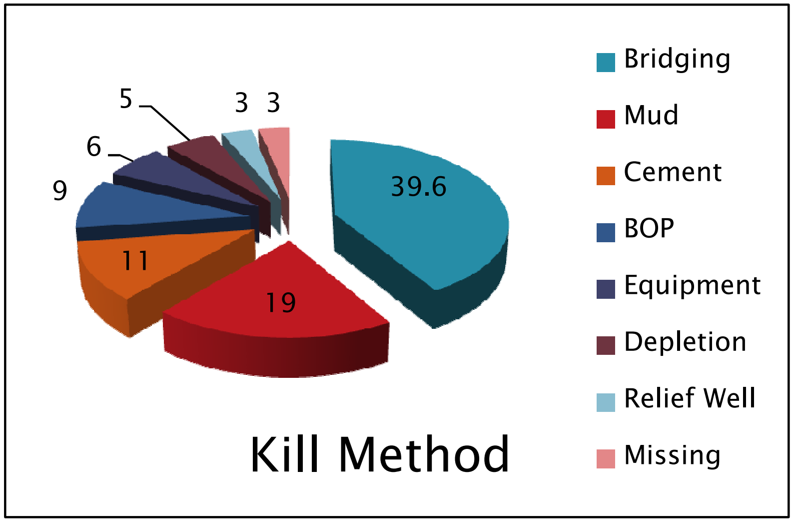
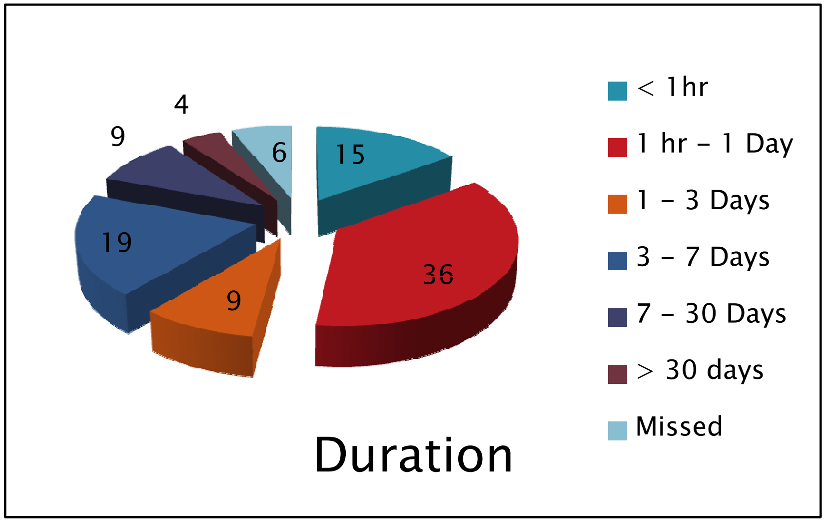
Load Variability



- **Probability of Occurrence**
  - **Design practices - estimation of pore pressure, fracture gradient and temperature**
  - **Operation practices - overbalance during drilling**
- **Magnitude**
  - **Mother Nature - fluid gradients, pore pressure, fracture gradients**
  - **Human error**
  - **Operational procedures - kill method, well control contingency planning**

OCS Blowouts – Kill Methods and Duration





Source: SPE 53974 (1999) – "Kill Methods and Consequences of 1120 Gulf Coast Blowouts During 1960 – 1996"

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OCS Losses of Well Control: 2006-2010

LOSS OF WELL CONTROL	2006 ***		2007 ***		2008 ***		2009 ***		2010 ***	
	GOM	PAC	GOM	PAC	GOM	PAC	GOM	PAC	GOM	PAC
Flow Underground	0	0	1	0	1	0	0	0	0	0
Flow Surface	0	0	3	0	3	0	2	0	1	0
Diverter Flow	0	0	0	0	1	0	0	0	0	0
Surface Equipment Failure	2	0	3	0	3	0	4	0	3	0
LOSS OF WELL CONTROL (TOTALS)	2	0	7	0	8	0	6	0	4	0
COMBINED TOTAL FOR THE YEAR	2		7		8		6		4	

YTD = Year to date

* * * Effective July 17, 2006, BOEMRE revised the regulations for Incident Reporting. Related to this chart, changes were made to the reporting criteria for Losses of Well Control incidents. Thus the number of incidents shown in these categories for 2006 and beyond may be affected by this change when compared to previous years.

SOURCE: TIMS Database as of **16-Feb-2011**

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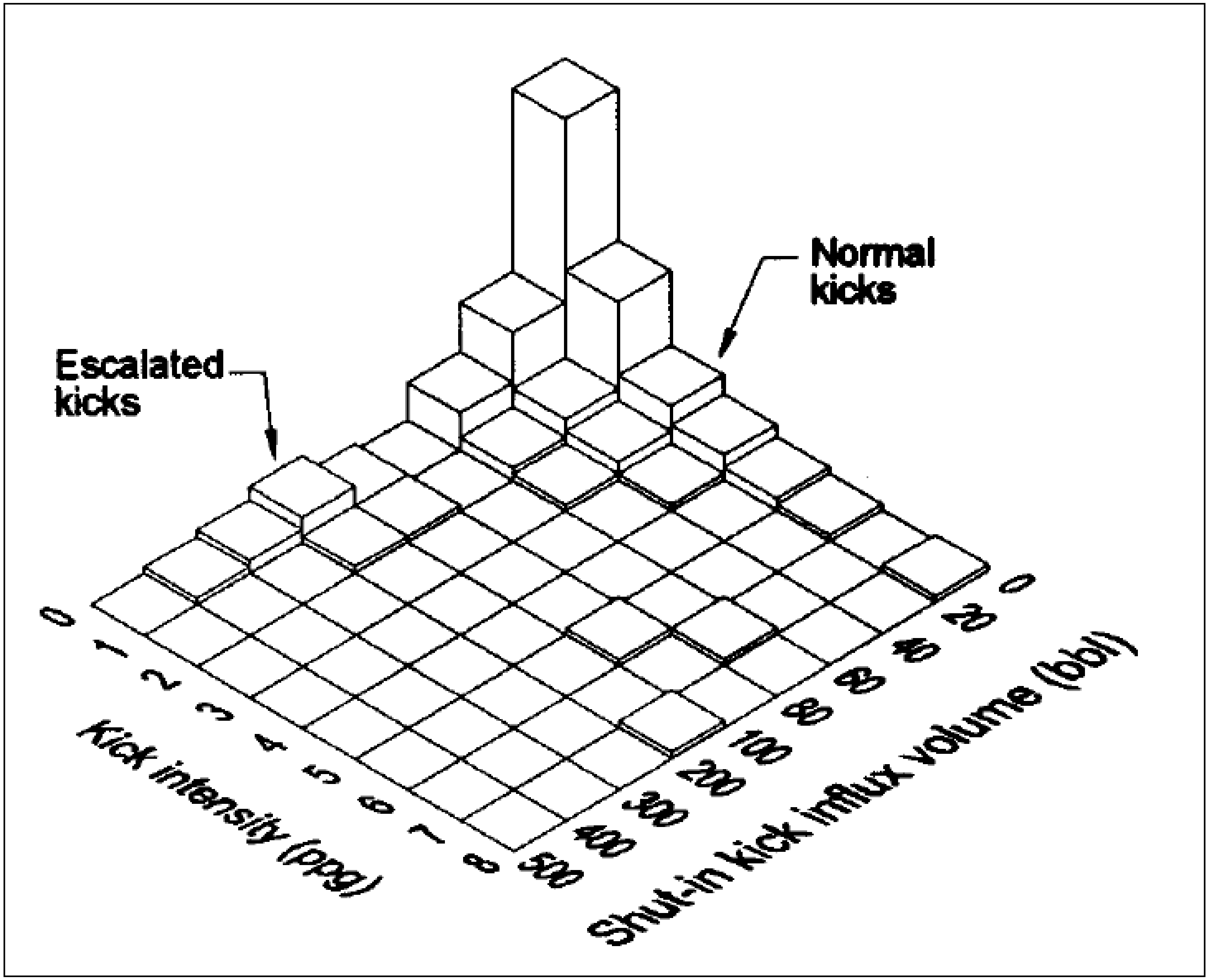
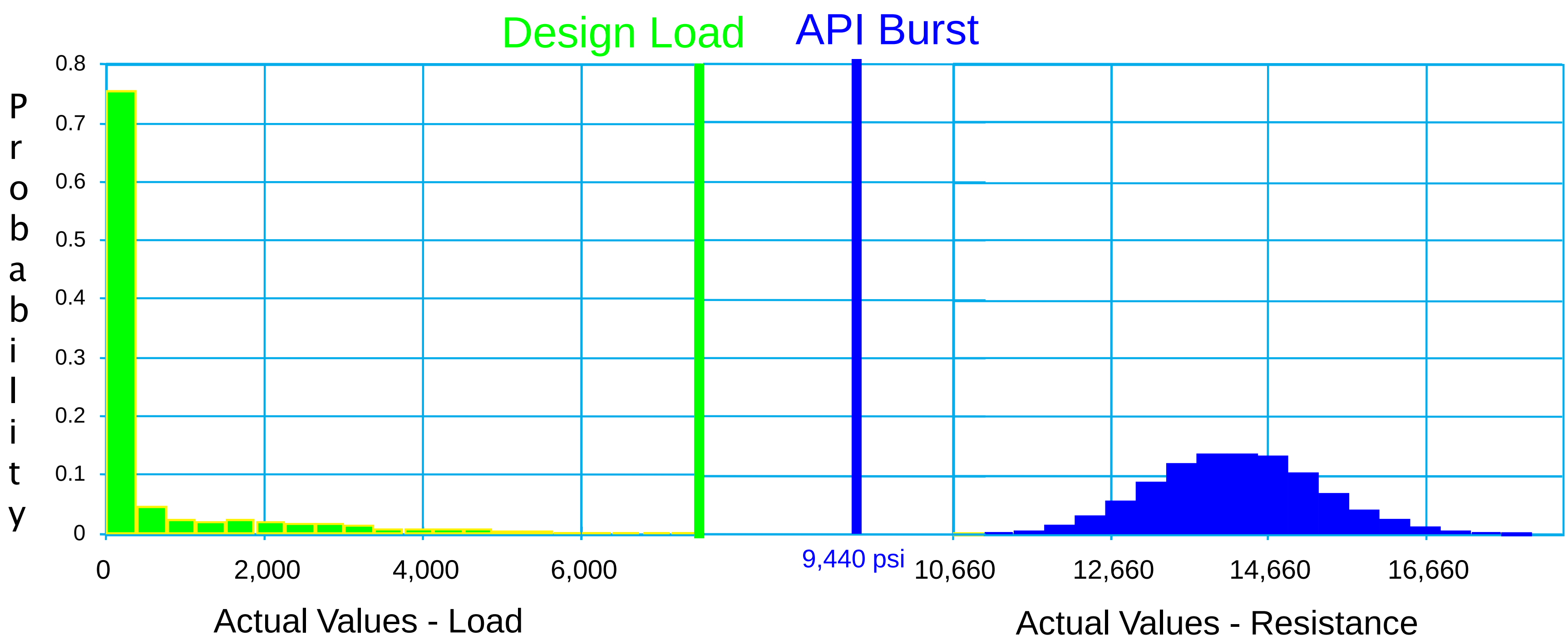


