UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT

NATIONAL NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL, GAS, AND SULPHUR
LEASES, OUTER CONTINENTAL SHELF (OCS)

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Subsea Pumping for Production Operations

Purpose

The purpose of this Notice to Lessees and Operators (NTL) is to provide guidance and clarification on the regulatory requirements for safe and environmentally sound use of subsea pumping as a recovery method in subsea development projects.

Authority

In accordance with the Bureau of Safety and Environmental Enforcement (BSEE) regulations at 30 CFR 250.286-.295, you must submit a deepwater operations plan (DWOP) to enable BSEE to review a deepwater development project and any other project, regardless of water depth, that uses nonconventional production or completion technology. Subsea pumping as a recovery method in subsea development projects is a nonconventional production technology.

In accordance with 30 CFR 250.295, you must revise your DWOP to reflect changes in your development project that materially alter the equipment and systems described in your DWOP. Consequently, if subsea pumping was not included in your approved DWOP, the addition of subsea pumping as a recovery method in a subsea development project requires a revision to your DWOP. This revision must address all equipment and systems affected by the subsea pumping system.

Other BSEE regulations that you should consider when you use subsea pumping as a recovery method include those at 30 CFR 250.802-.804, which prescribe requirements for the design, installation, and operation of surface production-safety systems; additional production system requirements; and requirements for production safety-system testing and records, respectively. Pursuant to 30 CFR 250.198, BSEE has incorporated API RP 14C, Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms, into these three regulatory sections, among others.

Additionally, BSEE regulations contained in 30 CFR 250.1002 prescribe the method for determining the internal design pressure for steel pipe and the design requirements for all pipeline valves, flanges, and flange accessories. Section 250.1002 also specifies the method you must use to determine the maximum allowable operating pressure (MAOP), and state that if the maximum source pressure (MSP) exceeds the pipeline's MAOP, you must install and maintain redundant safety devices that meet the requirements of Section A9 of API RP 14C.

Finally, several BSEE regulations require safe, workmanlike, and environmentally protective operations. *See* 30 CFR 250.107, .300, and 800(a).

Background

For many years, downhole pumping has been used successfully on OCS wells to increase the ultimate recovery of oil and gas reserves. API RP 14C addresses the necessary safety devices for process and pipeline pumps when they are located on a surface facility.

As drilling and production operations have expanded into greater water depths, the need for alternative recovery methods for subsea fields, potentially miles from a host platform, has developed. Based on the design of the subsea system, it may be possible, during upset conditions, for the subsea pump discharge pressure to be greater than the MAOP of the pipeline system, creating the possibility of a release to the environment if other mitigating controls are not in place.

BSEE has begun to approve the use of subsea pumping equipment and methodology in subsea wells, pipelines, and risers via the DWOP process. While the basic requirements of API RP 14C still apply for surface pumping systems, certain clarifications need to be made when you use subsea pumping systems.

Because BSEE recognizes the significant investment you make when you plan to use subsea pumping, it is important for you to understand the kinds of equipment and procedures sufficient to comply with BSEE regulations and the information you must include in a DWOP or revised DWOP that includes subsea pumping equipment. This NTL sets forth information requirements for your DWOP or revised DWOP and describes examples of equipment and procedures sufficient to meet current expectations for safe and environmentally protective operation.

Equipment and Procedures

BSEE regulations require you to perform all operations in a safe, workmanlike, and environmentally protective manner, using the best available and safest technology. When you seek approval in a DWOP or revised DWOP, pipeline application, and/or production safety system application to use subsea pumping as a recovery method, BSEE will evaluate whether your proposed project complies with these provisions. There may be variations of equipment and procedures that comply with the regulations and BSEE will consider each DWOP or revised DWOP, pipeline application, and/or production safety system application on a case-by-case basis.

The following are equipment and procedures you may include in your DWOP that will facilitate prompt approval of the DWOP:

A. If the maximum possible discharge pressure of the subsea pump (maximum shut in tubing pressure (SITP) at the pump inlet and operating in a dead head situation) ***is less*** than the MAOP of the pipeline, information ensuring that a pressure safety high low (PSHL) sensor is installed upstream of the boarding shutdown valve (BSDV) as described in NTL No. 2009-G36.

