



Bureau of Safety and Environmental Enforcement

BSEE Standards Workshop: HPHT Session

Christy Lan (BSEE)

Brian Skeels (FMC, 17D, TR8, 17G, etc.)

Russell Hoshman (BSEE)

Dan Fraser (ANL)

May 8th, 2015

“To promote safety, protect the environment and conserve resources offshore through vigorous regulatory oversight and enforcement.”

Today's Workshop

- The HPHT Session will be lead today by:
 - Christy Lan (BSEE)
 - Brian Skeels (FMC, 17D, TR8, 17G, etc.)
 - Russell Hoshman (BSEE)
 - Dan Fraser (Argonne National Lab)
- Today's Participants
 - BSEE
 - Oil companies (operators and lessees)
 - Equipment manufacturers
 - Engineering consultants (I3Ps)
 - Engineering standard committees

Rules of Engagement

- There is a broad spectrum representing a cross section of the industry here today to discuss HPHT
- We need to take this opportunity to have open and honest communication
- Feel free to express yourself. **It is OK to disagree and express your position constructively**
- **It is OK to question BSEE**

Rules of Engagement

- We have a very aggressive agenda today
- We are going to try and keep on schedule so we (Christy, Brian, Dan and myself) may be forced to stop a discussion to move to the next topic
- Dan Fraser will capture these topics that are of interest and the discussion may continue during the one hour Facilitated Session at the end of the day

Goals for Today

- **Communication** and **Exchange** of ideas
- **Education** and **Understanding**
- One step closer to solution convergences
- One step closer to system integration