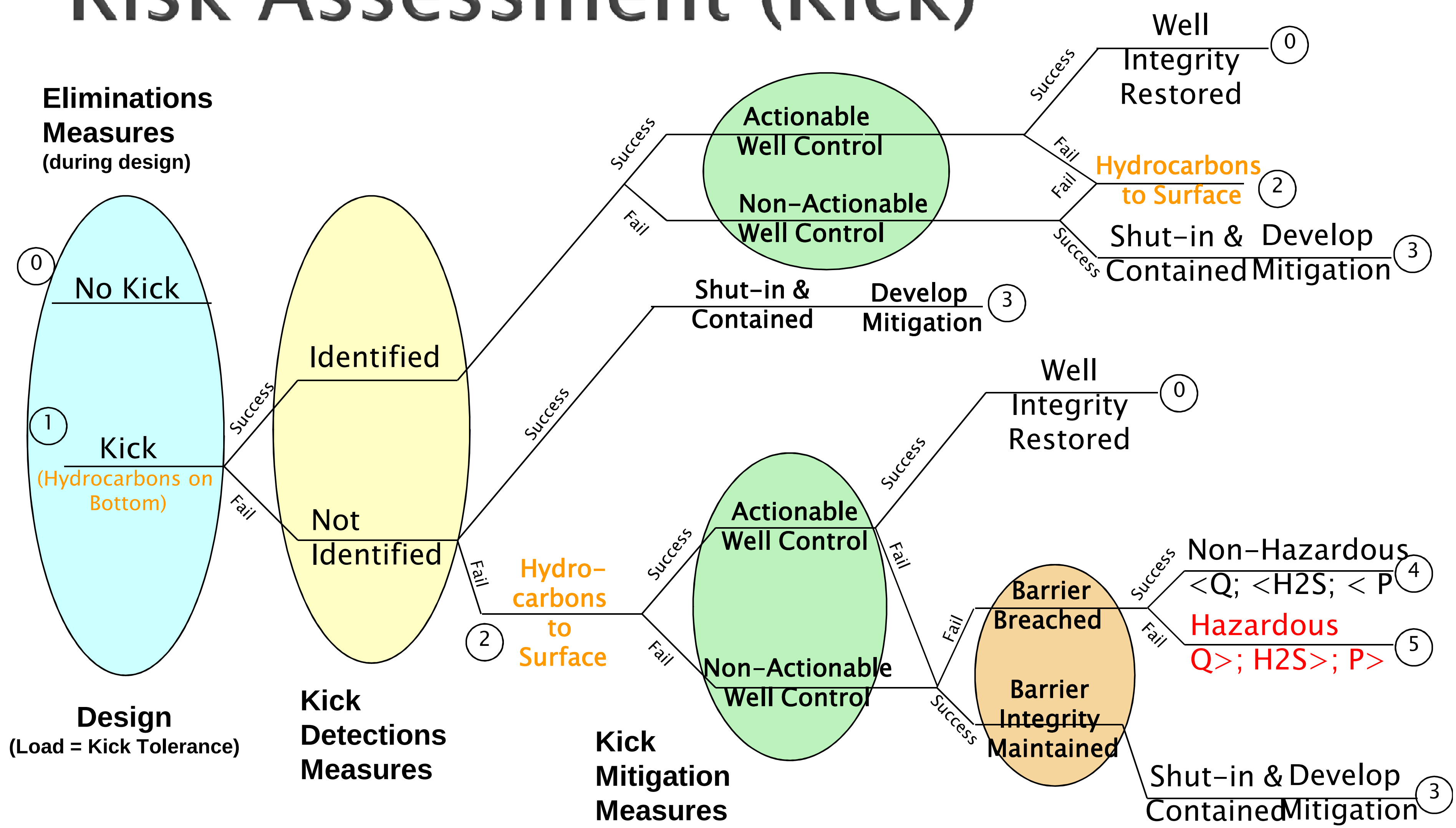
Typical Kick Volume versus Intensity Scatter Plot

Actual Design (Kick)



Internal Pressure, psi

Risk Assessment (Kick)



Reliability	Design		Detection			Control		Barrier	
	No Kick	Kick	Pore Pressure Prediction	Pressure Monitor	Flow Controls	Actionable	Non-Actionable	Breached	Integrity Maintained
High									
Medium									
Low									

Potential Risk Treatments

Topic 3 – Well Drilling & Completion Design and Barriers

- Once risks have been identified and assessed, all techniques to manage the risk fall into one or more of these four major categories:
  - Avoidance (eliminate or withdraw)
  - Reduction (optimize – mitigate)
  - Sharing (transfer – outsource or insure)
  - Retention (accept and budget)
- Trade-offs are made to a point where the risk is acceptable to the organization or person making the risk management decisions.
  - NOTE: US Department of Defense, Defense Acquisition University, calls these categories ACAT: Avoid, Control, Accept and Transfer.

Reference Documentation:

- ISO/IEC Guide 73:2009 (2009). Risk management — Vocabulary. International Organization for Standardization. http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=44651.
- ISO/DIS 31000 (2009). Risk management — Principles and guidelines on implementation. International Organization for Standardization. http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43170.
- "Committee Draft of ISO 31000 Risk management" (PDF). International Organization for Standardization. http://www.nsai.ie/uploads/file/N047_Committee_Draft_of_ISO_31000.pdf.

Acceptance Criteria (Hybrid)

- Acceptance Criteria

  1. Best Available Technology (BAT)
  2. Best Available and Safest Technology (BAST)
  3. Best Available Control Technology (BACT)
  4. As Low as Reasonably Practicable (ALARP)

- Risk management techniques:
  - Avoidance
    (eliminate, withdraw)
  - Reduction
    (optimize – mitigate)
  - Sharing
    (transfer – outsource or insure)
  - Retention
    (accept and budget)

  - Best Available Techniques Not Entailing Excessive Cost (BATNEEC)
  - Economically and Technically Feasible

Applying risk analysis methodology: BAST, 'best available and safest technologies--where economically feasible.'
`Requirement (Section 21B) of the Outer Continental Shelf Lands Act Amendments of 1978
http://www.boemre.gov/tarprojects/038.htm

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Risk Analysis

Topic 3 – Well Drilling & Completion Design and Barriers

- Quantitative risk assessment requires calculations of two components of risk (R): the magnitude of the potential loss L, and the probability p, that the loss will occur.

- Risk assessment consists in an objective evaluation of risk in which assumptions and uncertainties are clearly considered and presented. Both potential loss and probability of occurrence have uncertainty. A risk with a large potential loss and a low probability of occurring is treated differently from one with a low potential loss and a high likelihood of occurring. Expressed mathematically,

$$R_{total} = \sum_i L_i p(L_i)$$

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Risk Analysis

Topic 3 - Well Drilling & Completion Design and Barriers

Well 'Basis of Design' (BOD) Risk Analysis

Using the Barrier Philosophy from API RP 96 (below), API Bul 97 and NTL-10 Well Containment Analysis (L1L2 Rev 1.18), the workgroup will outline a methodology for a risk analysis of the BOD.

Proposed Methodology:

1. Identify the barriers between reservoir energy and the environment for each section of the well or activity to be performed.
2. Identify and rank the failure mechanisms of the barriers in place across all flow paths. Using a FMEA or other process.
3. Qualify the probability of failure (***'p'***) (i.e. the probability that the loss will occur) and the consequences of failure (i.e. the magnitude of the potential loss) (***'L'***) for each failure mechanism.
4. Work the risk treatments/trade-off's: avoid/eliminate, mitigate and transfer until the acceptable risk meets set criteria.

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Criteria

B

'best' in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole

A

'available techniques' means those techniques developed on a scale which allows implementation in the relevant class of activity under economically the technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying out the activity

T

'techniques' includes both the technology used and the way in which the installation is designed, built , managed, maintained, operated and decommissioned.

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Back-up slides

Rules (Workplace/Drilling)