B. If the maximum possible discharge pressure of the subsea pump operating in a dead head situation ***could be greater*** than the MAOP of the pipeline, information ensuring that you will be:

1. Providing two independent functioning PSHL sensors upstream and two independent functioning PSHL sensors downstream of the subsea pump module to (1) ensure that these PSHL sensors are operational when the subsea pump is in service, and (2) ensure that a PSHL sensor activation shuts down the subsea pump, the pump inlet isolation valve, and the underwater safety valve (USV) (either USV1 or USV2) or the alternate isolation valve (AIV).

Be advised that BSEE will not approve a DWOP that does not provide two functioning PSHL sensors upstream and two functioning PSHL sensors downstream of the subsea pump, in view of regulatory requirements to use best available and safest technology and for safe and environmentally protective operations; therefore, the use of redundant PSHL sensors is highly recommended. More than two sensors may be installed upstream and downstream of the pump for operational flexibility. If three or more sensors are installed upstream and three or more sensors are installed downstream of the subsea pump, then a 2 out of 3 voting logic, or more conservative, may be implemented. If only two sensors upstream and two sensors downstream of the pump are installed, then a trip of either sensor, even if it is determined to be a faulty signal, would shut in the subsea pump.

2. Conducting a subsea pump shutdown test quarterly, not to exceed 120 days between tests. This test may be combined with the required quarterly emergency shutdown (ESD) function test. The test should verify the accuracy, calibration, and operational performance of the dual PSHL sensors located both upstream and downstream of the subsea pump.

3. Performing a complete pump function test (including full shutdown) after any intervention or changes to the software and equipment affecting the subsea pump.

4. Interlocking the subsea pump motor with the BSDV to ensure that the pump cannot start or operate when the BSDV is closed, incorporating the following permissive signals into the control system for your subsea pump, and ensuring that the subsea pump is not able to be started or re-started unless they have been satisfied:

i. The BSDV is open;
ii. All automated valves downstream of the subsea pump are open;
iii. The upstream subsea pump isolation valve is open; and
iv. All alarms associated with the subsea pump operation (pump temperature high, pump vibration high, pump suction pressure high, pump discharge pressure high, pump suction flow low) are cleared or continuously monitored (personnel should

observe visual indicators displayed at a designated control station and have the capability to initiate shut-in action in the event of an abnormal condition).

5. Monitoring the separator for seawater.

6. Ensuring that the subsea pump systems are controlled by an electro-hydraulic control system.

7. Ensuring that if communication with the subsea wells is lost, and there is no ESD or sensor activation, or communication with the subsea pump control system is lost, you will follow the valve closure times in NTL No. 2009-G36 for loss of communication to your wells or as approved in your DWOP for the BSDV, USV1, USV2, AIV, and surface-controlled subsurface safety valve (SCSSV). See Appendix, Table 1.

8. Ensuring that if communication with both the subsea wells and the subsea pump control system is lost, you will follow the valve closure times in NTL No. 2009-G36 for loss of communication to your wells or as approved by your DWOP for the BSDV, USV1, USV2, AIV, and SCSSV; and immediately shut in the subsea pump via the topsides control system. See Appendix, Table 1.

9. Ensuring that if communication is not lost to the subsea wells but is lost to the subsea pump control system, you will immediately shut down the subsea boosting system via the topsides control system. See Appendix, Table 1.

10. Using a High Integrity Pressure Protection System (HIPPS) if there is a possibility of over-pressuring any downstream components.

11. Ensuring that operation of the subsea pump and the pump suction isolation valve(s) adheres to the conditions set forth in the Appendix to this NTL.

Approval Information

A complete DWOP, pipeline application, or production safety system application for a project that includes subsea pumping as a recovery method must include the following information:

A. Deepwater Operations Plan. To enable BSEE to evaluate your proposed subsea pumping equipment and procedures, you must provide the following in your DWOP required by 30 CFR 250.287 or your revised DWOP required by 30 CFR 250.295:

1. In accordance with 30 CFR 250.292(i), a description of the subsea pump system you will use. Specify the maximum pump discharge pressure assuming a closed BSDV (dead head situation) and the maximum possible pressure at the pump suction inlet (the SITP at the pump inlet). Provide a detailed description of the functionality of the pump safety system including permissive signals, safety sensor quantity and type, safety sensor voting logic, system redundancy, and spares.