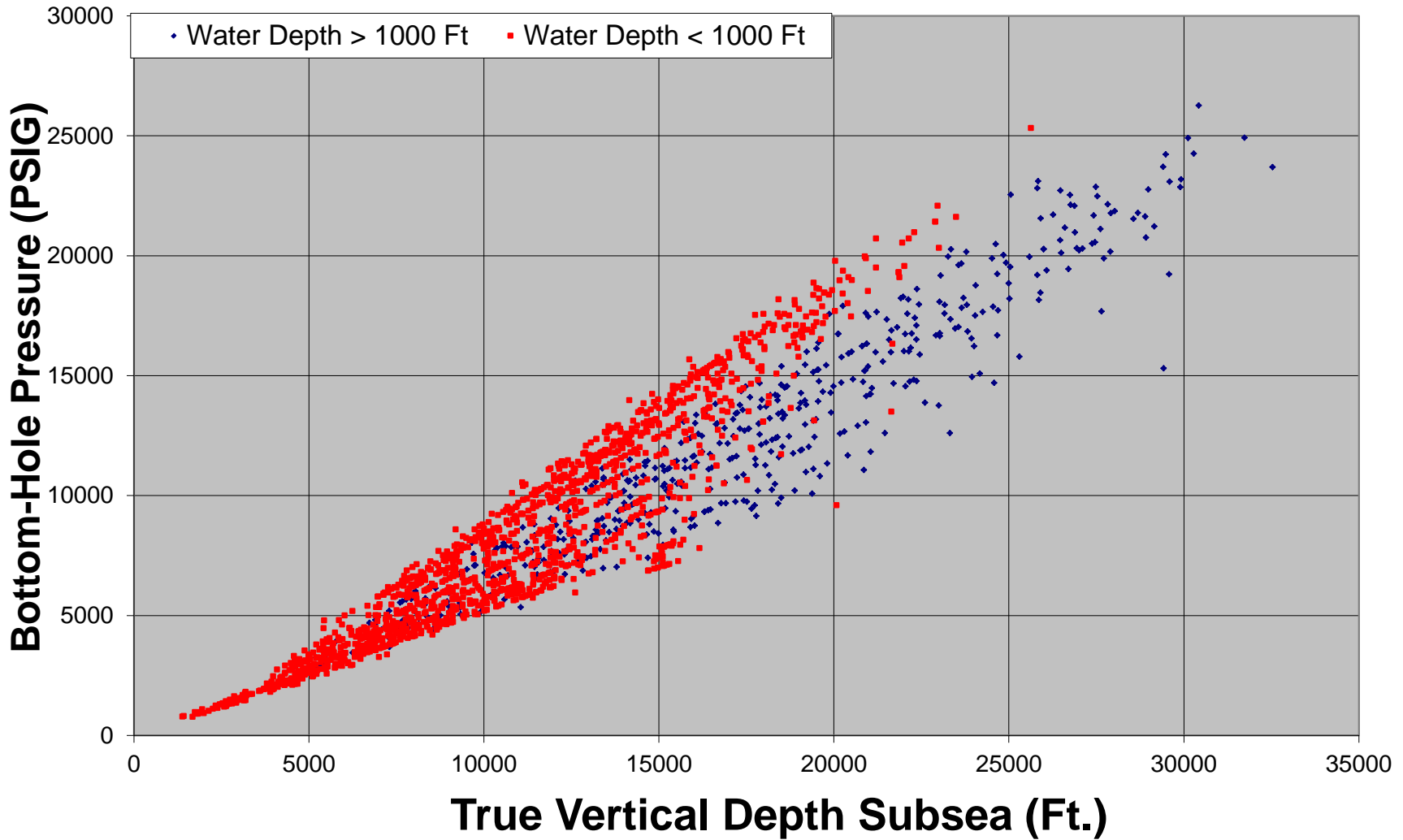


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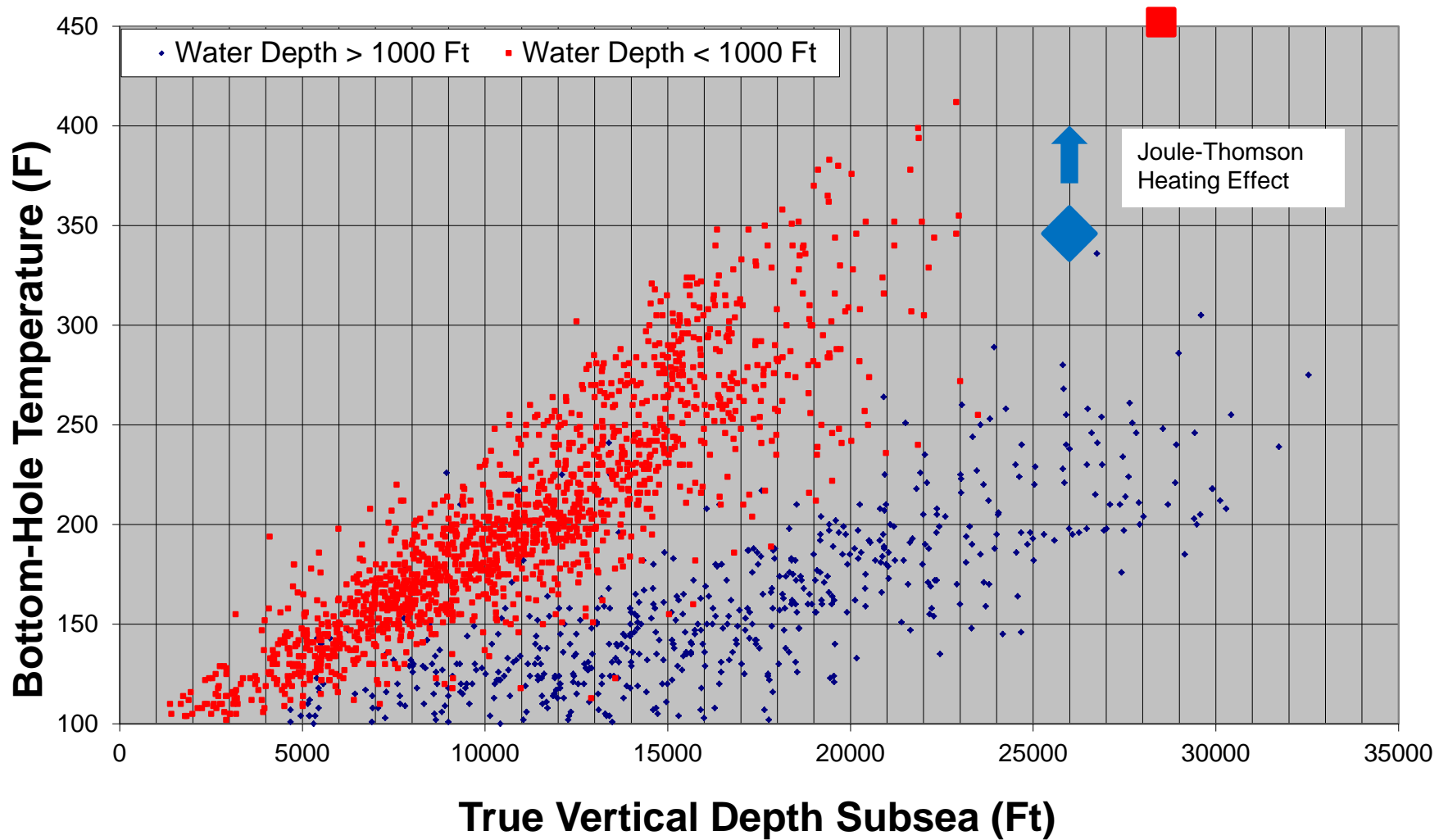
Approval Process for HPHT Projects in the Gulf of Mexico