Wellbore Construction and Barriers

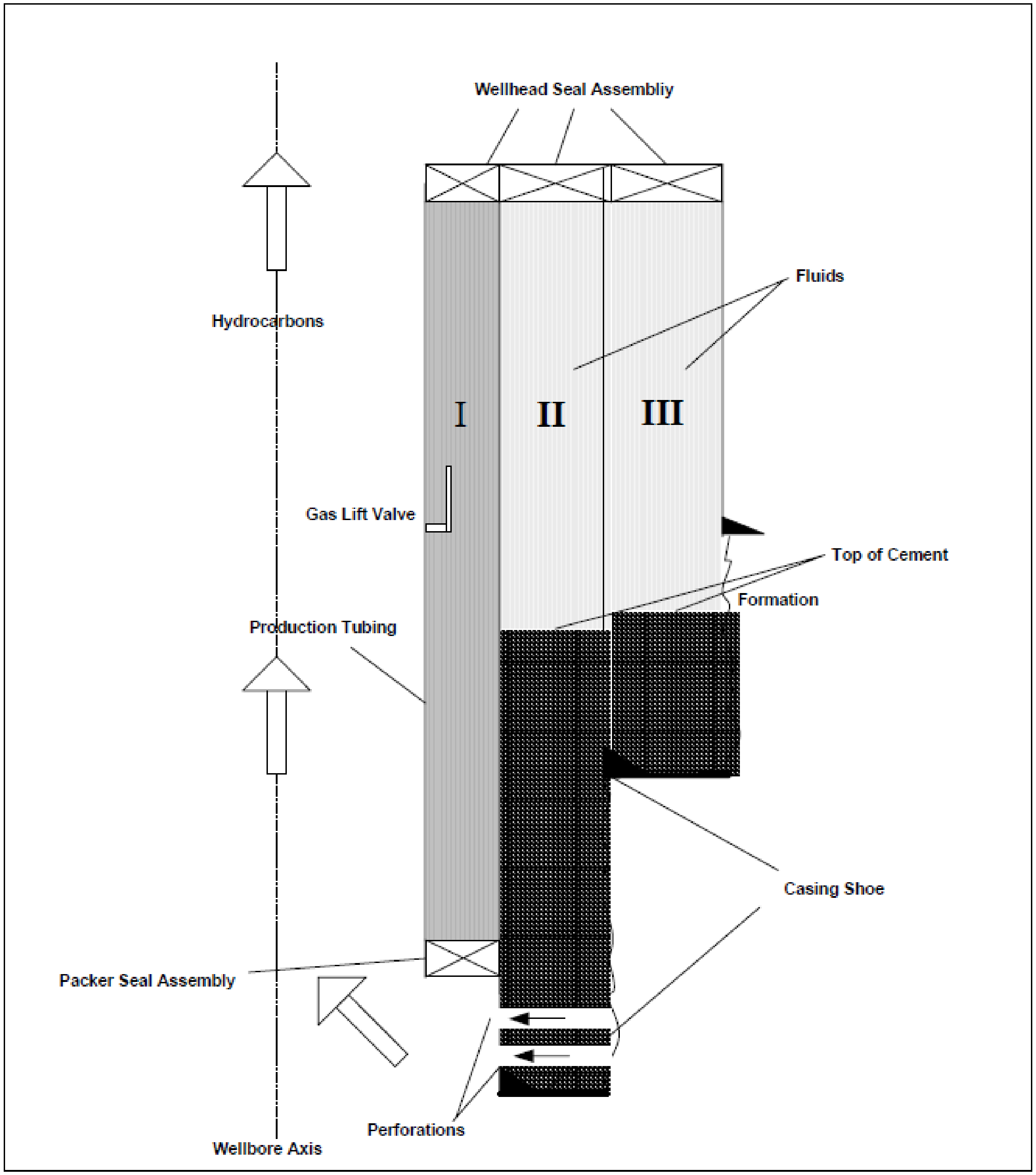

Figure 1 Types of annuli in a wellbore

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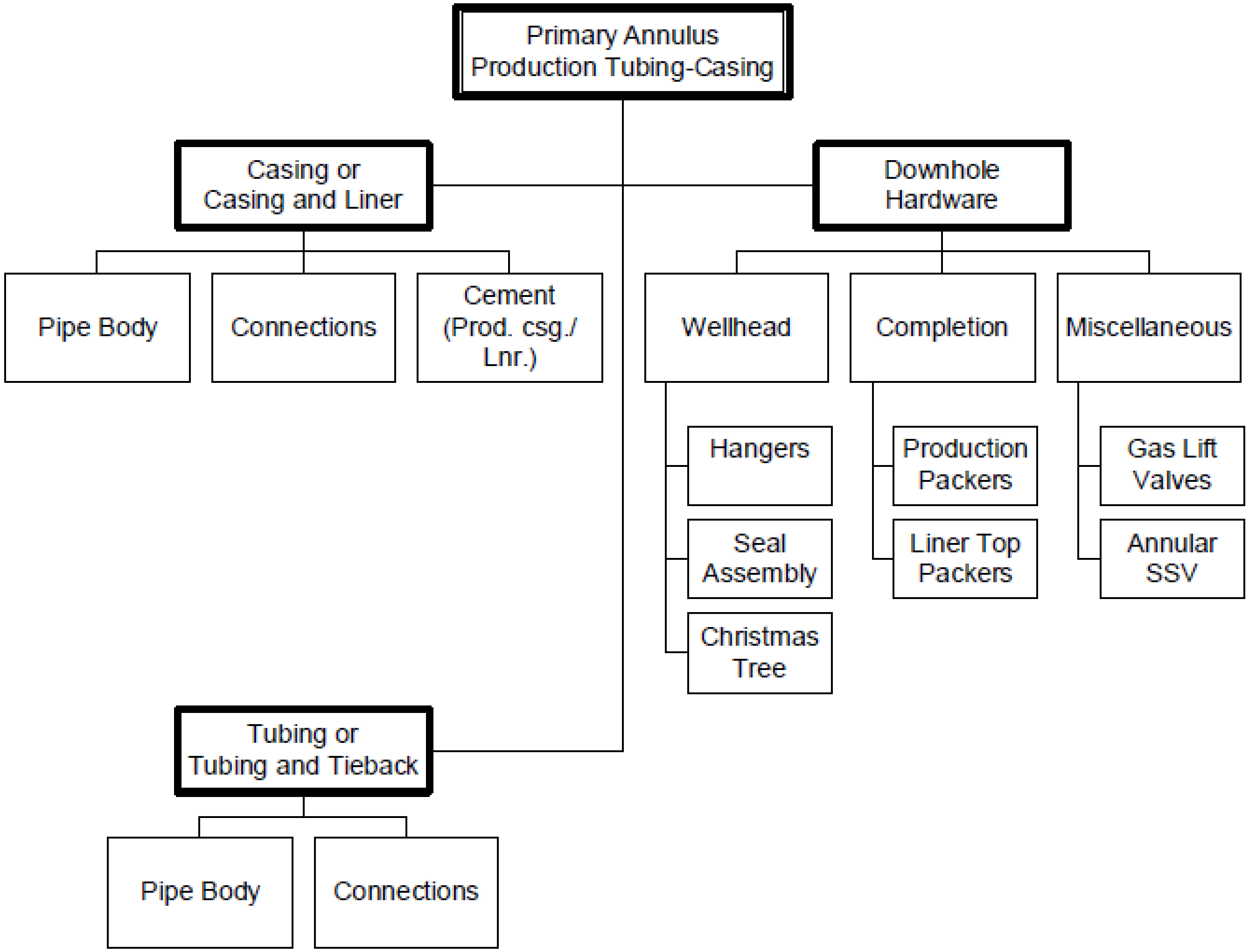

Figure 2 Potential weak points in the primary annulus

Type II annulus

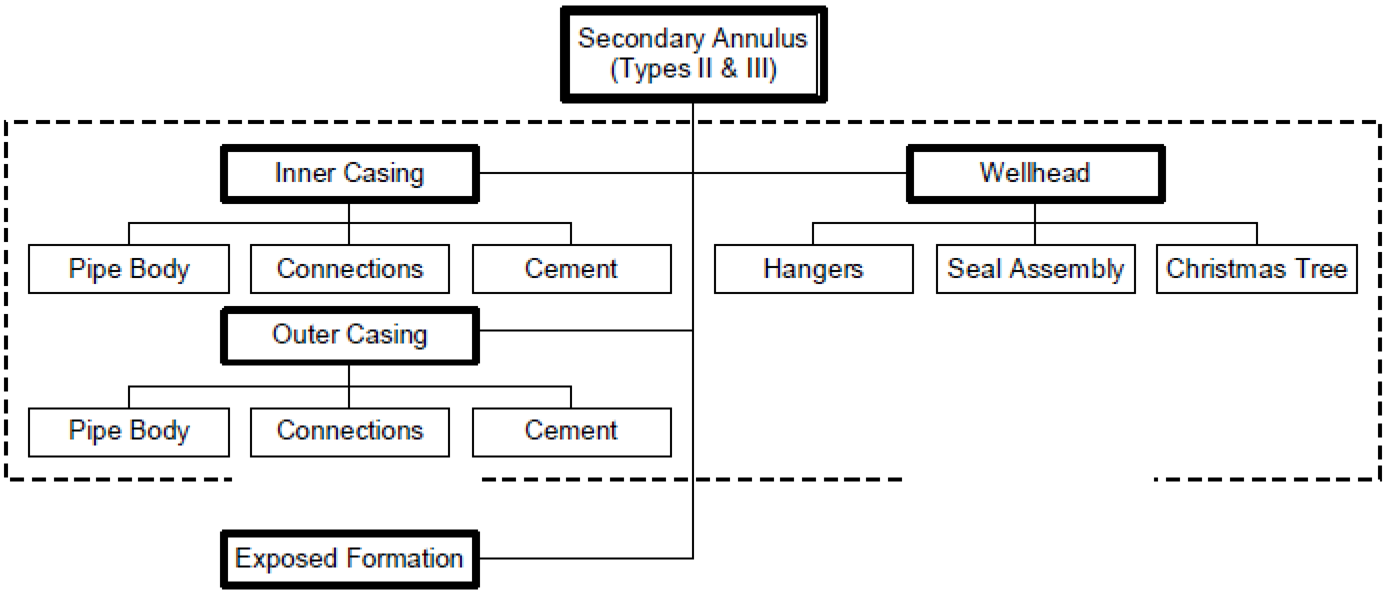

Figure 3 Potential weak points in the secondary annuli

Title 30: Mineral Resources
PART 250—OIL AND GAS AND SULPHUR OPERATIONS IN THE OUTER CONTINENTAL SHELF
Subpart D—Oil and Gas Drilling Operations – Casing and Cementing Requirements

§ 250.420 What well casing and cementing requirements must I meet?
You must case and cement all wells. Your casing and cementing programs must meet the requirements of this section and of §§250.421 through 250.428.

(a) *Casing and cementing program requirements.* Your casing and cementing programs must:
(1) Properly control formation pressures and fluids;
(2) Prevent the direct or indirect release of fluids from any stratum through the wellbore into offshore waters;
(3) Prevent communication between separate hydrocarbon-bearing strata;
(4) Protect freshwater aquifers from contamination;
(5) Support unconsolidated sediments; and
(6) Include certification signed by a Registered Professional Engineer that there will be at least two independent tested barriers, including one mechanical barrier, across each flow path during well completion activities and that the casing and cementing design is appropriate for the purpose for which it is intended under expected wellbore conditions. The Registered Professional Engineer must be registered in a State in the United States. Submit this certification with your APD (Form MMS-123).

Title 30: Mineral Resources
PART 250—OIL AND GAS AND SULPHUR OPERATIONS IN THE OUTER CONTINENTAL SHELF
Subpart D—Oil and Gas Drilling Operations – Casing and Cementing Requirements

§ 250.420 What well casing and cementing requirements must I meet?
You must case and cement all wells. Your casing and cementing programs must meet the requirements of this section and of §§250.421 through 250.428.

(b) *Casing requirements.*
(1) You must design casing (including liners) to withstand the anticipated stresses imposed by tensile, compressive, and buckling loads; burst and collapse pressures; thermal effects; and combinations thereof.
(2) The casing design must include safety measures that ensure well control during drilling and safe operations during the life of the well.
(3) For the final casing string (or liner if it is your final string), you must install dual mechanical barriers in addition to cement, to prevent flow in the event of a failure in the cement. These may include dual float valves, or one float valve and a mechanical barrier. You must submit documentation to BOEMRE 30 days after installation of the dual mechanical barriers.
(c) *Cementing requirements.* You must design and conduct your cementing jobs so that cement composition, placement techniques, and waiting times ensure that the cement placed behind the bottom 500 feet of casing attains a minimum compressive strength of 500 psi before drilling out of the casing or before commencing completion operations.
[68 FR 8423, Feb. 20, 2003, as amended at 75 FR 63373, Oct. 14, 2010]

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Level 1,2 & 3

Supplemental Information Regarding Approval Requirements For Activities That Involve the Use of a Subsea Blowout Preventer (BOP) Or a Surface BOP on a Floating Facility

2. Process for Evaluating Subsea Containment Information

The December 13, 2010, document provided additional guidance on the types of information described in NTL No. 2010-N10 that BOEMRE will evaluate to determine whether an operator has access to and can deploy surface and subsea containment resources that would be adequate to promptly respond to a blowout or other loss of well control, as required by BOEMRE's regulations.

