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

NTL No. 2019-N04 Effective Date: May 10, 2019

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL, GAS, AND SULPHUR LEASES IN THE OUTER CONTINENTAL SHELF

Calculating Maximum Anticipated Surface Pressure and Expected Surface Pressure for the Completion Case and Estimated Shut-in Tubing Pressure Prior to Production

Purpose

This Notice to Lessees and Operators (NTL) supersedes NTL 2012-N01. Its purposes are to: (1) clarify the definitions of the maximum anticipated surface pressure for the completion case (MASPcc), expected surface pressure for the completion case (ESPcc), and the estimated shut-in tubing pressure (SITP) prior to actual production, (2) clarify how to handle a gas reservoir isolated by cement behind the production casing; (3) describe the conditions when you should use an oil gradient and when you should use a gas gradient to calculate the MASPcc, ESPcc, and the estimated SITP; and (4) incorporate regulatory updates.

The calculation of MASPcc, ESPcc, and the estimated SITP prior to actual production is critical for proper selection of completion and well control equipment. The term ***maximum anticipated surface pressure*** (MASP) for completions used in 30 CFR Part 250, Subpart D – Oil and Gas Drilling Operations, and the term ***expected surface pressure*** (ESP) used in 30 CFR Part 250, Subpart E – Oil and Gas Well-Completion Operations, have the exact same meaning and are derived from the exact same formulas. ***Shut-In tubing pressure*** (SITP), as used in 30 CFR Part 250, Subparts E and F – Oil and Gas Well-Workover Operations, is a measured value determined after the well is placed on production; but, typically, an operator must estimate the value for the SITP before the well is completed in order to ensure that it installs completion equipment that is suited for the operating conditions. The estimated SITP prior to initiation of production, and the terms ESP and MASP for completion, are numerically the same.

Authority

"You" is defined in BSEE regulations at 30 CFR 250.105 as "a lessee, the owner or holder of operating rights, a designated operator or agent of the lessee(s), a pipeline right-of-way holder, or a State lessee granted a right-of-use and easement."

For the purposes of 30 CFR 250.413(f), MASPs are:

> "the pressures that you reasonably expect to be exerted upon a casing string and its related wellhead equipment. In calculating maximum anticipated surface pressures, you must consider: drilling, completion, and producing conditions; drilling fluid densities to be used below various casing strings; fracture gradients of the exposed formations; casing setting depths; total well depth; formation fluid types; safety margins; and other pertinent conditions. You must include [in your Application for Permit to Drill] the calculations used to determine the pressures for the drilling and the completion phases, including the anticipated surface pressure used for designing the production string . . . ."

Under 30 CFR 250.415(a) and (b), your casing and cementing programs must include well design information for: "(1) hole sizes; (2) bit depths (including measured and true vertical depth (TVD)); (3) casing information, including sizes, weights, grades, collapse, and burst values, types of connection, and setting depths (measured and TVD) for all sections of each casing interval; and (4) locations of any installed rupture disks (indicate if burst or collapse and rating);" and "[c]asing design safety factors for tension, collapse, and burst with the assumptions made to arrive at these values."

Your casing and cementing programs must also meet the requirements of 30 CFR 250.420, including certain specified casing and cementing requirements to prevent releases, certification of the casing and cementing design by a registered professional engineer, and specified casing design and cementing requirements. You also must meet the specific design, setting, and cementing requirements for casing strings and liners in 30 CFR 250.421.

Under 30 CFR 250.513, you must meet the requirements for obtaining approval and reporting of well-completion operations, including "a statement of the estimated surface pressure."

Under 30 CFR 250.518, you must ensure that wellhead, tree, and related equipment have a pressure rating greater than the shut-in tubing pressure and are designed, installed, used, maintained, and tested so as to achieve and maintain pressure control.

30 CFR 250.730 sets forth the general requirements for BOP systems and system components. Under section 30 CFR 250.730(a):

> "You must ensure that the BOP system and system components are designed, installed, maintained, inspected, tested, and used properly to ensure well control. The working-pressure rating of each BOP component (excluding annular(s)) must exceed MASP as defined for the operation. For a subsea BOP, the MASP must be taken at the mudline. The BOP system includes the BOP stack, control system, and any other associated system(s) and equipment. The BOP system and individual components must be able to perform their expected functions and be compatible with each other. Your BOP system (excluding casing shear) must be capable of closing and sealing the wellbore at all times, including under anticipated flowing conditions for the specific well conditions, without losing ram closure time and sealing integrity due to the corrosiveness, volume, and abrasiveness of any fluids in the wellbore that the BOP system may encounter."

30 CFR 250.730(a) also requires you to ensure that the BOP system and system components meet the requirements of the industry standards incorporated by reference.

Guidance

The Bureau of Safety and Environmental Enforcement (BSEE) provides the following guidance with respect to how you should calculate MASPcc, ESPcc, and SITP for purposes of complying with these regulatory requirements:

1. You must calculate the MASP (as used in 30 CFR 250.413(f) and 30 CFR 250.730(a)) for the completion case (MASPcc), ESP (as used in 30 CFR 250.513) for the completion case (ESPcc), and the estimated SITP (as used in 30 CFR 250.518(c)) before beginning production. These are calculated using the same methodology and are all numerically equal for the same well. A clear understanding of MASPcc, ESPcc, and the Estimated SITP is critical to prevent harm to people and the environment. To ensure safe operations, you should base the MASPcc, ESPcc, and the Estimated SITP on the lowest density fluid that could enter the wellbore from the reservoir.