Russell Hoshman
BSEE Standards Workshop
HPHT Session
May 8, 2015

BHP vs TVD 2000 to 2006



BHT vs TVD 2000 to 2006



Code of Federal Regulations for New Technology

- 30 CFR 250.286 to 250.295:
- All projects in the Gulf of Mexico using non-conventional production or completion technology will require a Deepwater Operations Plan (DWOP)
- Large, Complex and HPHT Projects require both a Conceptual Plan (C DWOP) and Deepwater Operations Plan

Code of Federal Regulations for HPHT Projects

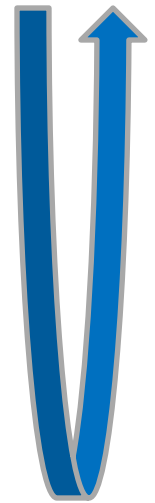
- 30 CFR 250.807 - Additional requirements for subsurface safety valves and related equipment installed in high pressure high temperature (HPHT) environments
- (a)(1) Design Verification Analysis
- (a)(2) Design Validation and Function Testing

Code of Federal Regulations for HPHT Projects

- 30 CFR 250.807
- (b) HPHT is greater than 15,000 psi or 350°F
- (c) Wellheads, tubing heads, tubulars, packers, threaded connections, seals, seal assemblies, production trees, chokes, well control equipment, and any other equipment exposed to the HPHT environment

Technology Evolution in the Gulf of Mexico

- **New Idea or Defined Need** (operators and/or manufacturers)
- **DWOP Application with BSEE** (operator)
- **Conditions of Approval for the DWOP** (BSEE)
- **New Technology Implementation** (operator)
- **New Technology Policy** (BSEE) ←
- **Engineering Standards** (operators, manufactures, & BSEE)
- **Regulations** (BSEE)



Technology
DO-Loop
with Exit

Basis for BSEE Conditions of Approval

- Protection of people and the environment
- Dual mechanical barriers
 - Liquids are never considered a mechanical barrier but may be considered a temporary barrier under certain conditions
 - Barriers must be verifiable by test
- Failure Mode Assessments / Risk Assessments
 - What can go wrong / fail
 - Mitigations for Failures
- Verifiable engineering principles

Complex New Technology Approvals

Technology Review

- Is the New Technology technically complex and does it require a high degree of specialized knowledge?
- Does the New Technology exceed the limits of existing Engineering Standards?
- Does the New Technology conflict with existing Engineering Standards?

Needs for Resolution

- An Independent Third Party (I3P) Analysis is generally required for complex technology reviews
- Industry Experts (Operators & Manufacturers) and BSEE must discuss with a high degree of convergence + I3P Analysis
(example API 17 TR8)
- BSEE generally will not approve New Technology that conflicts with existing Engineering Standards, but... (example API 17 TR12)

HPHT Oil Field Engineering Standards

- BSEE recognizes the collective effort that the industry has put into the **API Technical Report 17 TR8, “*High-Pressure High-Temperature (HPHT) Design Guidelines*”**. BSEE believes that API 17 TR8 is one of the best available guidance documents for the construction of HPHT oil field equipment at this time.
- BSEE also recognizes that API 17 TR8 is a general guidance document, is not complete in its scope, is not the only HPHT guidance document, and does not address all issues associated with the construction of all HPHT oil field equipment. Technical Reports are not Engineering Standards.

Conceptual Plan (C DWOP) for HPHT EQUIPMENT

Your Conceptual Plan must include:

- Equipment Categorization
 - Category 1 – Primary Barrier, or Alternate Analysis + I3P
 - Category 2 – Secondary Barrier + Internal review or I3P
 - Category 3 – Non critical equipment, no secondary review
- Summary of the Proposed Basis of Design
 - Identify mechanical loads such as internal pressure, external pressure, tension, compression, bending, internal temperature, external temperature, cyclic loading, etc
 - Identify environmental exposure such as H₂S, CO₂, Cl, Hg, etc
 - HAZID/HAZOP and/or FMEA/FMECA. All potential modes of failure must be identified. All potential load cases must be identified. Consequences of failure must be understood