This document supplements NTL No. 2010-N10 and the December 13, 2010, document by explaining that BOEMRE is conducting the evaluation described in those documents on a well-by-well basis with respect to each Permit to Drill for which subsea containment information is required. To facilitate this evaluation, BOEMRE, the Marine Well Containment Company (MWCC), the Helix Well Containment Group (HWCG), and certain companies have collaborated in the development of the Well Containment Screening Tool (WCST). The WCST is a software application tool that assists BOEMRE in evaluating whether a particular well could be shut in using a capping stack while maintaining wellbore integrity. The WCST facilitates well integrity calculations based on various factors including well design, geological characteristics, reservoir pressures and well bore fluid gradients.

Source: 3/28/2011 BOEMRE News Release

Supplemental Information Regarding Approval Requirements For Activities That Involve the Use of a Subsea Blowout Preventer (BOP) Or a Surface BOP on a Floating Facility

Based on this well-by-well analysis, including use of the WCST, BOEMRE will determine which of the following categories the proposed well falls within:

(1) **Well can be shut in with full well bore integrity.** This means a determination that an attempt to shut-in the well using a capping stack likely will not result in a rupture to the well casing or break down in the casing shoe causing an underground flow. If the well bore passes this evaluation, then containment can be approved without the need for an assessment of flowback and capture capacity, assuming the other information provided by the operator pursuant to NTL No. 2010-N10 is otherwise sufficient.

(2) **Well integrity might not be maintained, but no broach to the seafloor.** If well bore integrity cannot be demonstrated and it is determined that a casing shoe likely would break down causing underground flow, BOEMRE evaluates whether the underground flow likely would eventually broach to the seafloor. This assessment includes an evaluation by BOEMRE resource evaluation personnel of seismic data to determine whether there is local faulting capable of transmitting flow to the seafloor. If this seismic data indicates that the underground flow will not broach to the seafloor, then containment can be approved without the need for
an assessment of flowback and capture capacity, assuming the information provided by the operator is otherwise sufficient.

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Source: 3/28/2011 BOEMRE News Release

Supplemental Information Regarding Approval Requirements For Activities That Involve the Use of a Subsea Blowout Preventer (BOP) Or a Surface BOP on a Floating Facility

(3) **Well integrity might not be maintained and there likely will be a broach to the seafloor.** If full well bore integrity cannot be demonstrated and it is determined that a shut-in likely will result in an underground flow that broaches to the seafloor, then containment can only be approved if an operator can adequately demonstrate capping, flowback, and collection capability in addition to the other information required to demonstrate that an operator has access to and can deploy surface and subsea containment resources that would be adequate to promptly respond to a blowout or other loss of well control. If a calculated discharge rate for a particular well is greater than the operator's available surface collection capability, then the Permit to Drill cannot be approved. The calculated discharge rate for a particular well will be based on the "cap and flow" engineering solution developed for that well and, therefore, might not necessarily match the potential worst case discharge amount for the well.

Source: 3/28/2011 BOEMRE News Release

Cap, Cap and Flow Options

BOEMRE Bureau of Ocean Energy Management, Regulation and Enforcement

UNITED STATES DEPARTMENT OF THE INTERIOR

Technical Permitting Workshop

Containment Plans

August 30, 2011

by Bryan Domangue

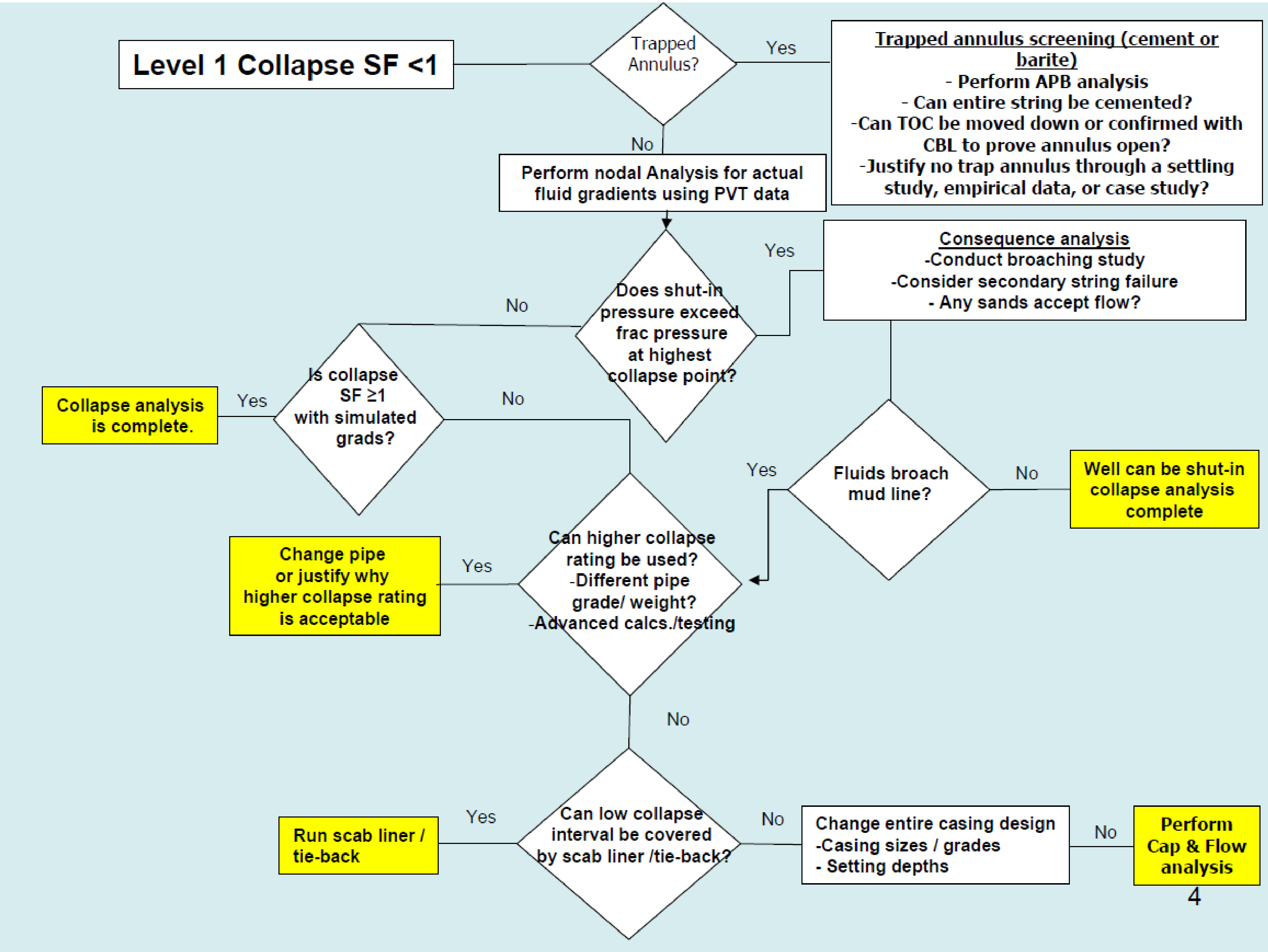
NTL 2010-N10 Containment: Cap and Flow Update

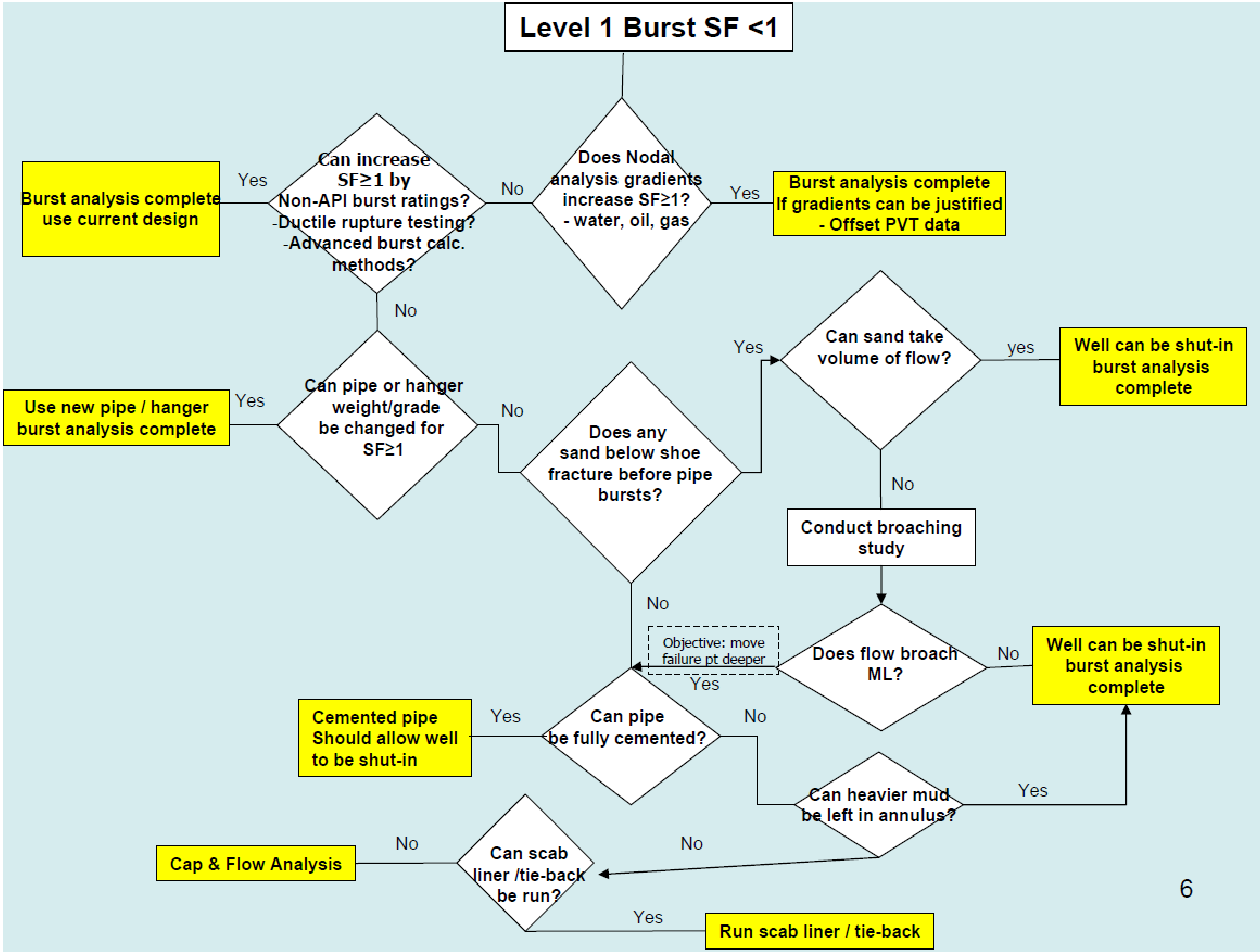
- All plan approvals to date have been "cap only".
- Currently working with members of HWCG and MWCC on two wells regarding a cap and flow option.

