

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT GULF OF MEXICO OCS REGION

NTL No. 2019-G03

Effective Date: May 10, 2019

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO OCS REGION

Guidance for Information Submissions Regarding Site Specific and Non-Site Specific HPHT Equipment Design Verification Analysis and Design Validation Testing

This Notice to Lessees and Operators of Federal Oil and Gas Leases (NTL) provides guidance related to the process for requesting approval to install and use well completion equipment, well control equipment, well intervention equipment, trees, and production equipment designed for a high pressure and/or high temperature (HPHT) environment. This NTL provides guidance regarding information submissions related to material selection, design verification analysis, and design validation and functional testing process and procedures. This NTL supersedes NTL No. 2007-G07.

Background

The guidance below provides recommendations and clarifications regarding operator HPHT equipment information submittals that, if followed, facilitate Bureau of Safety and Environmental Enforcement (BSEE) review and approval. Pursuant to 30 CFR Part 250, operators must submit the Conceptual Plan, the Deepwater Operations Plan (DWOP), the Application for Permit to Drill (APD), and the Application for Permit to Modify (APM) at specified times for pertinent operations. The other plans discussed below may be submitted voluntarily to assist BSEE with its overall review of the HPHT equipment. Through these voluntary submissions, operators may provide information earlier in the process than is required by the regulations. In a few instances, BSEE is providing the option to submit information not required by the regulations, but which facilitates BSEE's review. If an operator elects to voluntarily submit information early and/or voluntarily submit additional information, BSEE recommends that the operator follow the guidance below regarding the timing and formatting of its submissions to maximize BSEE's review efficiency.

Regulatory Authority

BSEE considers HPHT equipment to be non-conventional technology. A request to install and use HPHT equipment therefore requires the operator to submit and receive approval of a Conceptual Plan and a Deepwater Operations Plan (DWOP), as described in 30 CFR 250.286 through 250.295. The regulations at 30 CFR 250.288 through 250.291 explain when and how to submit a Conceptual Plan and a DWOP. BSEE regulations specify that any equipment with an

internal absolute pressure rating greater than 15,000 psia or with a temperature rating greater than 350 degrees Fahrenheit is HPHT equipment. Such equipment must comply with BSEE's HPHT regulations and guidance. Section 250.804 provides requirements regarding the information that operators must submit to obtain approval from BSEE to use HPHT equipment. In addition, 30 CFR 250.732(c) makes Independent Third Party (I3P) verification reports mandatory for HPHT blowout preventer (BOP) systems and related equipment. The I3P reports are required as part of the Application for Permit to Drill (APD) or Application for Permit to Modify (APM) pursuant to 30 CFR 250.731. Operators seeking permission to use HPHT equipment designed beyond the limits established in the API Standards incorporated into the regulations at 30 CFR 250.198 must obtain approval of a request for alternate procedures or equipment pursuant to 30 CFR 250.141.

Select DWOP and Conceptual Plan Regulations

§ 250.287: "You must submit a DWOP for each development project in which you will use non-conventional production or completion technology, regardless of water depth. If you are unsure whether BSEE considers the technology of your project non-conventional, you must contact the Regional Supervisor for guidance." § 250.290: "You may not complete any production well or install the subsea wellhead and well safety control system (often called the tree) before BSEE has approved the Conceptual Plan."

§ 250.292(a) and (e): "You must include...in your DWOP...[a] description and schematic of the typical wellbore, casing, and completion," and "[i]nformation concerning the drilling and completion systems."

§ 250.292(i): "You must include...in your DWOP...[i]nformation about subsea wells and associated systems that constitute all or part of a single project development covered by the DWOP."

Select HPHT Regulations

§ 250.804(a): "If you plan to install SSSVs and related equipment in an HPHT environment, you must submit detailed information with your Application for Permit to Drill (APD) or Application for Permit to Modify (APM), and Deepwater Operations Plan (DWOP) that demonstrates the SSSVs and related equipment are capable of performing in the applicable HPHT environment. Your detailed information must include the following:

- (1) A discussion of the SSSVs' and related equipment's design verification analyses;
- (2) A discussion of the SSSVs' and related equipment's design validation and functional testing processes and procedures used; and
- (3) An explanation of why the analyses, processes, and procedures ensure that the SSSVs and related equipment are fit-for-service in the applicable HPHT environment."

§ 250.804(b): "For this section, HPHT environment means when one or more of the following well conditions exist:

- (1) The completion of the well requires completion equipment or well control equipment assigned a pressure rating greater than 15,000 psia or a temperature rating greater than 350 degrees Fahrenheit;

- (2) The maximum anticipated surface pressure or shut-in tubing pressure is greater than 15,000 psia on the seafloor for a well with a subsea wellhead or at the surface for a well with a surface wellhead; or
- (3) The flowing temperature is equal to or greater than 350 degrees Fahrenheit on the seafloor for a well with a subsea wellhead or at the surface for a well with a surface wellhead.”

§ 250.804(c): “For this section, related equipment includes wellheads, tubing heads, tubulars, packers, threaded connections, seals, seal assemblies, production trees, chokes, well control equipment, and any other equipment that will be exposed to the HPHT environment.”

Guidance

For the purposes of assessing compliance with 30 CFR 250.732(c), BSEE considers “BOP systems and related equipment” to include all pressure controlling and pressure containing well control equipment that can or will be exposed to an HPHT environment during drilling, completion, and intervention (with or without the tree installed). Well control equipment includes equipment that is temporarily and permanently installed for the purpose of pressure control and containment when it becomes necessary to physically enter a well bore during drilling, completion, or workover modes of operation. Operator’s must demonstrate that the BOP systems and related equipment must have the appropriate shearing capacity, pressure containment capacity, and well control and recovery capacity during all phases of operation (see 30 CFR 250.730-250.738).

Operators should ensure that there are redundant mechanical barriers between a source of hydrocarbons and people and/or the environment, also known as the “BSEE Barrier Philosophy.” BSEE will only approve a plan if the required redundant mechanical barriers are testable and have a defined acceptance criteria. BSEE considers wellbore fluids to be a temporary conditional barrier.

The Appendices in this NTL provide specific guidance to inform an operator’s submission of information related to site specific and non-site specific equipment for wells in an HPHT environment.

Appendix 1 provides a standard list of definitions to facilitate communications on HPHT submissions.

Appendices 2-5 provide guidance concerning information that an operator should submit concerning material selection, design verification analysis, design validation and functional testing processes, and procedures, and an explanation of why the analyses, processes, and procedures ensure that HPHT equipment is fit-for-service in the applicable HPHT environment to facilitate the review and approval process.

Appendix 3 provides guidance on Initial and Final Site Specific Equipment Conceptual Plans.

Appendix 4 provides guidance on Independent Third Party (I3P) and Operator Expert Reviewer (OER) reports that an operator submits.

Operators should refer to all other applicable BSEE regulations and guidance documents regarding the submission of DWOPs and new technology applications, in addition to the following guidance. In addition to complying with specific regulations, documents incorporated by reference, and guidance addressing comprehensive requirements for drilling, completion, workovers, and production in an HPHT environment, operators should utilize recognized engineering practices that reduce risks to the lowest level practicable, as described in 30 CFR 250.107(a)(3). The operator must demonstrate that the risks are minimized to the greatest extent practicable.

Additional NTL Guidance

1. NTL No. 2009-G31, Hydrogen Sulfide. This NTL notes that concentrations of H₂S as low as 3 ppm at 20,000 psi will have a partial pressure greater than 0.05 psia and require materials compliant with National Association of Corrosion Engineers (NACE) standards. Unless the operator can accurately determine by direct measurements from a producing well that the concentration of H₂S is less than 0.05 psia, then NACE-compliant material will be required for any HPHT well completions. NACE MR0175 is incorporated into the regulations in 30 CFR 250.198 and referenced in 30 CFR 250.901 and 250.490.
2. NTL No. 2019-N04, Calculating Maximum Anticipated Surface Pressure and Expected Surface Pressure for the Completion Case and Estimated Shut-in Tubing Pressure Prior to Production. The calculation of the MASP for the Completion Case and the Estimated Shut-in Tubing Pressure are critical for determining whether the well is classified as a High Pressure well.

Guidance Document Statement

BSEE issues NTLs as guidance documents in accordance with 30 CFR 250.103, to clarify or provide more detail about certain BSEE regulatory requirements and to outline the information you provide in your various submittals. Under that authority, this NTL sets forth guidance and clarification regarding certain regulatory requirements and provides a clear and consistent approach to complying with those requirements.

Paperwork Reduction Act of 1995 Statement

The Office of Management and Budget (OMB) has approved the information collection requirements and assigned OMB Control Numbers 1014-0022, 1014-0024, 1014-0018, 1014-0004, 1014-0001, 1014-0028, 1014-0003, 1014-0025, and 1014-0026 for the subparts A, B, D, E, F, G, H, APD, and APM regulations. This NTL does not impose any additional information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

Contacts

Please address any questions on the content of this NTL to BSEE Gulf of Mexico (GOM) Regional Field Operations, Technical Assessment Section (TAS) by e-mail at Russell.Hoshman@bsee.gov or Otho.Barnes@bsee.gov.