Conceptual Plan (C DWOP) for HPHT EQUIPMENT

Your Conceptual Plan must include plans for:

- Material Selection and Qualification
 - Material Properties needed for design analysis to address identified failure modes
 - Material Tests to be conducted for material characterization
- Proposed Design Verification Analysis to be conducted for each component and assembly such as strength and fatigue analysis such that the potential modes of failure are addressed
- Proposed Design Validation Tests such as prototype tests, initial pressure test, nondestructive examination, destructive examination, life cycle test, etc

Conceptual Plan (C DWOP) for HPHT EQUIPMENT

Your Conceptual Plan must include plans for:

- Summary of Proposed Load Monitoring for components where fatigue has been identified as a potential mode of failure.
- Proposed Independent Third Parties (I3P)
- Plans for I3P Analysis for Basis of Design, Material Selection and Characterization, Design Verification, Validation Testing, and Fabrication

Conceptual Plan (C DWOP) for HPHT WELL DESIGN

Your Conceptual Plan must address:

- The completion of a HPHT well will require that the following equipment is built, readily available, and accessible in the Gulf of Mexico:
 - Well Control Equipment – BOPs, Riser, Choke lines, Kill Lines, and a rated Well Capping Stack
 - Well Completion and Intervention Equipment – Lower Workover Riser Packages, Subsea Test Trees, Riser Systems, Running Tools
 - Coiled Tubing BOP Equipment, Wireline Equipment, Tubing Plugs
 - Kill Pumps, Manifolds
 - All Well Completion Equipment and Tubulars

Conceptual Plan (C DWOP) for HPHT WELL DESIGN

Your Conceptual Plan must address:

- Plan for analysis of the production tubing, production casing and production liner for the site specific well for tri-axial forces, burst, collapse, compression, and tension for all possible load cases
- Plan for analysis of the cementing materials and procedures for the production casing and production liner
- Qualification of all tubular threaded connectors
- Trapped annular pressure and production casing pressure monitoring and management

Conceptual Plan (C DWOP) for HPHT WELL DESIGN

You Conceptual Plan must address:

- Relief Well Capabilities and HPHT Capping Stack.
NTL No. 2010-N10, *Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources.*
- Packer and Bridge Plug analysis and qualification.
- Well Completion Procedures, Well Control Procedures and Well Intervention Procedures for more than one method of Well Intervention with and without the tree in place.

Conceptual Plan (C DWOP) for HPHT WELL DESIGN

You Conceptual Plan must address:

- MASP for the Completion Case. **NTL No. 2012-N01**, *Calculating Maximum Anticipated Surface Pressure and Expected Surface Pressure for the Completion Case and Estimated Shut-in Tubing Pressure Prior to Production.*
 - Determines rated working pressure of completion equipment
 - Determines the Maximum Allowed Operating Pressure (MAOP) for your flowline

Conceptual Plan (C DWOP) for HPHT WELL DESIGN

You Conceptual Plan must address:

- **NTL No. 2009-G31**, “Hydrogen Sulfide”
 - 3.5 ppm H₂S at 15,000 psi requires NACE materials
 - Above 275° F in the GOM, very high probability that NACE materials will be required (JT Smith Correlation SPE 97568)

Independent Third (I3P) Review

- The Conceptual Plan provides a proposed plan for the design and construction of HPHT equipment and the completion of the HPHT wells
- The Conceptual Plan will provide an outline and specific expectations for the Independent Third Party
- The Independent Third Party(s) will review the actual analysis for the basis of design, material selection/ characterization/ qualification, design verification, design validation, fabrication, and load monitoring

Independent Third (I3P) Review

- Of particular interest to BSEE is FEA model qualification, welding and cladding for the HPHT environment and potential modes of failure
- The independent Third Party(s) will review all well control procedures, well completion procedures, and well intervention procedures
- The independent Third Party will review all well design tubulars, packers, cementing materials, etc
- The documentation of the actual analysis for the HPHT equipment will be retained by the manufacturers or operator as appropriate. This material will not be sent to BSEE. BSEE will have the right to review any of this material upon request at any point in the future

Independent Third (I3P) Review

- The Independent Third Party will provide a report to BSEE on their letter head for the HPHT component, assembly, well designs and procedures as outlined in the Conceptual Plan (C DWOP).
- The final Deepwater Operation Plan (DWOP) will not be approved until all the Independent Third Party reports are received, reviewed and accepted by BSEE.
- No HPHT well should be completed until the DWOP is approved.

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Environmental Enforcement

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