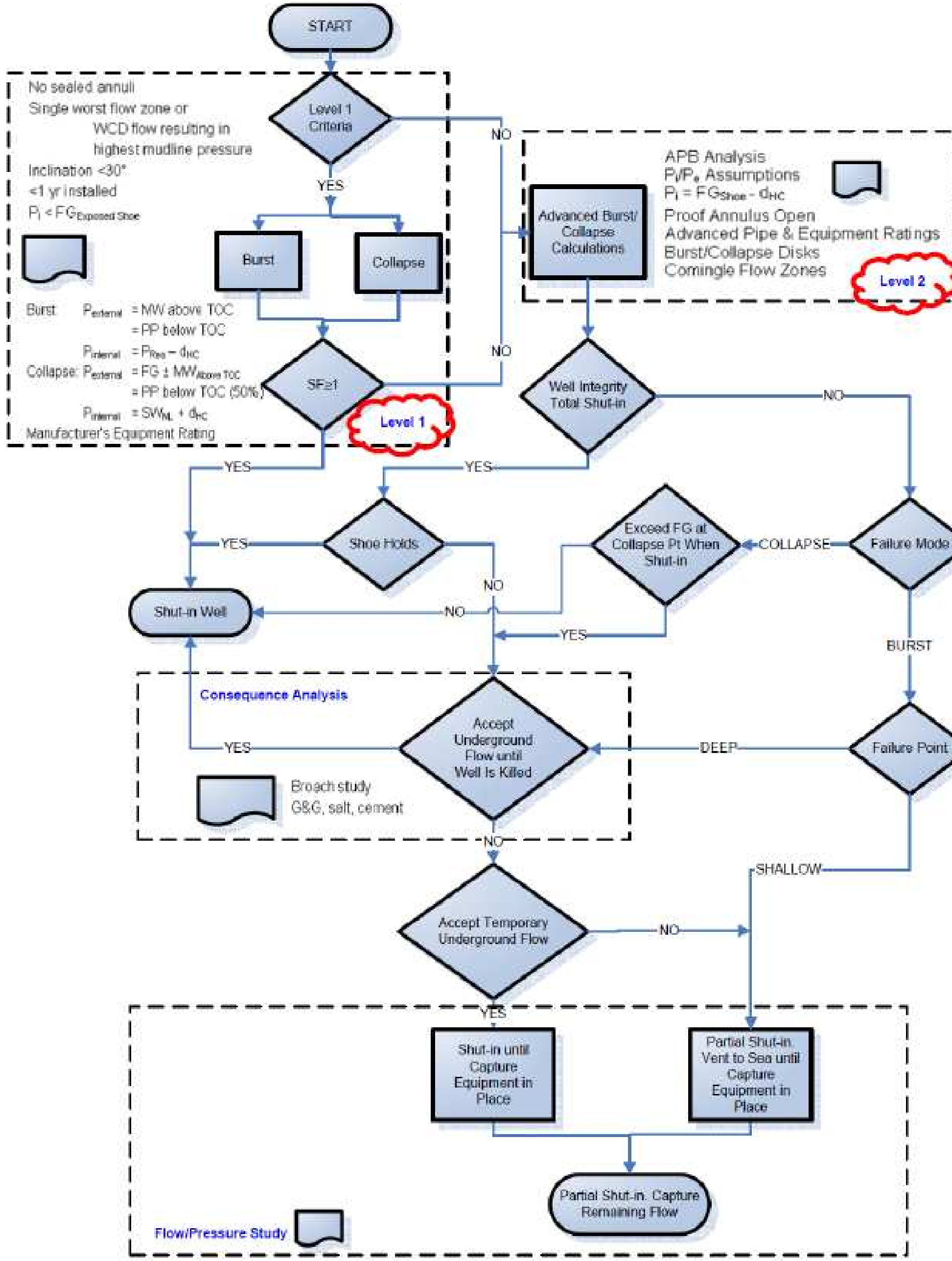
NTL 2010-N10 Containment: Cap and Flow Update

- Currently using our internal WCD model to determine a safe flowing pressure at the mud line that will prevent collapse, burst, and/or broach.

- This flowing pressure must then be modeled in the free water column and across the production process plant to ensure that no bottlenecks exist that would result in raising the flowing well head pressure above the safe limit.


Level 1 Collapse SF <1
Trapped Annulus?
Yes
Trapped annulus screening (cement or barite)
- Perform APB analysis
- Can entire string be cemented?
-Can TOC be moved down or confirmed with CBL to prove annulus open?
-Justify no trap annulus through a settling study, empirical data, or case study?
No
Perform nodal Analysis for actual fluid gradients using PVT data
Does shut-in pressure exceed frac pressure at highest collapse point?
Yes
Consequence analysis
-Conduct broaching study
-Consider secondary string failure
- Any sands accept flow?
No
Is collapse SF ≥1 with simulated grads?
Yes
Collapse analysis is complete.
No
Fluids broach mud line?
Yes
No
Well can be shut-in collapse analysis complete
Can higher collapse rating be used?
-Different pipe grade/ weight?
-Advanced calcs./testing
Yes
Change pipe or justify why higher collapse rating is acceptable
No
Can low collapse interval be covered by scab liner /tie-back?
Yes
Run scab liner / tie-back
No
Change entire casing design
-Casing sizes / grades
- Setting depths
No
Perform Cap & Flow analysis


Level 1 Burst SF <1
Does Nodal analysis gradients increase SF≥1? - water, oil, gas
Yes
Burst analysis complete If gradients can be justified - Offset PVT data
No
Can increase SF≥1 by Non-API burst ratings? -Ductile rupture testing? -Advanced burst calc. methods?
Yes
Burst analysis complete use current design
No
Can pipe or hanger weight/grade be changed for SF≥1
Yes
Use new pipe / hanger burst analysis complete
No
Does any sand below shoe fracture before pipe bursts?
Yes
Can sand take volume of flow?
yes
Well can be shut-in burst analysis complete
No
Conduct broaching study
Does flow broach ML?
No
Well can be shut-in burst analysis complete
Yes
Objective: move failure pt deeper
No
Can pipe be fully cemented?
Yes
Cemented pipe Should allow well to be shut-in
No
Can heavier mud be left in annulus?
Yes
No
Can scab liner /tie-back be run?
No
Cap & Flow Analysis
Yes
Run scab liner / tie-back



Source: 8/30/2011 BOEMRE Permitting Worksho

SPE 48331 – On the Development Of Reliability-Based Design Rules for Casing Collapse