Or
BSEE GOM District Field Operations by email at Frederick.brink@bsee.gov.

/S/ Lars Herbst
Lars Herbst
Regional Director

Attachments

Appendix 1: Definitions and Acronyms

Appendix 2: Information Submission Guidance for HPHT Equipment Conceptual Plan and DWOP

Appendix 3: Additional Information Submission Guidance for Initial and Final Equipment C Plans

Appendix 4: Guidance for Independent Third Party and/or Operator Expert Reviewer Reports

Appendix 5: Guidance for Design Verification and Validation of HPHT Equipment

Appendix 1: Definitions and Acronyms

Definitions

The following definitions are provided to facilitate communication between operators and BSEE. Where the definitions of terms are inconsistent with those in BSEE regulations and documents incorporated therein, the definitions in the BSEE regulations and documents incorporated therein govern.

Acceptance Criteria, Design: The limits placed on characteristics of material, products, or service to achieve conformity of the product design to an appropriate standard.

Approval by BSEE: For the purpose of oil and natural gas operations, BSEE only approves requests, applications, permits, and plan information submitted in accordance with the Code of Federal Regulations, Title 30, Part 250. *See* 30 CFR 250.102 for a summary list of topics covered by the regulations.

Ambient Pressure: The pressure exerted on an object by the surrounding medium, such as a gas or liquid, in contact with the object.

Assembly: An identifiable portion of a piece of equipment, composed of two or more sub-assemblies, components, or parts that can be isolated, installed, or removed.

BSEE Barrier Philosophy: A BSEE philosophy that there should be mechanical barrier systems between a source of hydrocarbons and people and/or the environment that are redundant, testable, and fully tested to a documented acceptance criteria.

Category 1 Equipment: Category 1 equipment includes all pressure containing and pressure controlling components from the production liner within the well through the last barrier in a subsea tree, BOP, or intervention system, or any equipment that acts as a primary barrier during any mode of operation including drilling, completion, production, injection, intervention, and abandonment.

Category 2 Equipment: Category 2 equipment includes: (1) pressure containing and pressure controlling components that are not critical to well control, (2) non-pressure containing and non-pressure controlling equipment whose failure could reasonably cause a piece of Category 1 HPHT equipment to fail, (3) non-HPHT equipment whose failure could reasonably cause a piece of HPHT Category 1 equipment to fail, or (4) temporarily installed equipment which acts as a secondary barrier during the period it is in the well.

Category 3 Equipment: Non-critical equipment and non-barrier equipment associated with the well.

NOTE: Any equipment that may have a barrier function at any time during the life of the well cannot be Category 3.

Closure Bolting: Threaded fasteners used to assemble wellbore pressure-containing components or join end or outlet connections.

Component or Part: For the purpose of this document, a component or part is an identifiable portion of a piece of equipment, assembly, or sub-assembly that cannot be dismantled further.

Conceptual Plan: The plan described in the regulations at 30 CFR 250.288 through 250.290, required as part of the DWOP process.

Critical Bolting: Threaded fasteners and closure bolting whose failure could lead to loss of structural integrity or pressure containment. Examples include studs, nuts, bolts, and cap screws.

Designated Operator: An entity identified as having control or management of operations on all or a given portion of a lease and any associated facilities pursuant to 30 CFR 550.143 and 550.144. This may be a lessee.

Deepwater Operations Plan (DWOP): The plan described in the regulation at 30 CFR 250.286 through 250.295 that provides sufficient information for BSEE to review a proposed deepwater development project and any other project that uses non-conventional production or completion technology.

External Hydrostatic Pressure: The pressure measured at depth in water in (psia) or estimated using External Hydrostatic Pressure in (psia) = 0.052 * (water density in #/gal) * (True Vertical Depth from Sea-level to depth of interest in feet).

Equipment: Any single completed unit that can be used for its intended purpose without further processing or assembly.

Equipment Diagrams: Sketches or diagrams that show the name(s) and location(s) of the components, assemblies, sub-assemblies, and sealing elements contained within the piece of equipment.

Fastener: Any device that mechanically joins two or more elements together, such as bolts, studs, connectors, nuts, and screws.

Fatigue Critical: When the factored fatigue life of a fatigue hot spot is less than or equal to the probable design service life.

Fatigue Sensitive: When fatigue failure has been identified as a potential failure mode.

Fit-for-Purpose: A determination made by an I3P and submitted to BSEE that a piece of equipment has been designed, tested, and built in conformance with recognized engineering standards and any additional project specific requirements; that the material selection, design verification analysis, validation testing, and quality control is appropriate to justify the technical specifications; and that the technical specifications meet or exceed a project's site specific functional specifications.

Fit-for-Service: Determination made by the operator and submitted to BSEE that the material selection, design verification analysis, design validation testing, and quality control of the manufactured equipment is appropriate to justify the technical specifications and that the technical specifications meet or exceed a project's site specific functional specifications. *See* 30 CFR 250.804(a)(3).

Functional Specifications: Project-specific requirements developed by the equipment end-user or operator typically contained in a document that describes the features, characteristics, process conditions, boundaries, and exclusions defining the performance and use requirements of a product, process, or service.

High Pressure High Temperature (HPHT) Environment:

As stated in 30 CFR 250.804(b), *HPHT environment* means when one or more of the following well conditions exist:

- (1) The completion of the well requires completion equipment or well control equipment assigned a pressure rating greater than 15,000 psia or a temperature rating greater than 350 °F;
- (2) The maximum anticipated surface pressure or shut-in tubing pressure is greater than 15,000 psia on the seafloor for a well with a subsea wellhead or at the surface for a well with a surface wellhead; or
- (3) The flowing temperature is equal to or greater than 350 °F on the seafloor for a well with a subsea wellhead or at the surface for a well with a surface wellhead.

HPHT Equipment Conceptual Plan (Equipment C Plan): A site specific or non-site specific plan that typically includes the following elements (which may be split between initial and final plans): a list of proposed equipment, components, assemblies, and sub-assemblies and their categorization, a summary of the proposed basis of design, any I3P nomination, any I3P and/or OER review plan, any I3P and/or OER reports, and a statement that the HPHT equipment is Fit-For-Service in the applicable HPHT environment. Multiple pieces of equipment, components, assemblies, and sub-assemblies can be combined into one Equipment C Plan. For HPHT wells, operators may submit information required by 30 CFR 250.291, 250.292, 250.732, 250.804, and regulations regarding APDs and APMs, at the Conceptual Plan stage to ensure that the proposed well equipment is acceptable early in the process.

HPHT Well Design and Operations Conceptual Plan (Well Design C Plan):

A site specific plan that typically addresses all items needed before an HPHT well can be completed, including well completion procedures, well control procedures, intervention procedures, tubing design, casing design, liner design, cement design, qualification of threaded connections, packer qualification, and the design for trapped annular pressure. For HPHT wells, operators may submit information required by 30 CFR 250.291, 250.292, 250.732, 250.804, and regulations regarding APDs and APMs, at the Conceptual Plan stage to ensure that the proposed well design is acceptable early in the process.

Independent Third Party (I3P): Individual or organization that consists of a qualified expert or team of experts that reviews and verifies the material selection, design verification analysis, and design validation testing performed by either the Original Equipment Manufacturer (OEM) or the operator. The I3P must meet the requirements of 30 CFR 250.732(b).

Industry Collaboration Effort (such as a Joint Development Agreement (JDA)) Project: Project in which operators jointly develop HPHT equipment. Functional Specifications for HPHT equipment developed under an industry collaboration effort are generally the combined worst case loads so that the HPHT equipment's Technical Specification can meet the needs of several operators' HPHT projects.

Non-critical Equipment: Equipment that does not meet the definition of a primary barrier or a secondary barrier and does not provide structural support for a primary or secondary barrier.

Non-Site Specific HPHT Equipment: Equipment developed for use at multiple locations potentially by multiple different operators. Generally, the equipment's technical specifications exceed the maximum environmental and operational conditions to which the equipment may be exposed while in service.

Operator Expert Reviewer (OER): A recognized expert employed or retained by the operator or a third party and who is not acting as the I3P.

Operating Margin: The difference in pressure between the maximum anticipated surface pressure (MASP) for the completion case for completion operations, MASP for the drilling case for drilling operations, Shut-in Tubing Pressure (SITP) or Expected Surface Pressure (ESP) for an intervention operation, and the required injection pressure needed at the wellhead for kill weight fluid to be bull headed if necessary.

Pressure Containing: A description of a part exposed to wellbore fluids whose failure to function as intended would result in a release of wellbore fluid to the environment.

Pressure Controlling: A description of a part that controls or regulates the movement of pressurized fluids (Example: Valve-bore sealing mechanisms (ball or gate), choke trim, or BOP rams).