2. In accordance with 30 CFR 250.292(g), the MAOP of the pipeline and the BSDV. If applicable, provide a statement that attests that the maximum discharge pressure cannot exceed the MAOP of the downstream equipment.

3. In accordance with 30 CFR 250.292(j), new or updated flow schematics starting from the subsea well and including the subsea pump, the BSDV, and downstream to the first relief valve capable of handling maximum well flow on the platform (separator). Include all valves, safety devices, specification breaks, and pressure ratings.

4. In accordance with 30 CFR 250.292(k), a description of how you will monitor the separator for seawater intake.

5. In accordance with 30 CFR 250.292(k), and using the guidance and format provided in the Appendix to this NTL, a valve closure timing table and a valve testing table. Include a procedure for testing of the valve(s) and sensors associated with the subsea pump.

6. Pursuant to 30 CFR 250.292(o), any departure or alternate compliance requests with supporting justification.

B. Pipeline Application. If the subsea pump is capable of over-pressuring the pipeline or BSDV, include a request to use alternate compliance procedures or equipment in lieu of those referred to in 30 CFR 250.1004(b)(9) in your pipeline application required by 30 CFR 250.1000(b). In the request, provide a detailed description of the functionality of the pump safety system including permissive signals, safety sensor quantity and type, safety sensor voting logic, system redundancy, and spares. Reference this submission in your DWOP application.

C. Production Safety System Application. If you propose to use subsea pumping equipment and procedures, make sure that the schematic flow and piping diagrams and Safety Analysis Function Evaluation (SAFE) charts you provide in your production safety system application required by 30 CFR 250.802(e) include a description of the subsea pump system you will use. Specify the maximum pump discharge pressure assuming a closed BSDV (deadhead situation) and the maximum possible pressure at the pump suction inlet (SITP at the pump inlet). Provide a detailed description of the functionality of the pump safety system including permissive signals, safety sensor quantity and type, safety sensor voting logic, system redundancy, and spares.

D. Modifications. Any DWOP or production safety system application approval applies only to the proposal described in the approved plan or application. Because the addition of subsea pumping equipment as an alternate recovery method in subsea development projects materially alters the equipment and systems, you must submit revisions to the DWOP and production safety system application identifying what will be the installed condition and outlining all impacts to safety systems and deviations from the original approval.

Exclusions

A. If you have already received approval from BSEE for any alternative compliance mitigations, valve closure timing, or valve closure testing related to the use of subsea pumping, you may continue to operate as currently approved without submitting the information described in this NTL.

B. If you plan on installing new subsea pumps on a pipeline which ties back to a platform currently operating with this technology, you may propose, in the DWOP or revised DWOP, to use the alternate compliance mitigations, valve closure timing, and valve closure testing schedule previously approved for that platform. You must include the alternate compliance(s) requested and a copy of the BSEE letter(s) that previously approved the alternate compliance request(s).

Guidance Document Statement

The 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 must provide in your various submissions. Under that authority, this NTL sets forth a policy on and an interpretation of a regulatory requirement that provides a clear and consistent approach to complying with that requirement.

Paperwork Reduction Act of 1995 Statement

The information collection referred to in this NTL provides clarification, description, or interpretation of requirements contained in 30 CFR 250, Subparts A, B, H, and J. The Office of Management and Budget (OMB) approved the information collection requirements for these regulations and assigned OMB Control Numbers 1010-0114, 1010-0151, 1010-0059, and 1010-0050, respectively. This NTL does not impose any additional information collection requirements subject to the Paperwork Reduction Act of 1995.

Contact

Please direct any questions you may have regarding this NTL to Christy Lan, Technical Assessment and Operations Support Section, by telephone at (281) 987-6841 or by e-mail at christy.lan@bsee.gov.