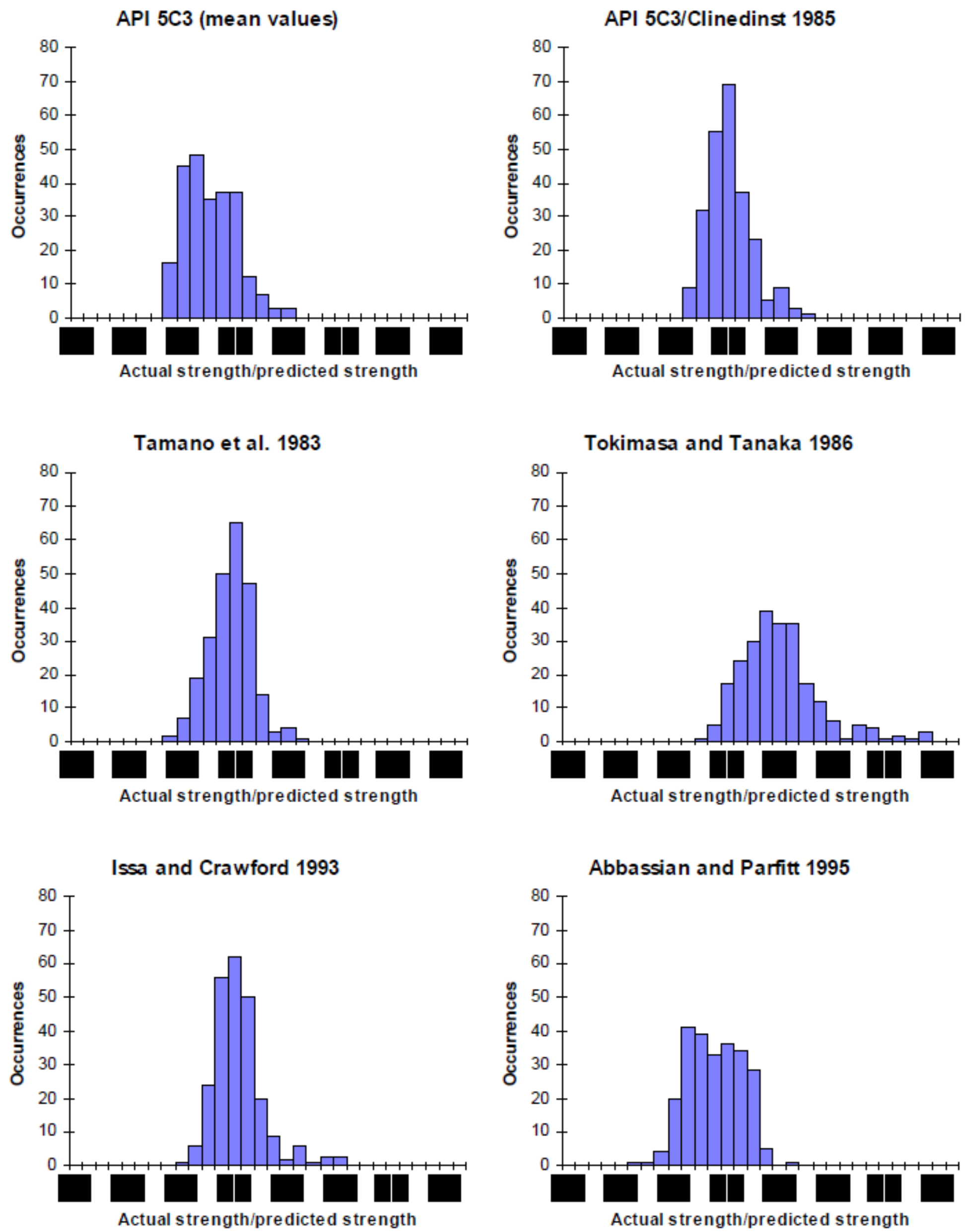


Figure 1: Actual/predicted strength

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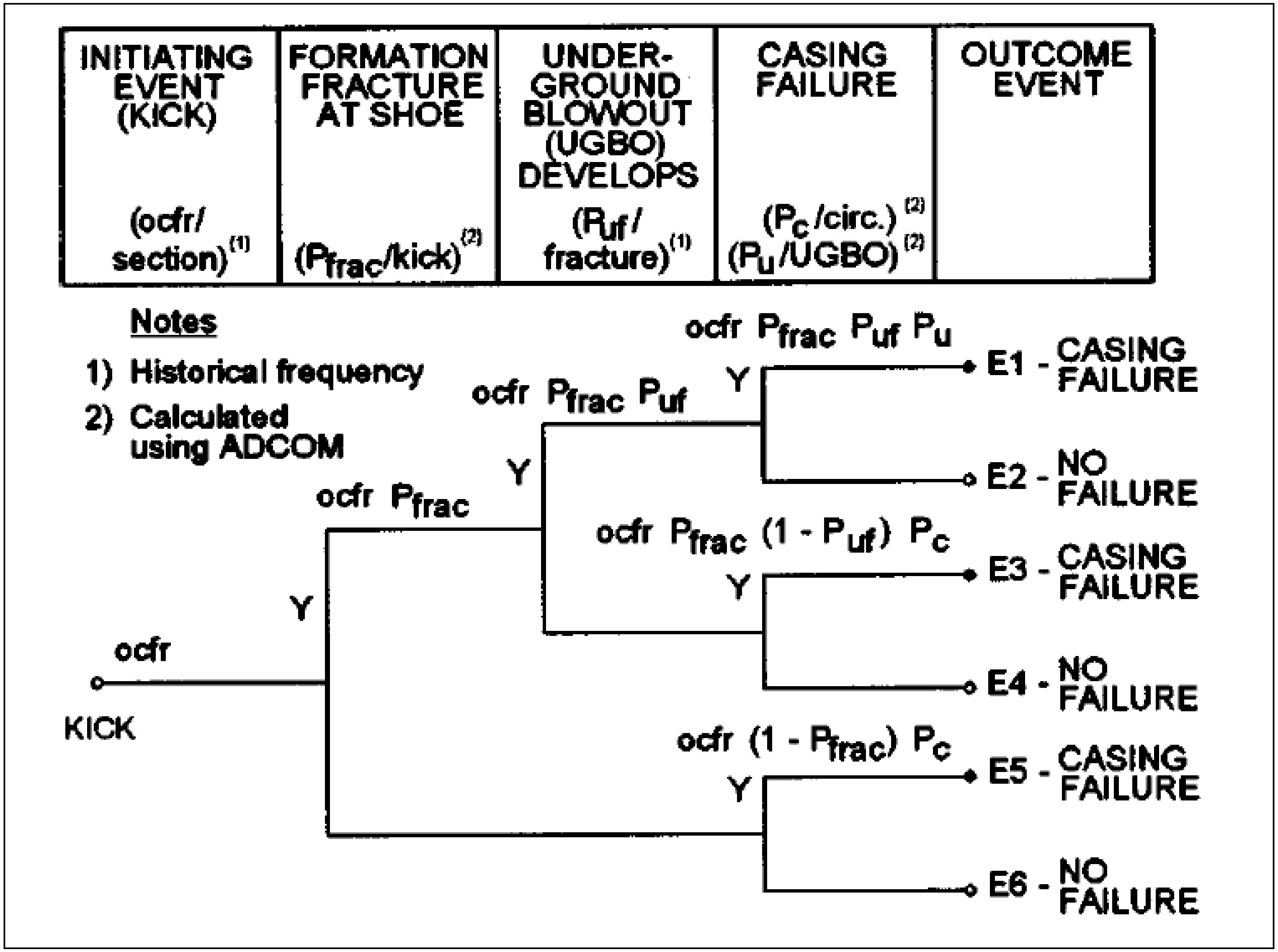

Event Tree for the Gas Kick Load Case

A.J. Adams and T. Hodgson: Casing/Tubing Design
SPE Drill. & Completion, Vol. 14, No. 1, March 1999

Regulations

Applicable Rules

Topic 3 - Well Drilling & Completion Design and Barriers

- Workplace Safety Rule
- Drilling Safety Rule

Drilling Safety Rule

Wellbore Integrity

Topic 3 – Well Drilling & Completion Design and Barriers

The Drilling Safety Rule imposes requirements that will enhance the safety of oil and gas drilling operations on the Outer Continental Shelf (OCS). It addresses both well bore integrity and well control equipment and procedures.

Well bore integrity provides the first line of defense against a blowout by preventing a loss of well control. It includes the appropriate use of drilling fluids and the well bore casing and cementing program. Provisions in the rule addressing well bore integrity are:

- Making mandatory the currently voluntary practices recommended in the American Petroleum Institute's (API) standard, RP 65 – Part 2, Isolating Potential Flow Zones During Well Construction (an industry standard program);
- Requiring submittal of certification by a professional engineer that the casing and cementing program is appropriate for the purposes for which it is intended under expected wellbore pressure;
- Requiring two independent test barriers across each flow path during well completion activities (certified by a professional engineer);
- Ensuring proper installation, sealing and locking of the casing or liner;
- Requiring approval from the BOEM District Manager before replacing a heavier drilling fluid with a lighter fluid; and
- Requiring enhanced deepwater well control training for rig personnel.

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Drilling Safety Rule

BOP Equipment

Topic 3 – Well Drilling & Completion Design and Barriers

Well control equipment includes the Blowout Preventer (BOP) and control systems that activate the BOP. Provisions in the rule on well control equipment include:

- Submittal of documentation and schematics for all control systems;
- Requirements for independent third party verification that the blind-shear rams are capable of cutting any drill pipe in the hole under maximum anticipated surface pressure;
- Requirement for a subsea BOP stack equipped with Remotely Operated Vehicle (ROV) intervention capability (at a minimum the ROV must be capable of closing one set of pipe rams, closing one set of blind-shear rams, and unlatching the Lower Marine Riser Package);
- Requirement for maintaining a ROV and having a trained ROV crew on each floating drilling rig on a continuous basis;
- Requirement for auto shear and deadman systems for dynamically positioned rigs;
- Establishment of minimum requirements for personnel authorized to operate critical BOP equipment;
- Requirement for documentation of subsea BOP inspections and maintenance according to API RP 53, Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells;
- Require testing of all ROV intervention functions on subsea BOP stack during stump test and testing at least one set of rams in initial seafloor test;
- Require function testing auto shear and deadman systems on the subsea BOP stack during the stump test and testing the deadman system during the initial test on the seafloor; and
- Require pressure testing if any shear rams are used in an emergency.

NTL 2010- N06

- A blowout scenario as required by 30 CFR 250.213(g) and 250.243(h). Provide a scenario for the potential blowout of the proposed well in your plan or document that you expect will have the highest volume of liquid hydrocarbons. Include the estimated flow rate, total volume, and maximum duration of the potential blowout. Discuss the potential for the well to bridge over, the likelihood for surface intervention to stop the blowout, the availability of a rig to drill a relief well, and rig package constraints. Specify as accurately as possible the time it would take to contract for a rig, move it onsite, and drill a relief well, including the possibility of drilling a relief well from a neighboring platform or an onshore location.

- Describe the assumptions and calculations that you used to determine the volume (daily discharge rate) of your worst case discharge scenario required by 30 CFR 250.219(a)(2)(iv) (for EPs) or 30 CFR 250.250(a)(2)(iv) (for DPPs and DOCDs). Provide all assumptions you made concerning the well design, reservoir characteristics, fluid characteristics, and pressure volume temperature (PVT) characteristics; any analog reservoirs you considered in making those assumptions; an explanation of your reasons for using those analog reservoirs; and the supporting calculations and models you used to determine the daily discharge rate possible from the uncontrolled blowout portion of your worst case discharge scenario for both your proposed or approved EP, DPP or DOCD worst-case discharge scenario and your proposed or approved regional (Oil Spill Response Plan (OSRP) worst-case discharge scenario used in your comparison.

NTL 2010– N06

- Describe the measures you propose that would enhance your ability to prevent a blowout, to reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout, including your arrangements for drilling relief wells, and any other measures you propose.

FROM CRISIS TO REFORM: RAISING THE BAR FOR SAFETY AND ENVIRONMENTAL PROTECTION ON OFFSHORE OIL AND GAS OPERATIONS

The Permitting Stage:

Raising the Bar for Safety and Environmental Protections in Proposed Drilling Projects

Out: Interior closed the loophole, established in 2003, that exempted operators in the Gulf of Mexico from submitting plans for worst-case discharge scenarios.

Out: The Administration has submitted legislation to remove the requirement that hamstrings BOEM by requiring review and approval of exploration plans within 30-days.

In: Permit applications for drilling projects must meet new standards for well-design, casing, and cementing, which must be independently certified by a professional engineer.

In: Proposed exploration plans must meet new requirements to show the operator is prepared to deal with a potential blowout and the potential worst-case discharge scenario and the operator's ability to respond to such a discharge.

Source: 9/30/2010 DOI Press Release – Fact Sheet

FROM CRISIS TO REFORM: RAISING THE BAR FOR SAFETY AND ENVIRONMENTAL PROTECTION ON OFFSHORE OIL AND GAS OPERATIONS

Drilling and Production Stages:

Strengthening Standards for Equipment, Safety Practices, Environmental Safeguards, and Oversight of Offshore Drilling and Production

Out: Over the last three decades, safety equipment and regulatory requirements fell behind the technology that allowed companies to reach new oil and gas reserves in deeper waters.

In: Operators must adhere to the new Drilling Safety Rule, implemented through emergency rulemaking, that raises the standards for blowout preventers, well design, casing, cementing, and safety equipment. Blowout preventers must also meet new standards for testing and must be independently certified.

In: Under the new Workplace Safety Rule, operators will be required to develop a comprehensive management program for identifying, addressing and managing operational safety and environmental hazards and impacts, with the goal of reducing the risk of human error and improving workplace safety and environmental protection.

Source: 9/30/2010 DOI Press Release – Fact Sheet

FROM CRISIS TO REFORM: RAISING THE BAR FOR SAFETY AND ENVIRONMENTAL PROTECTION ON OFFSHORE OIL AND GAS OPERATIONS

Drilling and Production Stages:

Strengthening Standards for Equipment, Safety Practices, Environmental Safeguards, and Oversight of Offshore Drilling and Production

In: The CEOs of drilling companies must – for the first time ever – put their signature on the line to certify that their rigs comply with all safety and environmental laws and regulations.

In: BOEM is significantly expanding its team of inspectors, engineers, and other specialists to ensure that operators are following all laws and regulations.

Source: 9/30/2010 DOI Press Release – Fact Sheet

FROM CRISIS TO REFORM: RAISING THE BAR FOR SAFETY AND ENVIRONMENTAL PROTECTION ON OFFSHORE OIL AND GAS OPERATIONS

Blowout Containment and Spill Response:

Ensuring that Industry is Prepared to Respond to Deepwater Blowouts and Oil Spills

In: Federal agencies, led by the Department of the Interior and the Department of Energy, are collaborating to institutionalize the experience, expertise, and leadership developed through the *Deepwater Horizon* source containment and spill response efforts.