Primary Barrier: First piece of equipment or system that prevents flow from a source as defined in API 17TR8, or an alternate definition proposed by the operator and approved by BSEE.

NOTE: BSEE recognizes that equipment barrier functions may change with the mode of operations. The modes of operations are drilling, completion, production, injection, workover, and abandonment. BSEE created equipment categorization to recognize that during one or more of these modes of operation, a particular piece of equipment may have to function as a primary barrier.

Reviewed by BSEE: BSEE’s denotation to an operator submittal that is not subject to BSEE approval (e.g., if information is submitted for review before all the required information is ready to be submitted) indicating that BSEE considers the submittal complete and that BSEE requires no supplemental materials.

Secondary Barrier: Piece of equipment or system that prevents flow from a source in the event the primary barrier fails, as defined in API 17TR8.

Sealing Element: A component or part of a pressure-containing or pressure-controlling component that prevents leakage at the intersection of two parts or components. A sealing element may be metallic, thermoplastic, or elastomeric.

Site Specific HPHT Equipment: Equipment developed for use at a specific location for a specific operator. The equipment’s technical specifications will exceed the maximum environmental and operational conditions at the specific site.

Sub-assembly: For the purpose of this document, a sub-assembly is an identifiable portion of an assembly, composed of two or more components or parts, that can be isolated, installed, or removed.

Subcategory A, Alternate Analysis Methods: Equipment design methods not captured in published component API Standards, Specifications, or Recommended Practice documents. Examples of alternate analysis methods include, but are not limited to, ASME Boiler and Pressure Vessel Code (BPVC) Section VIII, Div 2 or Div 3, Article KD-4 of ASME Section VIII Div 3, API RP 579, British Standard (BS) 7910, Det Norske Veritas (DNV) C203, or API 17TR8.

Subcategory SN, Standard Analysis Methods: Equipment, component, assembly, and sub-assembly design methods published in existing API Component Standards, Specifications, or Recommended Practices that BSEE has not incorporated into the BSEE Regulations at 30 CFR 250.198.

Subcategory SI, Standard Analysis Methods: Equipment, component, assembly, and sub-assembly design methods published in existing API Standards, Specifications, or Recommended Practices that BSEE has incorporated into the BSEE regulations at 30 CFR 250.198.

Subsea Production Equipment: All production equipment from the wing valve on the tree to the Boarding Shut-Down Valve on a production platform. Examples include flowline jumpers, PLETs, PLEMs, umbilicals, manifolds, pipelines, flowlines, risers, and HIPPS systems.

Survival: A rare condition in which equipment survives without leakage of wellbore fluid to the environment, but may be otherwise damaged. Any such damage should not lead to cascading failures in other equipment.

System: For the purpose of this document, a system is two or more pieces of equipment working together to perform an identifiable function.

Technical Specifications: Documented technical requirements for a piece of equipment developed by the OEM to be fulfilled by the product, process, or service, in order to comply with the Functional Specifications developed by the end user or operator of the equipment. Technical Specifications form an equipment's operating envelope. In addition to load capacity, the equipment's Technical Specification should include the Temperature Classification, the Material Class, the Product Specification level (PSL), and the Performance Requirements (PR).

Temporary Conditional Barrier: A non-permanent barrier to the environment consisting of wellbore fluids where the density of the fluid creates a bottom hole pressure exceeding that of the pressure source, the height of the wellbore fluid level is known, a tested mechanical barrier system that can be activated on command (such as a BOP) is installed on the well, and the wellbore is manned.

NOTE: In the case of well control on the OCS, manned refers to having a person dedicated to the well activity that is trained to recognize an abnormal condition or event and is trained, qualified, and authorized to take the appropriate action.

Acronyms

API: American Petroleum Institute
APD: Application for Permit to Drill
APM: Application for Permit to Modify
ASME: American Society of Mechanical Engineers
BOP: Blowout Preventer
BPVC: Boiler and Pressure Vessel Code
BS: British Standard
BSEE: Bureau of Safety and Environmental Enforcement
Cat 1: Category 1
Cat 2: Category 2
Cat 3: Category 3
CFR: Code of Federal Regulations
C Plan: Conceptual Plan
CVA: Certified Verification Agent
CWOR: Completion and Workover Riser
DWOP: Deepwater Operations Plan
DNV: Det Norske Veritas
FMEA: Failure Modes and Effects Analysis
FMECA: Failure Modes, Effects, and Criticality Analysis
HAZID: Hazard Identification Study
HAZOP: Hazard and Operability Study
HIPPS: High Integrity Pressure Protection System
HPHT: High Pressure High Temperature
JDA: Joint Development Agreement
I3P: Independent Third Party

PLEM: Pipeline End Manifold
PLET: Pipeline End Termination
OCS: Outer Continental Shelf
OEM: Original Equipment Manufacturer
OER: Operator Expert Reviewer
SCSSV: Surface Controlled Subsurface Safety Valve
TAS: Technical Assessment Section of BSEE
TR: Technical Report

Appendix 2: Information Submission Guidance for HPHT Equipment Conceptual Plan and DWOP

Site Specific Equipment will be developed with project specific Functional Specifications, which will form the basis for the Site Specific equipment’s Technical Specifications. Non-Site Specific equipment may be developed via an industry collaboration effort such as a joint development agreement (JDA) or by an operator for use at multiple locations. Generally, Non-Site Specific equipment will be developed based on Non-Site Specific Functional Specifications for a set of conditions that could be encountered at several locations. BSEE does not approve Non-Site Specific Plans, but BSEE may review Non-Site Specific Plans and provide feedback to operators for use when developing equipment for a Site Specific project(s).

Operators may submit information in support of the Conceptual Plan and DWOP in the following order:

	Plan or Submittal	Additional Guidance	Submittal Requirement
1.	Initial Non-Site Specific Equipment Conceptual Plan (Equipment C Plan)	Contact BSEE Technical Assessment Section (TAS) for more details, if applicable	Voluntary Submission
2.	I3P and/or OER Reports corresponding to the Non-Site Specific Equipment C Plan	Contact BSEE TAS for more details, if applicable	Voluntary Submission
3.	Final Non-Site Specific Equipment C Plan	Contact BSEE TAS for more details, if applicable	Voluntary Submission
4.	Initial Conceptual Plan	This will always be for a Site Specific Project	Voluntary Early Submission of Required Information
5.	Initial Site Specific Equipment C Plan(s)	See Appendix 3	Voluntary Early Submission of Required Information and Voluntary Submission
6.	I3P and/or OER Reports corresponding to the Site Specific Equipment C Plan	See Appendix 4	Voluntary Early Submission of Required Information and Voluntary Submission
7.	Final Site Specific Equipment C Plan	See Appendix 3	Voluntary Early Submission of Required Information
8.	Well Design Conceptual Plan (Well Design C Plan)	See Appendix 3 in NTL 2019-G02 “Guidance for Information Submissions Regarding Proposed High Pressure and/or High Temperature (HPHT) Well Design, Completion and Intervention Operations”	Voluntary Early Submission of Required Information and Voluntary Submission
9.	I3P and/or operator	See Appendix 4 in “NTL 2019-G02	Voluntary Early Submission of

	reports corresponding to the Well Design C Plan	Guidance for Information Submissions Regarding Proposed High Pressure and/or High Temperature (HPHT) Well Design, Completion and Intervention Operations”	Required Information and Voluntary Submission
10.	Conceptual Plan		Required Submission
11.	Application for Permit to Drill (APD), Application for Permit to Modify (APM), DWOP		Required Submission

NOTE: After the plans are deemed complete and acceptable, all the plans and reports listed above will be marked “Reviewed by BSEE” with the exception of the Conceptual Plan, APD, APM, and DWOP. The Conceptual Plan, APD, APM, and DWOP will be marked “Approved by BSEE” upon successful completion of BSEE’s review.

Additional Guidance for the Non-Site Specific Equipment C Plan(s) and I3P and/or OER reports:

1. BSEE does not require Non-Site Specific Equipment C Plans (Initial or Final) or the corresponding I3P and/or OER reports; they are an option available for the operator or operator representative of a joint collaboration effort (operator representative) to facilitate HPHT equipment development and to expedite the review process.
2. If an operator or operator representative elects to submit a Non-Site Specific Equipment C Plan, they may submit I3P verification reports for HPHT BOP systems and related equipment, and for all other HPHT equipment, to expedite the review process.
3. The I3P and/or OER should state that they reviewed appropriate documentation to support the defined Technical Specifications.
4. The I3P and/or OER should list the equipment’s final, verified, and validated Technical Specifications in their report.
5. An operator who plans to submit Non-Site Specific Equipment C Plans (Initial and Final) and the corresponding I3P and/or OER reports should contact BSEE TAS for additional information.