2. In 30 CFR 250.413(f), BSEE specifies that the fluid density used to calculate the MASPcc is a critical parameter and that you must use a safety margin in determining the MASPcc. You should base the MASPcc, ESPcc, and the Estimated SITP on the lowest density fluid that could enter the well bore from the reservoir that will indicate the maximum pressure to which the well bore will potentially be exposed. You should not consider the density (ρ) of the completion fluid when calculating the MASPcc, ESPcc, or estimated SITP.

3. 30 CFR 250.730(a) requires that you calculate the MASPcc at the surface for a surface BOP and at the mudline for a subsea BOP. You must likewise calculate the Estimated SITP at the surface for a surface tree and at the mudline for a subsea tree.

4. If the well bore has a gas reservoir behind the primary cement for the production casing or production liner, as defined in 30 CFR 250.421, or if the presence of gas is unknown, you should use a gas gradient to calculate the MASPcc, ESPcc, or estimated SITP. You should use a gas gradient in making these calculations regardless of whether you plan to complete the gas reservoir in the well, unless the well meets the requirements of step #8.

5. When calculating the MASPcc, ESPcc, or estimated SITP, if the properties of the gas are unknown, you should use a dry gas maximum fluid specific gravity (SG) of 0.6 (reference SG_{air}=1.0), and determine the fluid specific density (ρ) based on the maximum reservoir pressure, appropriate wellbore thermal gradient, and the appropriate gas compressibility factor (z).

6. If you have determined the reservoir fluid pressure-volume-temperature (PVT) (gas) properties though laboratory analysis, you may use the specific properties of the reservoir gas to determine the gas gradient.

7. If the wellbore does not intersect a gas reservoir, but an oil reservoir contacts the cemented section of the production casing or production liner, as defined in 30 CFR 250.421, you may use an oil gradient to calculate the MASPcc, ESPcc, or estimated SITP for the well completion, provided:

a. Using well log data, you can demonstrate the absence of a gas reservoir within the hydrocarbon bearing zones of the producing interval;

b. You use a fluid specific density based on the reservoir fluid PVT (oil and gas) properties, the maximum source pressure, and the appropriate wellbore thermal gradient; and

c. You use an oil gradient of 0.23 psi/foot for the initial completion in the zone if the reservoir fluid PVT (oil and gas) properties are not known from laboratory analysis.

8. If the wellbore has a gas reservoir isolated by cement behind the production casing or production liner, as defined in 30 CFR 250.420, you may submit a request to use alternate procedures under 30 CFR 250.141. Such a request should include technical justifications for the use of an oil gradient to calculate the MASPcc, ESPcc, or the estimated SITP for the proposed well completion and demonstrate that:

a. You will not produce the gas reservoir at any point in the life of the well;

b. You have verified zonal isolation and top of cement. In accordance with 30 CFR 250.420, you must submit a certification from a registered professional engineer, who has reviewed the cement evaluation log to ensure the gas zone will not be in communication with the oil zone. You should also provide brief documentation to demonstrate that the reviewer is a qualified expert in the area of cement quality evaluation.

c. You have evaluated the tubing, casing, and liner for a survival case using a gas gradient. BSEE considers a survival case to be an accidental overload resulting from a failure within the wellbore and will not approve operations under such a condition. However, BSEE requests that you verify that the tubing, casing, and liner will survive such an accidental overload. When evaluating the tubing and casing for the survival case, you should design all factors for internal burst, collapse, buckling, and tensile yield to be greater than or equal to one. Your survival case analysis should consider the design factors for tubing and casing based on maximum pressure encountered anywhere in the wellbore.

d. You have submitted a well survival case analysis when using a gas gradient. You should use the following methods for the determination:

i. When calculating the MASPcc, ESPcc, or estimated SITP, if the properties of the gas are unknown, use a dry gas maximum fluid specific gravity (SG) of 0.6 (reference SGair=1.0), and determine the fluid specific density (ρ) based on the maximum reservoir pressure, appropriate wellbore thermal gradient, and the appropriate gas compressibility factor (z).

ii. If you have determined the gas reservoir fluid PVT properties through laboratory analysis, you may use the specific properties of the reservoir gas to determine the gas gradient.

e. You have ensured that proper installation of casing in the subsea wellhead or liner in the liner hanger as required in 30 CFR 250.423

Guidance Document Statement

BSEE issues NTLs as guidance documents in accordance with 30 CFR 250.103 to clarify and 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 (PRA) Statement

The Office of Management and Budget (OMB) has approved the information collection requirements in 30 CFR Part 250, Subparts D, E, and G and assigned OMB Control Numbers 1014-0018, 1014-0004, and 1014-0028, respectively. 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*.).

Contact

If you have any questions regarding this NTL, contact:

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