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Source: 9/30/2010 DOI Press Release – Fact Sheet

FROM CRISIS TO REFORM: RAISING THE BAR FOR SAFETY AND ENVIRONMENTAL PROTECTION ON OFFSHORE OIL AND GAS OPERATIONS

Blowout Containment and Spill Response:

Ensuring that Industry is Prepared to Respond to Deepwater Blowouts and Oil Spills

Out: The *Deepwater Horizon* spill laid bare the gap between the oil and gas industry's drilling technology and the technology available to contain and control blowouts in deepwater.

Out: Until the *Deepwater Horizon* disaster, oil spill response planning had not anticipated a spill of such a scale and duration.

In: BOEM Director Bromwich held eight public forums around the country to gather information about how to strengthen safety, blowout prevention, and spill response in deepwater. Director Bromwich will be developing recommendations for Secretary Salazar based on these meetings.

Source: 9/30/2010 DOI Press Release – Fact Sheet

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Source: 9/30/2010 DOI Press Release – Fact Sheet

PSM	Workplace Safety Rule API RP 75 – SEMS I, II
Employee Participation	Employee Participation (SEMS II)
Process Safety Information	Safety and Environmental Information
Process Hazard Analysis	Hazards Analysis
Operating Procedures	Operating Procedures
Training	Training
Pre-Startup Safety Review	Pre-Startup Review
Mechanical Integrity	Mechanical Integrity
Work Permits	Safe Work Practices
Management of Change	Management of Change
Incident Investigation	Investigations of Incidents
Emergency Response Plan	Emergency Response and Control
Compliance Audits	Auditing, Use of independent 3rd Pty auditors
Trade Secrets	
Contractors	Records and documentation
	A Stop Work provision (SEMS II)
	Definition of authority (SEMS II)
	Reporting of unsafe conditions (SEMS II)
	Additional requirements for JSAs (SEMS II)

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The 13 elements of RP 75 that the Workplace Safety Rule makes mandatory are as follows:

1. **General provisions**: for implementation, planning and management review and approval of the SEMS program.
2. **Safety and environmental information**: safety and environmental information needed for any facility, e.g. design data; facility process such as flow diagrams; mechanical components such as piping and instrument diagrams; etc.
3. **Hazards analysis**: a facility-level risk assessment.
4. **Management of change**: program for addressing any facility or operational changes including management changes, shift changes, contractor changes, etc.
5. **Operating procedures**: evaluation of operations and written procedures.
6. **Safe work practices**: manuals, standards, rules of conduct, etc.
7. **Training**: safe work practices, technical training – includes contractors.
8. **Mechanical integrity**: preventive maintenance programs, quality control.
9. **Pre-startup review**: review of all systems.
10. **Emergency response and control**: emergency evacuation plans, oil spill contingency plans, etc.; in place and validated by drills.
11. **Investigation of Incidents**: procedures for investigating incidents, corrective action and follow-up.
12. **Audits**: rule strengthens RP 75 provisions by requiring an audit every 4 years, to an initial 2-year reevaluation; and then subsequent 3-year audit intervals.
13. **Records and documentation**: documentation required that describes all elements of the SEMS program.

Topic 3 – Well Drilling & Completion Design and Barriers

FOR RELEASE: May 15, 1995 CONTACT: Lee Scurry (202) 208-3983 MMS RELEASES OIL SPILL STATISTICS FACT SHEET The U.S. Department of the Interior's Minerals Management Service (MMS) released today statistics on oil spills on the Outer Continental Shelf (OCS). The fact sheet includes statistics on: -- Oil Spills on the Federal OCS for 1980-93. -- Comparison of the Federal OCS Oil Spill Record for 1964- 79 and 1980-93 for Spills Equal to or Greater than 50 Barrels. -- Comparison of Federal OCS Activities and U.S. Natural Oil Seeps. -- Comparison of Federal OCS Activities to Tankers. -- Oil Spill Occurrence Rates. Between 1980 and 1993, OCS operators produced about 4.7 billion barrels of oil, while the amount spilled totaled about 58,000 barrels -- 0.001 percent of production. This spill record is eight times lower than the previous 15-year period in which the same amount of oil was produced. There have been no large platform spills (spills greater than 1,000 barrels) since 1980, which continues a downward trend. An increased frequency of pipeline spills, however, reverses a previously observed downward trend in occurrences. Since 1980 there have been six large pipeline spills on the OCS, the largest of which was about 16,000 barrels. OCS Oil Spill Facts is available free of charge from the MMS Office of Communications and Government Affairs. For copies call (202) 208-3983. MMS is the federal agency that manages the nation's natural gas, oil and other mineral resources on the OCS, and collects and disburses about $4 billion yearly in revenues from offshore federal mineral leases and from onshore mineral leases on federal and Indian lands.

CHAPTER II--MINERALS MANAGEMENT SERVICE, DEPARTMENT OF THE INTERIOR

PART 254--OIL-SPILL RESPONSE REQUIREMENTS FOR FACILITIES LOCATED SEAWARD OF THE COAST LINE

Subpart C--Related Requirements for Outer Continental Shelf Facilities
Sec. 254.47 Determining the volume of oil of your worst case discharge scenario.

b) For exploratory or development drilling operations, the size of your worst case discharge scenario is the daily volume possible from an uncontrolled blowout. In determining the daily discharge rate, you must consider any known reservoir characteristics. If reservoir characteristics are unknown, you must consider the characteristics of any analog reservoirs from the area and give an explanation for the selection of the reservoir(s) used. Your scenario must discuss how to respond to this well flowing for 30 days as required by Sec. 254.26(d)(1).

OCS Losses of Well Control: 2006-2010

LOSS OF WELL CONTROL	2006 ***		2007 ***		2008 ***		2009 ***		2010 ***	
	GOM	PAC	GOM	PAC	GOM	PAC	GOM	PAC	GOM	PAC
Flow Underground	0	0	1	0	1	0	0	0	0	0
Flow Surface	0	0	3	0	3	0	2	0	1	0
Diverter Flow	0	0	0	0	1	0	0	0	0	0
Surface Equipment Failure	2	0	3	0	3	0	4	0	3	0
LOSS OF WELL CONTROL (TOTALS)	2	0	7	0	8	0	6	0	4	0
COMBINED TOTAL FOR THE YEAR	2		7		8		6		4	

YTD = Year to date

* * * Effective July 17, 2006, BOEMRE revised the regulations for Incident Reporting. Related to this chart, changes were made to the reporting criteria for Losses of Well Control incidents. Thus the number of incidents shown in these categories for 2006 and beyond may be affected by this change when compared to previous years.

SOURCE: TIMS Database as of **16-Feb-2011**

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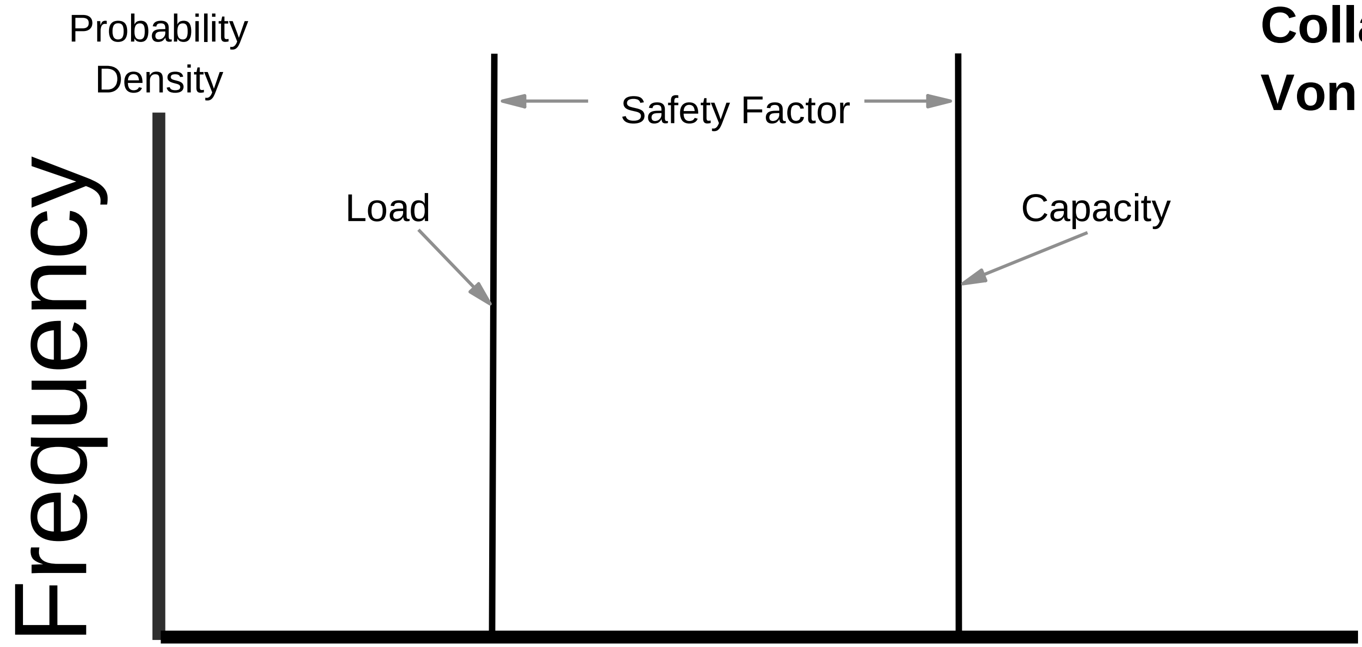
Design Methods