NOTE: The purpose of a Non-Site Specific Equipment C Plan is to qualify HPHT equipment relative to its own Technical Specification. The purpose of a Site Specific Equipment C Plan is to qualify HPHT equipment relative to the site specific project’s Functional Specification. If the operator chooses not to submit a Non-Site Specific Equipment C Plan, then the Technical Specification and the Functional Specification both will need to be qualified in the Site Specific Equipment C Plan (voluntary early submittal) or the Conceptual Plan (required).

Additional Guidance for the Initial Conceptual Plan:

1. The Initial Conceptual Plan should include the information required by 30 CFR 250.289.
2. The operator should provide information in its Initial Conceptual Plan sufficient for the BSEE reviewer’s use when reviewing the Site Specific Equipment C Plan(s).

3. After BSEE deems the plan complete and acceptable, the Initial Conceptual Plan will be marked “Reviewed by BSEE.”

Additional Guidance for the Site Specific Equipment C Plan(s) and I3P and/or OER reports:

1. Operators may submit Site Specific Equipment C Plans (Initial and Final) for well equipment prior to Conceptual Plan approval. Site Specific Equipment C Plans (Initial and Final) for Subsea Production Equipment may be submitted prior to Conceptual Plan approval or prior to DWOP approval.
2. To help maximize the efficiency of BSEE review of voluntary early information submission, operators should submit an I3P report when the regulations would require submission of such a report prior to operations. 30 CFR 250.732 makes I3P verification reports mandatory for HPHT BOP systems and related equipment, and these reports may be submitted for all other HPHT equipment to facilitate the review process.
3. If a Non-Site Specific Equipment C Plan (Initial and Final) was submitted to BSEE and marked “Reviewed by BSEE,” the operator should ensure in the Site Specific Equipment C Plan that the I3P and/or OER reports confirm that the Site Specific Functional Specifications fit within the previously verified and validated equipment Technical Specifications from the Non-Site Specific Equipment C Plan and I3P and OER reports.
4. In the I3P and/or OER reports, the I3P or OER should make sure that there is appropriate documentation to support the defined Technical Specifications and ensure that the Functional Specification fit within the defined Technical Specifications.
5. In the I3P and/or OER reports, the I3P or OER should list the equipment’s final, verified, and validated Technical Specifications. The I3P or OER may reference the fact that this information was included in a Non-Site Specific Equipment C Plan that has been previously marked “Reviewed by BSEE,” if applicable.
6. The I3P or OER should document when the Site Specific Functional Specifications are outside of the Technical Specifications. This should be re-evaluated or justified.
7. The I3P or OER should state that the HPHT equipment is Fit-for-Purpose as a barrier for the site specific environment.
8. The operator may reference any plan or document that was previously marked “Reviewed by BSEE.” The operator may only reference plans or document that they have legal rights to use.
9. In the Final Site Specific Equipment C Plan, the operator should include a letter stating that the I3P or OER reports are intended to 1) demonstrate that the plan addresses the requirements of 30 CFR 250.804 and 2) verify that the plan complies with 30 CFR 250.732 for HPHT equipment. The operator may submit a statement that the proposed equipment is Fit-for-Service as a barrier for the Site Specific HPHT Environment. If this statement is not submitted with the Final Site Specific Equipment C Plan or the Conceptual Plan, it must be submitted as part of the APD, APM, or DWOP pursuant to 30 CFR 250.804(a)(3).
10. Additional guidance for the Site Specific Equipment C Plans is provided in Appendix 3, and additional guidance for the I3P and OER reports is provided in Appendix 4.

Additional Guidance for the Well Design C Plan and I3P and/or Operator Reports:

1. Well Design C Plans are always Site Specific.
2. BSEE will not review the Well Design C Plan until the Site Specific HPHT equipment Design has been finalized. The HPHT equipment Design and the HPHT Well Design are interdependent and highly interrelated. An operator may reference any Equipment C Plans and I3P and/or OER or Operator Reports in future submittals once they have been marked as “Reviewed by BSEE.”
3. To help maximize the efficiency of BSEE review of voluntary early information submissions, operators should submit an I3P report when the regulations would require submission of such a report prior to operations. 30 CFR 250.732 makes I3P verification reports mandatory for HPHT BOP systems and related equipment, and these reports may be submitted for all other HPHT equipment to facilitate the review process.
4. An operator may employ an I3P to facilitate BSEE’s review process for well equipment and tubular design. An operator is not required to submit I3P reports for well drilling, completion, and intervention operations (procedures) that are normally reviewed by BSEE as part of the permit approval process.
5. The I3P and/or operator may submit their reports to BSEE as they are available or combine into one final report.
6. An operator may reference all previous letters or documents marked as “Reviewed by BSEE.”
7. The operator should review NTL “Guidance for Information Submissions Regarding Proposed High Pressure and/or High Temperature (HPHT) Well Design, Completion and Intervention Operations” for information that should be included in the Well Design C Plan and associated I3P and/or operator reports.

Additional Guidance for the Conceptual Plan:

1. If operators submit a Final Site Specific Equipment C Plan for well equipment, Well Design C Plan, and Well Design I3P or operator reports, they should do so before submitting the Conceptual Plan.
2. In accordance with 30 CFR 250.290, an operator must submit and BSEE must review and approve the Conceptual Plan before an operator may complete a production well or install a subsea tree.
3. The Conceptual Plan should consist of: a letter from the operator submitted to BSEE referencing the date BSEE marked the Well Design C Plan as “Reviewed by BSEE”; any modifications or revisions to the plan; a full listing of any Well Design I3P and/or operator reports that have been marked “Reviewed by BSEE”; and the date the Final Site Specific Equipment C Plan(s) were marked “Reviewed by BSEE.” If it was not already submitted with the Final Site Specific Equipment C Plan, the operator may submit a statement that the proposed equipment is Fit-for-Service as a barrier for the Site Specific HPHT Environment. If this statement is not submitted with the Conceptual Plan, it must be submitted as part of the APD, APM, or DWOP pursuant to 30 CFR 250.804(a)(3).
4. If an operator has elected not to voluntarily submit the plans outlined above, the operator must submit the information required by 30 CFR 250.289.

5. The operator may submit the Final Site Specific Equipment C Plans for Subsea Production Equipment before BSEE approval of the Conceptual Plan, or as a revision to the Conceptual Plan, or before BSEE approval of the DWOP.
6. In the APM and APD, operators should state that all the HPHT components in the well design have been “Approved by BSEE” in the Conceptual Plan.

Additional Guidance for the DWOP:

1. BSEE’s DWOP review process assesses two plans, a Conceptual Plan and a DWOP.
2. The Final Site Specific Equipment C Plans for the Subsea Production Equipment may be submitted before or after the Conceptual Plan approval. The Final Site Specific Equipment C Plans for the Subsea Production Equipment must be submitted before the DWOP can be approved.
3. If the Final Site Specific Equipment C Plans for the Subsea Production Equipment was submitted prior to the DWOP phase in the Conceptual Plans phase, the DWOP should consist of: a letter from the operator submitted to BSEE referencing the date the Final Site Specific Equipment C Plans for the Subsea Production Equipment was marked “Reviewed by BSEE” and the date the Conceptual Plan was approved by BSEE.
4. If an operator has elected not to voluntarily submit the plans outlined above, the operator must submit the information required by 30 CFR 250.292. Operators should also include a statement that the proposed equipment is Fit-for-Service as a barrier for the Site Specific HPHT Environment pursuant to 30 CFR 250.804(a)(3) if not previously submitted.
5. BSEE must review and approve the DWOP prior to an operator commencing production.

Appendix 3: Additional Information Submission Guidance for Initial and Final Equipment C Plans

BSEE must approve the Conceptual Plan before an operator completes an HPHT well. If an operator submits a Final Site Specific Equipment C Plan(s) (including the Initial Site Specific Equipment C Plan and any I3P and/or OER report(s)) for well equipment, it should do so before submitting the Conceptual Plan. The operator may submit the Final Site Specific Equipment C Plan(s) (including the Initial Site Specific Equipment C Plan and any I3P and/or OER report(s)) for Subsea Production Equipment prior to submitting the Conceptual Plan, as a revision to the Conceptual Plan, or prior to submitting the DWOP.

NOTE: Operators may elect to submit a Non-Site Specific Equipment C Plan, but this is not required. BSEE does not approve Non-Site Specific Plans, but BSEE may review Non-Site Specific Plans and provide feedback to operators for use when developing equipment for a Site Specific project(s). Typically, Non-Site Specific Equipment C Plans may be submitted pursuant to the process provided for Site Specific Equipment C Plans as is described below. The operator may contact BSEE TAS for additional details.

Overview of the Site Specific Equipment C Plan

The operator may submit a Site Specific Equipment C Plan (which contains an Initial Site Specific Equipment C Plan, I3P and/or OER reports, and a Final Site Specific Equipment C Plan, as described in this document) to BSEE for review of the equipment, components, assemblies, or sub-assemblies that are designed by an operator or OEM for use in an HPHT environment. OEMs may not submit Site Specific Equipment C Plans. The Site Specific Equipment C Plan allows the operator to have HPHT equipment reviewed by BSEE in advance of submitting the Conceptual Plan or DWOP. The operator may submit multiple Site Specific Equipment C Plans (i.e., individual initial and final plans for the wellhead, subsea tree, lower completion equipment, upper completion equipment, BOP, etc.) or combine all required equipment into one Site Specific Equipment C Plan.