Michael R. Bromwich
Director, Bureau of Safety and
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Appendix

Appendix: Subsea Pumping Equipment and Procedures

Table 1: Recommended Valve Closure Timing, Electro-Hydraulic Control System*[8, 9, 10]

Conditions[3]	Pipeline BSDV	USV1[1]	USV2[1]	AIV[2]	SCSSV	Subsea Pumps[6]	Pump Inlet Isolation Valve[5]	LP Hydraulic System	HP Hydraulic System
Subsea pump PSHL[4]	Close within 30 minutes after sensor activation.	One or more valves must close within 2 minutes after sensor activation. Designated USV must close within 20 minutes after sensor activation.			No automatic closure.	Stop immediately (within 30 seconds after sensor activation).	Close within 20 minutes after sensor activation.	No bleed.	No bleed.
BSDV closure (includes process upset, pipeline PSHL, all ESD's and TSE's)	See NTL No. 2009-G36.	See NTL No. 2009-G36.				Stop immediately with electrical disconnect (within 30 seconds after sensor activation).	See footnote 7 below.	See NTL No. 2009-G36.	See NTL No. 2009-G36.
Subsea pump temperature high	No automatic closure.	No automatic closure.				Stop immediately (within 30 seconds after sensor activation).	Close within 20 minutes after sensor activation.	No bleed.	No bleed.
Subsea pump vibration high	No automatic closure.	No automatic closure.				Stop immediately (within 30 seconds after sensor activation).	Close within 20 minutes after sensor activation.	No bleed.	No bleed.
Subsea pump flow low	No automatic closure.	No automatic closure.				Stop immediately (within 30 seconds after sensor activation).	Close within 20 minutes after sensor activation.	No bleed.	No bleed.

* The table provides the maximum allowable closure times for safe and environmentally protective operations.

[1] In order to designate a valve as the USV, locate it upstream of the choke valve. A USV2 is not a regulatory requirement, but the master or wing valve is often qualified per API Spec 6AV1 as a USV by the lessee or operator for operational flexibility.

[2] An alternate isolation valve (AIV) is not a regulatory requirement, but you may choose to install one for operational flexibility. When you have installed an AIV, ensure that the AIV is an API Spec 6A valve to be recognized as an AIV per the table above.

[3] Design the subsea control system to meet the valve closure times listed in this table. Upon installation, verify the valve closure times.

[4] At minimum, locate two independent functioning PSHL sensors upstream of the pump and two independent functioning PSHL sensors downstream of the pump.

[5] Inlet isolation valve to the pump module.

[6] Pump motor must stop within 30 seconds after sensor activation.

[7] Subsea pump isolation valve closure times:
a. Close within 20 minutes after sensor activation for process upset, pipeline PSHL, and platform ESD or TSE not associated with the BSDV.
b. Close within 10 minutes after sensor activation for subsea ESD from the platform or a BSDV TSE.
c. Initiate closure immediately for a subsea ESD from a MODU.

[8.] If communication is lost to the subsea wells and not the subsea pump control system without a ESD or sensor activation, adhere to the valve closure times in NTL No. 2009-G36 for loss of communication to your wells or as approved in your DWOP for the BSDV, USV1, USV2, AIV, and SCSSV.

[9.] If communication is lost to the subsea wells and the subsea pump control system
a. Follow the valve closure times in NTL No. 2009-G36 for loss of communication to your wells or as approved in your DWOP for the BSDV, USV1, USV2, AIV, and SCSSV, and
b. Immediately shut in subsea pump via the topsides control system.

[10.] If communication is not lost to the subsea wells but is lost to the subsea pump control system, immediately shut down the subsea boosting system via the topsides control system.

Table 2: Recommended Valve Closure Testing[2]

Valve	Allowable Leakage Rate	Testing Interval
Primary BSDV	Zero leakage.	Monthly, not to exceed 6 weeks.
Electronic ESD logic	N/A	Monthly, not to exceed 6 weeks.
Electronic ESD function	N/A	Quarterly, not to exceed 120 days.
USV1	400 cc per minute of liquid or 15 scf per minute of gas.	Quarterly, not to exceed 120 days.
SCSSV	400 cc per minute of liquid or 15 scf per minute of gas.	Semiannually, not to exceed 6 calendar months.
Subsea pump shutdown, including PSHL sensors both upstream and downstream of the pump.	N/A	Quarterly, not to exceed 120 days, concurrently with ESD function test.
USV2	N/A[1]	N/A[1]

[1] Should the designated primary USV fail to test or meet the conditions specified in NTL No. 2009-G36, notify the appropriate BSEE District Office and designate another certified subsea valve as the primary USV. Test the newly designated valve for conformance with the conditions specified in this NTL.

[2] Notify and receive approval from the appropriate BSEE District Office before you perform any subsea intervention that modifies the existing subsea infrastructure in a way that may affect the testing frequencies listed in the table above.