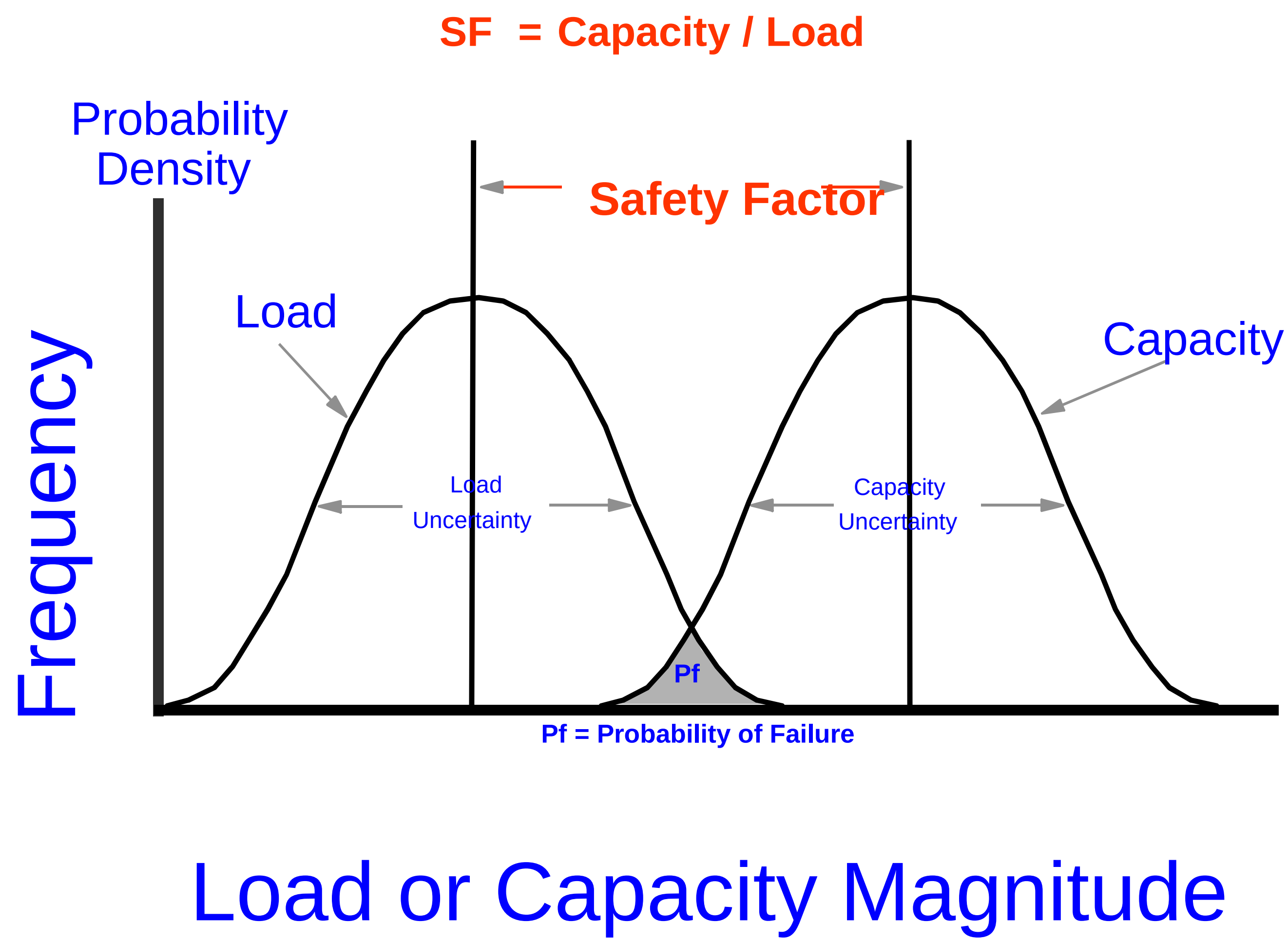
Working Stress Design

	SF
Tension	1.6
Burst	1.25
Collapse	1.0
Von Mises	1.25-1.67

SF = Capacity / Load

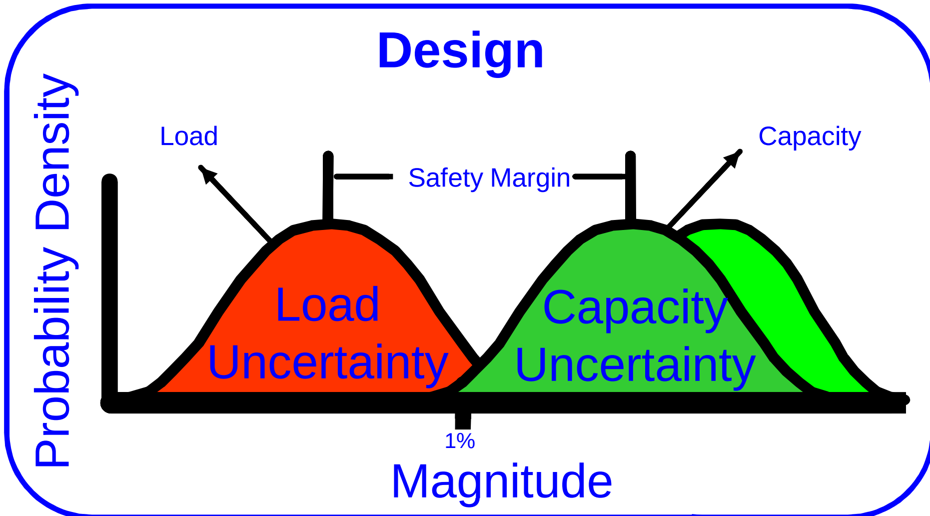


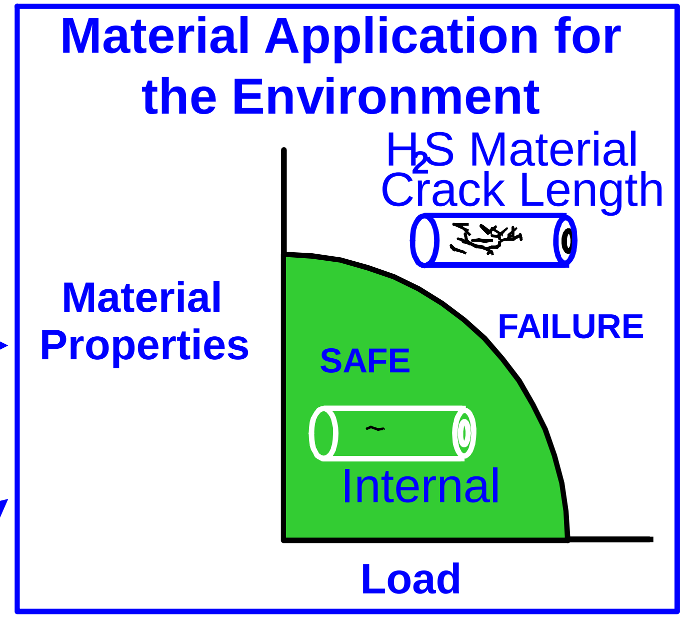
Load or Capacity Magnitude



WSD = Working Stress Design

Design Philosophy





Material Quality System

- Based on API
- Puts Burden of Quality on the Supplier
- Quality is viewed in a historical context
- Know and understand the risks

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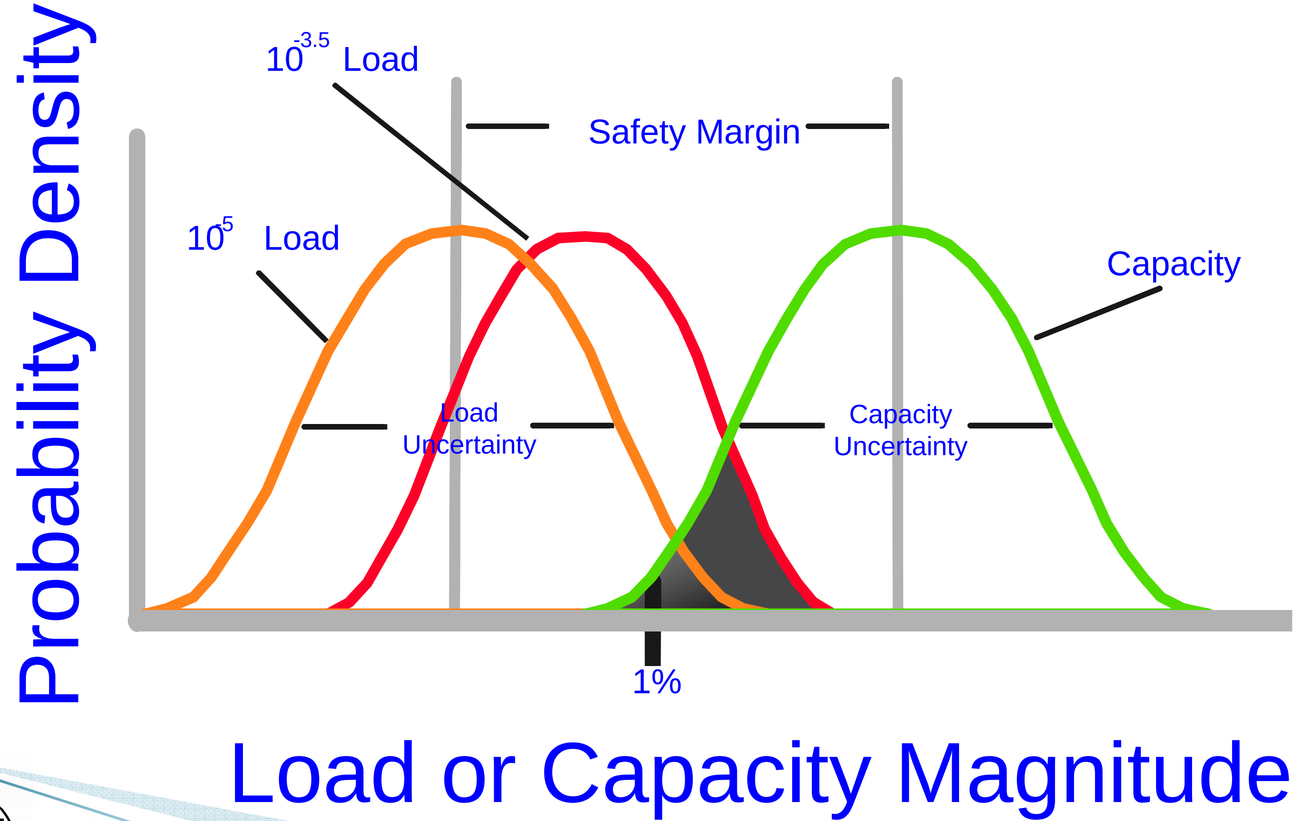
Design Concept

Risk = Probability (Load > Capacity)



White Paper

Regulatory Issues

Bureau of Safety and Environmental Enforcement

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Example 250.142/250.409

- Requests to extend blind shear function testing beyond 7 days to avoid unnecessary trips and their associated pipe handling and well control risks. Shear/Blind rams can be function tested immediately when the drill string is above the BOP.
- This could be considered an alternate procedure if an operator could show that increasing the timeframe is as safe or safer???
- This request may enhance operational efficiency, however, is it as safe?
- A Departure may be considered due to the overall operational safety
- You should identify and discuss the departure you are requesting in your APD (see Sec. 250.414(h)).

Source: 8/30/2011 BOEMRE Permitting Worksho

Consistency of Departures

- BOEMRE is currently working on OOC's "green list" of departures
- BOEMRE is currently working to address inconsistencies between Districts in granting departures
- BOEMRE will use OOC's prioritization based on highest impact to operations
- Some decisions may need to be elevated to BOEMRE HQ
- Departures or alternate procedures/equipment that are determined to be routine will be pursued to be codified
- Decisions on departures and alternate procedures/equipment will be communicated to the district as they are made
- Decisions on those request that are not considered departures or alternated procedures will be listed and communicated to the Districts in the form of Policy
- BOEMRE is proposing to communicate the decisions to operators through quarterly OOC meetings

Source: 8/30/2011 BOEMRE Permitting Worksho