The operator should include in its Initial Site Specific Equipment C Plan the information described in Sections A through F below. The operator should submit one paper copy and one digital copy of each part of the Site Specific Equipment C Plan (Initial Site Specific Equipment C Plan, I3P and/or OER reports, and Final Site Specific Equipment C Plan) to BSEE.

The I3P and/or OER may submit their reports to BSEE as the reports are available or may combine them into one final report.

The operator may submit its Final Site Specific Equipment C Plan after the Initial Site Specific Equipment C Plan and all associated I3P and/or OER reports have been marked “Reviewed by BSEE.” The Final Site Specific Equipment C Plan should reference the date the Initial Site Specific Equipment C Plan was marked “Reviewed by BSEE,” any modifications or revisions to the plan, and a full listing of all I3P and/or OER reports that have been marked “Reviewed by BSEE,” including the date the reports were marked “Reviewed by BSEE.” This will signal to BSEE that the plan is complete.

If appropriate, the operator should state in its Final Site Specific Equipment C Plan that the I3P and/or OER reports marked as “Reviewed by BSEE” are intended to 1) demonstrate that the plan addresses the requirements of 30 CFR 250.804 and 2) verify that the plan complies with 30 CFR 250.732 for HPHT equipment. In addition, per 30 CFR 250.804(a)(3), the operator should explain why its analyses, processes, and procedures ensure that the HPHT equipment is Fit-for-Service in the applicable HPHT Environment. After the Final Site Specific Equipment C Plan has been marked “Reviewed by BSEE,” the operator may reference the plan in its Conceptual Plan, DWOP, APD, or APM. If the operator elects not to satisfy the requirements of 30 CFR 250.804 and 250.732 through the submission of a Final Site Specific Equipment C Plan, the operator must demonstrate satisfaction of those requirements in its APD, APM, or DWOP.

NOTE: If the operator submits a Non-Site Specific Equipment C Plan, the requirements of 30 CFR 250.804(a)(3) do not need to be addressed in that plan.

Guidance for Information Included in a Site Specific Equipment C Plan

(A) General Information about I3Ps, OERs, I3P and/or OER Review Plans, and I3P and/or OER Reports

- (1)** To help maximize the efficiency of BSEE’s review of voluntary early information submission, operators should submit an I3P report with the Site Specific Equipment C Plan when the regulations would require submission of such a report prior to operations. 30 CFR 250.732 makes I3P verification reports mandatory for HPHT BOP systems and related equipment, and these reports may be submitted for all other HPHT equipment to further facilitate the review process.
- (2)** If the operator chooses to list an I3P(s) or an OER(s) for each piece of equipment, component, assembly, or sub-assembly proposed in the Initial Site Specific Equipment C Plan based on its category and sub-category, as described below, the operator should provide information to BSEE regarding the proposed I3P’s or OER’s qualifications (see 30 CFR 250.732(b) for I3P qualification requirements).
- (3)** I3P: If the operator chooses to have an I3P report address each piece of HPHT equipment, the operator should demonstrate that the I3P is a qualified expert (or team of experts) for each piece of HPHT equipment, component, assembly, or sub-assembly that they will review. The operator should address the specific qualifications, technical capabilities, and previous experience of the individual(s) who will review the design verification and validation work of the OEM or the operator. I3Ps should not have, or appear to have, an organizational conflict of interest with the operator. If they do, the operator should disclose this information and explain why it does not impair the I3P’s independence.
- (4)** OER: The operator may have the Category 2, Subcategory SI (as described below) equipment review and reports prepared by a recognized expert within the operating company or by a third party employed by the operating company. In this case, the operator should name the OER and include a brief summary of the OER’s qualifications.

(5) An I3P and/or OER is not a Certified Verification Agent (CVA). An I3P and/or OER should openly communicate with the operator, the OEM, and BSEE, and their review should benefit all parties. Through submission of I3P or OER reports, the operator asserts its determination that the I3P or OER is a subject matter expert or a team of subject matter experts with the resources to be a competent reviewer of HPHT equipment design.

(6) Role of I3P and/or OER: The operator may employ an I3P to help facilitate BSEE review of the Conceptual Plan contents. The I3P and/or OER may review the following items and provide reports to BSEE for each piece of equipment, component, assembly, and sub-assembly.

- (a)** Basis of Design and Functional Specification
- (b)** Hazards and Failure mode analysis
- (c)** Material Selection, Qualification, and Testing
- (d)** Design Verification Analysis
- (e)** Design Validation Testing
- (f)** Load monitoring requirements
- (g)** Fabrication, Quality Management Systems, and Inspection and Test Plan
- (h)** Document the Technical Specifications and determine if the Technical Specifications are appropriately supported by the design verification and validation processes (This may be completed in Non-Site Specific Equipment C Plan and I3P and/or OER reports, if applicable, and referenced in the Site Specific Equipment C Plan and I3P and/or OER reports)
- (i)** Comparison of the Technical Specifications to the Site Specific Functional Specifications (This is only applicable to Site Specific Equipment C Plan and I3P and/or OER reports)

NOTE: For Non-Site Specific Equipment C Plans, (i) would not be applicable.

I3Ps and/or OERs typically do not design the equipment, optimize the design of the equipment, or determine the basis of design.

I3Ps and/or OERs typically:

- (a)** Review the verification and validation work of the operator or OEM;
- (b)** Determine whether the operator and OEM have completed the work they stated they would do;
- (c)** Determine whether the results of the design verification and validation work justify the Technical Specifications for the equipment, components, assembly, or sub-assembly;
- (d)** Determine whether the Site Specific Functional Specifications are met by the equipment's Technical Specifications (for Site Specific Plans only);
- (e)** Prepare reports to be submitted to BSEE.

I3Ps and/or OERs may review the equipment, components, assemblies, and sub-assemblies identified in Section C and D.

(7) I3P and/or OER Review Plan: An operator may submit an I3P and/or OER review plan as a part of its Initial Site Specific Equipment C Plan. The Initial Site Specific Equipment C Plan typically includes a brief description of the review that the I3Ps and/or OERs will conduct, the reports that the I3P/OER will generate for submission to BSEE, and a tentative schedule for submittal of the reports to BSEE. This schedule is not typically updated throughout the project unless BSEE requests that the operator update the schedule. The contents of typical I3P and/or OER reports are contained in Appendix 4.

(B) List of Equipment, Components, Assemblies, and Sub-assemblies

In the Initial Site Specific Equipment C Plan, operators should include a list of all of the equipment, components, assemblies, and sub-assemblies proposed to be used in the HPHT Environment, including all Category 1, 2, and 3 equipment (early submission of information required by 30 CFR 250.292). BSEE will only review the equipment, components, assemblies, and sub-assemblies that the operator lists in the plan for use in an HPHT Environment. An Initial Site Specific Equipment C Plan should also include equipment diagrams or sketches identifying the name and location of each component, assembly, sub-assembly, and sealing element contained within the equipment. The equipment diagrams do not have to be detailed engineering drawings. The operator should submit any changes to the equipment, components, assemblies, and sub-assemblies as a revision to the plan.

(C) Equipment Categorization

Categories

The operator should categorize each piece of equipment, component, assembly, and sub-assembly listed in the Initial Site Specific Equipment C Plan using the category and sub-category definitions below and appropriately justify the categorization in the Initial Site Specific Equipment C Plan (early submission of information required by 30 CFR 250.732 and voluntary submission). The operator may propose alternate equipment categorization, and BSEE will review such proposals on a case-by-case basis. The operator should establish the need for an I3P and/or OER review based on the requirements of 30 CFR 250.732 and the category and sub-category for each piece of equipment, component, assembly, and sub-assembly.

NOTE: The identification of a piece of equipment as a primary or secondary barrier under API 17TR8 for the purpose of establishing design requirements is a different issue than the categorization of equipment as defined here.

Category 1 (Cat 1) Equipment: Category 1 Equipment includes all pressure containing and pressure controlling equipment, components, assemblies, and sub-assemblies from the production liner within the well through the last barrier in a subsea tree, BOP, or intervention system. BSEE considers any piece of equipment that may have to function as a primary barrier during any phase in the lifecycle of the well or project (drilling, completion, production, injection, intervention, or abandonment) to be Category 1.

- An I3P must review all HPHT Cat 1 Equipment that is part of the BOP systems and

related equipment pursuant to 30 CFR 250.732.

- To enable BSEE to make a determination regarding whether to approve an operator's request to use Subcategory of A or SN equipment pursuant to 30 CFR 250.141 (see below), BSEE requires that an I3P review HPHT Cat 1 Equipment with a Subcategory of A or SN.
- An operator may use an I3P to meet the design verification and validation requirements of 30 CFR 250.804(a) for HPHT Cat 1 Equipment with a Subcategory of SI.
- BSEE will not expect an I3P or OER review for non-HPHT equipment, unless required by 30 CFR 250.732, even if it is listed below, as long as it does not provide structural support for a piece of HPHT Cat 1 Equipment.

BSEE considers the following equipment (including all pressure containing and pressure controlling elements within the equipment) to be Cat 1 Equipment:

- Wellhead system, such as the High Pressure Housing, production casing hangers, and seal assemblies
- Tubing head
- Tubing hanger
- Tree – Including all valves, fittings, and chokes
- SCSSV – Including all associated safety valve locks and landing nipples
- Capping stack
- BOP
- High pressure completion workover riser (CWOR)
- Well intervention well control equipment, such as CWOR or subsea test tree
- Wellhead connector
- Landing nipples and tubing plugs
- Surface flowhead used above a CWOR
- Production liner hanger/packer
- Packers
- Pipeline boarding shutdown valve
- Flowline riser (Note: Requires CVA per 30 CFR 250.910, 250.911)
- High integrity pressure protection system (HIPPS), including all equipment between the HIPPS and the tree
- Well Top Tension Riser Systems (Note: Requires CVA per 30 CFR 250.910, 250.911)
- Any other pressure containing and pressure controlling items from the production liner within the well through the last barrier in a subsea tree, BOP, or intervention system.

The operator should address the following Cat 1 Equipment in its Well Design C Plan:

- Production tubing
- Production casing
- Production liner
- Production casing and liner cement

- Production tubing, casing, and liner threaded connections
- Production liner hanger/packer¹
- Packers¹

¹The packers and the liner top hanger/packer design verification and validation should be addressed in the Equipment C Plan, but the packer analysis for the Site Specific well should be addressed in the Well Design C Plan.

The Functional Specifications for Cat 1 Equipment should define the tension, compression, bending, cyclic loadings, internal pressure, external pressure, temperature, and fluid and environmental exposure that the equipment may experience as a part of a barrier system for every phase of its operating life.

Category 2 (Cat 2) Equipment: BSEE considers the following to be Cat 2 Equipment:

- The drilling, intervention, and well completion equipment listed below (because they do not act as a primary barrier):
 - The lock down sleeve and the casing hangers below the production casing hanger within the High Pressure Housing
 - Low Pressure Housing and Conductor
 - Jumpers, Jumper connectors
 - Manifolds, PLETs, PLEMs
 - Flowline jumpers
 - Flowlines
 - Umbilicals
 - Any non-pressure containing or pressure-controlling equipment that could cause a piece of Cat 1 equipment to fail. For example, a piece of equipment that provides structural support for a piece of Cat 1 equipment is Cat 2 even if it is not pressure containing or pressure controlling.
- Non-pressure containing and non-pressure controlling equipment whose failure could reasonably cause a piece of Category 1 Equipment to fail (example: the Low Pressure Wellhead Housing),
- Non-HPHT equipment that provides structural support to a piece of Cat 1 Equipment or whose failure could reasonably cause a piece of HPHT Category 1 Equipment to fail (example: 1st Position Casing Hanger), or
- Temporarily installed equipment which acts as a secondary barrier during the period it is in the well.

An I3P must review all HPHT Cat 2 Equipment that is part of the BOP systems and related equipment pursuant to 30 CFR 250.732.

To enable BSEE to make a determination regarding whether to approve an operator's request to use Subcategory A or SN equipment pursuant to 30 CFR 250.141 (see below), BSEE requires that an I3P review HPHT Cat 2 Equipment with a Subcategory of A or SN. An I3P or OER may review Cat 2 Equipment with a Subcategory of SI.

The Functional Specifications for Cat 2 Equipment should define the tension, compression, bending, cyclic loadings, internal pressure, external pressure, temperature, and fluid and environmental exposure that the equipment may experience as a part of a barrier system for every phase of its operating life.

Category 3 (Cat 3) Equipment: BSEE considers non-critical equipment and equipment not permanently installed in the well, but used in an HPHT Environment, to be Cat 3 Equipment. Cat 3 Equipment generally are not considered barriers. Additional information is not needed for Cat 3 Equipment.

Subcategories

BSEE has established the subcategories discussed below based on the design analysis methodology.

Subcategory A, Alternate Analysis Methods: Equipment design methods not described in published component API Standards, Specifications, or Recommended Practice documents. Examples of alternate analysis methods include, but are not limited to, ASME Boiler and Pressure Vessel Code (BPVC) Section VIII, Div 2 or Div 3 (post-2004), Article KD-4 of ASME Section VIII Div 3, API RP 579, British Standard (BS) 7910, Det Norske Veritas (DNV) C203, or API 17TR8. An operator must request approval to use these alternate procedures, pursuant to 30 CFR 250.141, for Cat 1 and Cat 2 Equipment. To enable BSEE to make a determination regarding whether to approve an operator's request pursuant to 30 CFR 250.141, BSEE requires that an I3P review HPHT Cat 1 or Cat 2 Equipment with a Subcategory of A.

Subcategory SN, Standard Analysis Methods: Equipment design methods, including existing component API Standards, Specifications, or Recommended Practices, that have not been incorporated into the BSEE regulations in 30 CFR 250.198. An operator must request approval to use these alternate procedures, pursuant to 30 CFR 250.141, for Cat 1 and Cat 2 Equipment. To enable BSEE to make a determination regarding whether to approve an operator's request pursuant to 30 CFR 250.141, BSEE requires that an I3P review HPHT Cat 1 or Cat 2 Equipment with a Subcategory of SN.

Subcategory SI, Standard Analysis Methods: Equipment design methods, including existing API Standards, Specifications, or Recommended Practices, that are incorporated into the BSEE regulations at 30 CFR 250.198. HPHT BOP systems and related equipment with a Subcategory of SI must be reviewed by an I3P per 30 CFR 250.732. Other HPHT Cat 1 Equipment, components, assemblies, or sub-assemblies with a Subcategory of SI may be reviewed by an I3P to facilitate BSEE's review. Other HPHT Cat 2 Equipment, components, assemblies, or sub-assemblies with a Subcategory of SI may be reviewed by an I3P or OER to facilitate BSEE's review.

(D) Summary of the Proposed Basis for the Design

The operator should submit a summary of the proposed basis for the design of each individual piece of HPHT equipment, component, assembly, and sub-assembly, including every pressure

containing and pressure controlling body, element, sealing element, and fastener, including connectors, closure bolting, and critical bolts (early submission of information required by 30 CFR 250.289, 250.505, 250.513, 250.518, 250.700, 250.730, and 250.731).

The summary should include the following:

(1) Site Specific Functional Specification (Requirements), identifying:

(a) A summary of the defined loads (type(s), magnitude(s), and frequency) that the equipment, components, assemblies, or sub-assemblies will be subjected to during their proposed service life. The loads may include, but are not limited to, tension, compression, bending, cyclic loadings, internal pressure, external pressure, temperature, and fluid and environmental exposure.

(b) A summary of the materials' environmental exposure to oil, gas, water, drilling fluids, completion fluids, treating fluids, Hydrogen Sulfide, Carbon Dioxide, Chlorides, Mercury, or any other fluid which may impact the service life.

(c) A summary of any other important operational considerations, restrictions, or emergency response not included in (a) or (b) above. This may include, but is not limited to, worst case discharge and survival load evaluations.

(d) A summary of the hazards analysis including, for example, the Hazard Identification Study/Hazard and Operability Study (HAZID/HAZOP) and Failure Modes and Effects Analysis/Failure Modes, Effects, and Criticality Analysis (FMEA/FMECA) that has been conducted for the site-specific conditions, identifying:

- i.** Safety critical functions, i.e., function(s) performed by or inherent to the equipment enabling it to achieve or maintain a safe state;
- ii.** Potential modes of failure;
- iii.** Fatigue sensitivity:
 - a. Document the fatigue screening process per ASME Section VIII Div 2.
 - b. When evaluating a component for fatigue, identify fatigue hot spot(s).
 - c. A fatigue hot spot is considered "fatigue sensitive" when it requires a fatigue assessment through the S-N or Fracture mechanics design methods. A fatigue sensitive hot spot would need to be identified in a design analysis review and would be considered a possible potential mode of failure.
 - d. A fatigue hot spot is considered "fatigue critical" if the factored fatigue life is less than or equal to the probable design service life. A fatigue critical hot spot would need to be identified in a design analysis review and would be considered a highly probable potential mode of failure. A fatigue critical hot spot may require an analysis and

inspection or replacement before this component would be allowed to operate beyond its factored fatigue life.

- iv. The summary should identify and address all cladding, welding, and critical bolting proposed for the subject equipment, component, assembly, or sub-assembly, including the industry design standards in the hazard analysis, because of their importance in the design verification and validation process.

(2) A list of the manufacturer(s) for each assembly, including any additional engineering firms that are doing design work for a manufacturer;

(3) Complete or partial technical specifications for each piece of HPHT equipment, component, assembly, or sub-assembly that is available at the time the Initial Site Specific Equipment C Plan is submitted.

(E) Document Control Process

Documentation referenced in the I3P and/or OER report(s) should be made available upon request to BSEE after the equipment is placed in service and be retained for the life of the project (voluntary, but see e.g. 30 CFR 250.730, 250.740, 250.741, 250.801 and documents incorporated therein regarding document retention requirements). The operator should describe the document control process, including the company that is responsible for maintaining the documents and where the documents will be retained, document numbering, etc., such that the documents can be retrieved in the future if necessary. BSEE may want to review these reports in the future, especially if there is an unanticipated failure.

(F) Acronyms

A list of all the acronyms used throughout the design verification, validation, and review plan (voluntary).

Approval to Utilize the Equipment in a Site Specific Development – Conceptual Plans

30 CFR 250.804(a) requires that the operator submit detailed information with their APD or APM and DWOP that demonstrates that the SSSVs and related equipment are capable of performing in the applicable HPHT Environment. The detailed information must include:

- (1) A discussion of the design verification analysis,
- (2) A discussion of the design validation and functional testing processes and procedures, and
- (3) An explanation of why the analyses, processes, and procedures ensure that the SSSVs and related equipment are Fit-for-Service in the applicable HPHT environment.

An operator's Initial and Final Site Specific Equipment C Plans, if marked "Reviewed by BSEE," will typically satisfy requirements (1) and (2) above, and the operator may reference these plans in lieu of submitting detailed information in a Conceptual Plan, DWOP, APD, or APM that relies on this same equipment. The operator's statement, with associated explanation, that the HPHT equipment is Fit-for-Service as a barrier at the site specific location may be used

to satisfy requirement (3) above.

Appendix 4: Guidance for Independent Third Party and/or Operator Expert Reviewer Reports

BSEE regulations at 30 CFR 250.732 require completion and submission of verification reports prepared by an I3P for HPHT BOP systems and related equipment. BSEE recommends completion and submission of such reports, or OER reports, for all other HPHT equipment to facilitate its review process for HPHT projects. The following guidance is provided for circumstances where the operator chooses to use an I3P or OER, and where I3P reports are required.

(A) General Guidance for Operators Concerning I3Ps and OERs:

The I3P and/or OER reports should:

- (1) Identify and document the Functional Specifications (Requirements) established by the operator for the various pieces of equipment for all the potential modes of operation.
- (2) Identify and document that the acceptance criteria established by the standards, practices, and process, as well as the functional specifications, have been met for each stage of the Design Verification and Validation process for each report.
- (3) Identify and document the various engineering analyses and validation tests performed by the operator and/or OEM. Identify and document that the analysis or test methods used provided the necessary verification and validation for the establishment of the equipment's Technical Specifications.

NOTE: This is applicable to Non-Site Specific Equipment C Plans or Site Specific Equipment C Plans if a Non-Site Specific Equipment C Plan was not submitted.

- (4) Identify and document that the equipment's Technical Specifications meet or exceed the Functional Specifications for the Site Specific project .

NOTE: This is only applicable to Site Specific Equipment C Plans.

- (5) Capture the results of the review in a report that is clear, concise, and complete.

The I3P and/or OER should review the analysis and documentation created by the OEM and/or the operator, but not participate in the design or analysis of the equipment, component, assembly, or sub-assembly.

(B) Format and Guidance for BSEE Review of I3P and/or OER Equipment C Plan Reports

- (1) The reports generated by the I3P and/or OER will become a BSEE record and will be an integral part of the approval process. The report submitters should arrange them in a consistent format, such as the format described below. The I3P, OER, or operator should summarize any analysis and documentation in a standalone document.

The I3P and/or OER reports should generally follow the following format:

- (a) Transmittal Letter
- (b) Title Page
- (c) Executive Summary
- (d) Table of Contents
- (e) List of Figures and Tables
- (f) Report Body
- (g) Conclusion
- (h) Complete list of acronyms used in the design verification, validation, and review plan.
- (i) Reference Section
- (j) List of Comments or Questions and responses between the I3P and the operator or OEM (for well equipment and tubular design reports only)
- (k) Appendix

(2) In the Reference Section of the report, an operator should include a brief summary of the document control process, including who is responsible and where the documents and test records will be retained for the life of the project.

(3) A complete list of referenced documents, data books, and test records should be included in the report. At a minimum, the list should contain the following:

- (a) Reference Number
- (b) Submitter
- (c) Document Number
- (d) Revision Number (or Original)
- (e) Title
- (f) Brief Description or Executive Summary of the Document
- (g) Brief Description of the Conclusion

An I3P, OER, or operator should not attach or include the referenced documents, data books, and test records.

(4) During the review process, the I3P and/or OER may develop a list of clarifying comments or questions on the documents for the operator or the OEM. Before the I3P or OER writes a report, the operator or OEM should clarify or resolve any issues that the I3P and/or OER has raised. The questions and answers developed and discussed during the review process should be attached as an Appendix to the report. The questions and the response/resolution may aid in BSEE's level of understanding of the project.

NOTE: The I3P and/or OER should be allowed to ask questions seeking clarity and completeness. The prudent operator should be able to answer any question for clarification or completeness to satisfy the reviewer's comments or questions.

(5) If external hydrostatic pressure is considered for the design or pressure rating of subsea equipment, the I3P and/or OER should also address NTL 2019-G04, Consideration of External Hydrostatic Pressure Effects in Calculating Internal Pressure Containment Capability for Pressure Containing and Pressure Controlling Subsea Equipment.

(C) I3P and/or OER Reports for Category 1A, 1SN, 1SI, 2A, 2SI, 2SN equipment:

NOTE: See Appendix 3 for equipment categorization guidance. As an example, 1A equipment would be Category 1 equipment with a subcategory A.

- (1) I3P and/or OER reports should provide a clear summary of the design verification and validation of equipment, components, assemblies, or sub-assemblies covered in the report. Specifically, the I3P and/or OER reports should contain all the information for BSEE’s review without having to reference other documents. For example, a single report should contain variables, loads, and factors considered in the review; analysis methods used by the OEM; standards of review used; tests performed; the acceptance criteria; and the results of the review.
- (2) The I3P and/or OER may submit reports separately as they are completed or as one combined report. For example, the I3P and/or OER may submit Reports 1A through 1G separately or in one single combined report for each piece of equipment, component, assembly, or sub-assembly.
- (3) If the I3P and/or OER submits Reports 1A-1G as a single combined report, they should label each individual report within the combined report. For example, Report 1A, “Basis of Design and Functional Specifications,” Report 1B “Material Selection, Qualification, and Testing,” and so on through Report 1G, “Final Report,” should be clearly labeled within the single combined report.
- (4) The reports should contain quantitative engineering analysis based on defined acceptance criteria to the appropriate engineering standards.
- (5) The I3P reports should be submitted on the letterhead of the I3P for Category 1A, 1SN, 1SI, 2A, and 2SN equipment, as defined in Appendix 3.
- (6) The I3P or OER reports may be submitted on the letterhead of the I3P or operating company for Category 2SI equipment, as defined by Appendix 3.
- (7) An I3P must review all BOP systems and related equipment per 30 CFR 250.732. BSEE typically does not request I3P and/or OER reports for other equipment rated at less than 15,000 psi and less than 350 °F, or Cat 3. In order to facilitate BSEE’s review, BSEE may request that the operator conduct such a review if BSEE determines that failure of the equipment could reasonably cause the failure of a primary or secondary HPHT barrier or that review is justified for some other reason.

(E) Description of the I3P and/or OER Review and Reports

The following is a description of the items the I3P and/or OER may review and report for each piece of equipment, component, assembly, or sub-assembly. The reports do not have to be submitted in the order listed below. The individual reports can be combined into a single report for the equipment, component, assembly, and sub-assembly being reviewed, if desired. It should

be noted that the Non-Site Specific and the Site Specific I3P reports will have the same format except for the Final Report 1G.

(1) Report (1A) Basis of Design and Functional Specifications (Requirements)

This report should review and document:

(a) The defined loads (type(s), magnitude(s), and frequency) that the equipment, components, assemblies, or sub-assemblies will be subjected to during their proposed service life. The loads may include, but are not limited to, tension, compression, bending, cyclic loadings, internal pressure, external pressure, temperature, and fluid and environmental exposure.

(b) The materials' environmental exposure to oil, gas, water, drilling fluids, completion fluids, treating fluids, Hydrogen Sulfide, Carbon Dioxide, Chlorides, Mercury, or any other fluid which may impact the service life.

(c) Any other important operational considerations, restrictions, or emergency response not included in (a) or (b) above. This may include, but is not limited to, worst case discharge and survival load evaluations.

(d) The hazard analysis, including for example HAZID/HAZOP and FMEA/FMECA that has been conducted by the operator/OEM for equipment, components, assemblies, and sub-assemblies, identifying:

(i) Safety critical functions, *i.e.*, function(s) performed by or inherent to the equipment enabling it to achieve or maintain a safe state;

(ii) Potential modes of failure of identified barriers or components, assemblies, or sub-assemblies that could cause a barrier to fail;

(iii) Fatigue sensitivity

- a. Document the fatigue screening process per ASME Section VIII Div 2.
- b. When evaluating a component for fatigue, identify fatigue hot spot(s).
- c. A fatigue hot spot is considered "fatigue sensitive" when it requires a fatigue assessment through the S-N or Fracture mechanics design methods. A fatigue sensitive hot spot would need to be identified in a design analysis review and would be considered a possible potential mode of failure.
- d. A fatigue hot spot is considered "fatigue critical" if the factored fatigue life is less than or equal to the probable design service life. A fatigue critical hot spot would need to be identified in a design analysis review and would be considered a highly probable potential mode of failure. A fatigue critical hot spot may require an analysis and inspection or replacement before this component would be allowed to operate beyond its factored fatigue life.

(iv) The hazard analysis should identify and address all cladding, welding, and critical bolting proposed for the subject equipment, component, assembly, or sub-assembly, including the industry design standards used, because of their importance in the design verification and validation process.

(2) Report (1B) Material Selection, Qualification, and Testing

The I3P and/or OER should review and document:

- (a) The basis for the material selection for each assembly or sub-assembly.
- (b) All Standards used for material characterization for both metallic and non-metallic materials.
- (c) All metallic material selected for pressure containing and pressure controlling components.
- (d) All elastomeric sealing elements and metallic sealing elements, including the location of each element and expected environmental exposures.
- (e) All material properties needed for each material for the design analysis. This will become the basis for acceptance criteria for material testing results.
- (f) All tests that were conducted for each material. These tests may include, but are not limited to, material qualification testing for tension, compression, bending, cyclic loadings, internal pressure, external pressure, temperature, crack growth, and fluid and environmental exposure.
- (g) All material test results. Confirm that the material tests meet or exceed the acceptance criteria established for each material.
- (i) All material Mill Certification Records.

(3) Report (1C) Design Verification Analysis

The I3P and/or OER should sufficiently describe the following elements in their reports:

- (a) The standards that the OEM will use in the design analysis.
- (b) The analysis conducted for each equipment, component, assembly, and sub-assembly, such as strength analysis, fatigue analysis, etc., and the analysis methodology used to address all the potential failure modes identified during the hazards analysis, including fatigue if applicable.

(c) The finite element analysis (FEA) model that was used. The I3P and/or OER should review how the FEA model was validated to ensure accuracy, including an evaluation of the grid density.

(d) The design analysis methods for welding and cladding, plus the specification(s) for heat treatment for the equipment, component(s), assembly(ies), and sub-assembly(ies).

(e) The design analysis methods for critical bolts.

(f) The acceptance criteria for each design analysis method(s) proposed (including key parameters).

(g) Comparison of the design acceptance criteria for structural (strength) analysis and the actual design analysis results.

(h) Fatigue analysis screening and/or fatigue analysis result for each equipment, component(s), assembly(ies), and sub-assembly(ies), including design factor for service life.

(i) Any identified equipment, component(s), assembly(ies), and sub-assembly(ies) for which the I3P and/or OER was not allowed to review the design verification analysis, including a discussion of provisions for I3P validation of any elements, such as sealing elements, that the manufacturer considers to be trade secrets.

(4) Report (1D) Design Validation Testing

The I3P and/or OER should review and document:

(a) The standards that the OEM used for design validation testing, deviations from the standards, and supporting justifications for any deviations.

(b) The test methodology and results that the OEM used for design validation, such as prototype test(s), pressure test(s), nondestructive examination(s), destructive examination(s), life cycle test(s), etc.

(c) The identified potential modes of failure that can reasonably be validated by test, based on the FMECA. The I3P should also identify any validation process or acceptance procedures that are based on something other than the FMECA.

(d) The identified potential modes of operation or failure that cannot be validated by test and the explanation for why validation testing is not possible, including OEM and operator justifications for use of alternate qualification methods. If testing is impractical, the operator and OEM may use simulation(s) in lieu of testing if they can demonstrate that the simulation is representative of a physical test.

(e) The inspection and testing plan for cladding, welding, and heat treatment

specifications.

(f) The acceptance criteria for each proposed test compared to the actual test results.

The reports should include a summary of tests and test results, in which any discrepancies or concerns are highlighted. An operator's or OEM's representative or the I3P or OER (if different than the operator's representative) should witness the critical parts of the validation testing conducted by the OEM. If an operator's or OEM's representative witnessed the Design Validation Testing, they should provide adequate documentation for the I3P and/or OER (if different than the operator or OEM's representative) to review, in addition to the documentation developed by the OEM. Finally, the I3P and/or OER report should specify when insufficient documentation exists for evaluation of validation testing.

(5) **Report (1E)** Load Monitoring (if fatigue is a potential failure mode)

The I3P and/or the OER should review and document:

(a) The proposed load monitoring when the operator or OEM has identified fatigue as a potential mode of failure for a piece of equipment.

(b) How information the operator proposed to collect and record after the equipment has been placed in service will be used to evaluate the equipment for fatigue at a future date.

(6) **Report (1F)** Fabrication, Quality Management System, and Inspection and Test Plan (ITP) that identifies the Quality Control/Quality Assurance process, and Inspections of the final products.

The I3P and/or the OER should review and document:

(a) The proposed equipment fabrication procedures for traceability and quality assurance.

(b) The Quality Management System to be used during the fabrication process.

(c) The Inspection and Test Plan (ITP) for the equipment fabrication processes.

(7a) **Report (1G)** Site Specific Final Report that ties Reports 1A through 1F together.

The I3P and/or the OER should perform the following tasks:

(a) Review the final equipment Technical Specifications. Confirm that the basis of design, material selection, design verification analysis, design validation testing, and fabrication process support the equipment's Technical Specifications. (This may have been completed previously in the Non-Site Specific I3P and/or OER reports. These reports may be referenced if they were marked "Reviewed by BSEE.")

(b) List the Technical Specifications and the Functional Specifications in a tabular form.

(c) Review the Technical Specifications relative to the Functional Specifications (requirements); confirm that the equipment's Technical Specifications meet or exceed the site-specific Functional Specifications, and state that the HPHT equipment is Fit-for-Purpose (as-a-barrier) in the applicable HPHT Environment.

(d) List the critical deficiencies, if any, in basis of design, material selection, design verification analysis, validation testing, and fabrication process for the equipment, components, assemblies, or sub-assemblies.

(7b) Report 1G Non-Site Specific Final Report that ties Reports 1A through 1F together.

The I3P and/or the OER should perform the following tasks:

(a) Review the final equipment Technical Specifications. Confirm that the basis of design, material selection, design verification analysis, design validation testing, and fabrication process support the equipment's Technical Specifications.

(b) List the Technical Specifications in a tabular form.

(c) List the critical deficiencies, if any, in basis of design, material selection, design verification analysis, validation testing, and fabrication process for the equipment, components, assemblies, or sub-assemblies.

NOTE: Only one Report 1G will be submitted as described in 7a or 7b, as applicable.

Appendix 5: Guidance for Design Verification and Validation of HPHT Equipment

(A) HPHT Equipment Design Verification Analysis and Validation Testing when Designing to ASME Section VIII Div 3

An operator must request approval to use ASME Section VIII Division 3, pursuant to 30 CFR 250.141, if the operator would like to use it for the design verification analysis and validation testing for any equipment other than pressure vessels (see 30 CFR 250.851(a), where ASME Section VIII Division 3 is incorporated by reference, and thus required). To enable BSEE to make a determination regarding whether to approve an operator's request pursuant to 30 CFR 250.141, BSEE requires that operators/OEMs perform an additional load case for their Global Plastic Collapse analysis at the site-specific pressure and determine the resulting design load factor. This must be completed when, for example, a piece of wellhead equipment originally designed for 20,000 psi using ASME Section VIII Div 3 is being used at a location with a MASP for the completion case of 17,500 psi. The operator or OEM must evaluate a load case for the Site Specific pressure of 17,500 psi to determine the resulting design load factor for Global Plastic Collapse and report this in the Site Specific Equipment C Plan or the I3P and/or OER reports.

When evaluating combined stresses using linear elastic analysis, operators and OEMs should continue to follow the guidance in API Standard 6X.

(B) Industry Collaboration Efforts such as a Joint Development Agreement (JDA)

BSEE will accept Non-Site Specific Equipment C Plans from the operator representing an industry collaboration effort or JDA. Most of the guidance in this NTL is applicable to Non-Site Specific Equipment. The operator or operator representing an industry collaboration effort or JDA should contact BSEE for additional guidance on Non-Site Specific Equipment.