

Final Report



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Cost to Industry for Proposed 2022 Changes to BSEE's Well Control Rule

Prepared for:
**American Petroleum
Institute - API**

Purpose:

Provide an independent estimate
of the cost to the O&G industry for
the proposed 2022 changes to
BSEE's Well Control Rule.

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1 Executive Summary

The American Petroleum Institute (API) asked Blade Energy Partners, Ltd. (Blade), an independent technical consulting company, to assist in developing an estimate of the cost, to the industry, that the BSEE 2022 Well Control Rule (WCR) proposed changes will require.

This report outlines the methodology used to perform the cost estimate and this estimate is compared to the figures published by BSEE in their proposed Rule change.

Of the seven Rule changes proposed, three have the potential to significantly impact the industry.

- Modification of § 250.730(a) to require that the BOP system be capable of closing and sealing the wellbore at all times to the well's maximum kick tolerance design limits.
- An addition to § 250.732(b) to require that an independent third party must be accredited by a qualified standards development organization and that BSEE may review the independent third party's accreditation and qualifications to ensure that it has sufficient capabilities to perform the required functions.
- An addition to § 250.733(b)(1) to require that an operator also must follow the BOP requirements of § 250.734(a)(1) when replacing an entire surface BOP stack on an existing floating production facility.

The remaining proposed changes are believed, by industry, to present only minor effects.

The cost of initial estimated industry compliance - at \$200 million - is significantly higher than BSEE's cost estimate. Industry compliance estimated cost is subject to the number of industry floating production facilities that require modification and to the extent that those facilities' modifications will need to accommodate replaced BOP stacks. Since production facility modifications may entail significant structural changes, the cost of each facility modification may be great, and number of facilities requiring modification will need to be determined – possibly 25.

The minimum estimated time required for industry to comply with these proposed rule changes is two years or more, subject to extent of each production facility's required modification.

The intended use of this information is to provide feedback to BSEE prior to finalization of the proposed rule changes. It is suggested that the industry request BSEE to provide a minimum two and one-half years grace period in order to fully comply with the changes proposed for § 250.730(a) and for § 250.734(a)(4).

This Cost Estimate is based on industry understanding of BSEE's Proposed Changes to the WCR currently published, and is subject to certain reasonable industry assumptions and estimations. BSEE clarifications or adjustments to the current WCR Proposed Changes can change industry's Cost Estimate.

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2 Introduction

On September 14, 2022, the U.S. Department of Interior's Bureau of Safety and Environmental Enforcement (BSEE) issued proposed Well Control Rule changes to the Code of Federal Regulations. The public comment period on these proposed changes ends on November 14, 2022. The American Petroleum Institute (API) asked Blade Energy Partners (Blade) to assist in developing an estimate of the cost, to the industry, that these proposed changes will require.

In their proposal, BSEE provided their estimated cost to industry associated with the proposed changes to the BOP and well control regulations, shown in Table 1.

Table 1: BSEE's Estimated Cost

Year	Undiscounted	Discounted at 3%	Discounted at 7%
2023	\$1,801,301	\$1,801,301	\$1,801,301
2024	\$1,357	\$1,317	\$1,268
2025	\$1,357	\$1,279	\$1,185
2026	\$1,357	\$1,242	\$1,108
2027	\$557,653	\$495,467	\$425,431
2028	\$1,357	\$1,171	\$967
2029	\$1,357	\$1,136	\$904
2030	\$1,357	\$1,103	\$845
2031	\$1,357	\$1,071	\$790
2032	\$1,357	\$1,040	\$738
Total	\$2,369,809	\$2,306,128	\$2,234,537
Annualized	\$236,981	\$270,349	\$318,148

In a meeting between industry representatives and the API, it was agreed that the BSEE estimated cost is likely to be a few orders of magnitude too low, and that the industry needs to provide a more realistic estimate of the cost.

Seven changes have been proposed by BSEE, which are listed in Table 2. Those with a potential to significantly impact the industry are highlighted.

Table 2: BSEE's Proposed Changes to the BOP and Well Control Regulations

Change No.	Code Reference	Existing Clause	Proposed Clause
1	§ 250.730(a)	BOP system must be capable of closing and sealing the wellbore in the event of flow due to a kick, including under anticipated flowing conditions for the specific well conditions	BOP system must be capable of closing and sealing the wellbore at all times to the well's maximum kick tolerance design limits.
2	§ 250.730(c)	Removing, throughout the paragraph, the option for submission of failure reporting to a designated third party	N/A
3	§ 250.730(c)(2)	The operator starts a failure investigation and analysis within 120 days of the failure	The operator starts a failure investigation and analysis within 90 days of the failure
4	§ 250.732(b)	N/A	An independent third party must be accredited by a qualified standards development organization and that BSEE may review the independent third party accreditation and qualifications to ensure that it has sufficient capabilities to perform the required functions.
5	§ 250.733(b)(1)	N/A	An operator also must follow the BOP requirements of § 250.734(a)(1) when replacing an entire surface BOP stack on an existing floating production facility.
6	§ 250.734(a)(4)	N/A	The operator must have the Remotely Operated Vehicle (ROV) intervention capability to both open and close each shear ram, ram locks, and one pipe ram.
7	§ 250.734(d)(2)(i)	N/A	If BSEE is unable to witness the testing, the operator must provide the initial test results to the appropriate District Manager within 72 hours after completion of the tests.
	§ 250.734(d)(3)(iii)		

Of the seven changes proposed, three have the potential to significantly impact the industry.

- Modification of § 250.730(a) to require that the BOP system be capable of closing and sealing the wellbore at all times to the well's maximum kick tolerance design limits.
- An addition to § 250.732(b) to require that an independent third party must be accredited by a qualified standards development organization and that BSEE may review the independent third

party (I3P) accreditation and qualifications to ensure that it has sufficient capabilities to perform the required functions.

- An addition to § 250.733(b)(1) to require that an operator also must follow the BOP requirements of § 250.734(a)(1) when replacing an entire surface BOP stack on an existing floating production facility.

§ 250.730(a) and § 250.733(b)(1) represent significant economic potential, while § 250.732(b) has the potential to impact the time needed to comply.

The remaining proposed changes are believed, by industry, to present only minor effects.

While the burden of these changes lies with the BOP manufacturers and oil and gas lease operators, Blade has made, with support from industry, an estimate of the time and potential cost needed to comply with these three proposed rule changes.

3 Conclusions and Results

The cost, to the industry, of compliance is estimated to be approximately \$202 million over a ten-year period. A summary is presented in Table 3.

Table 3: Estimated Non-Discounted Cost to Industry of Proposed Changes in Millions of Dollars

Code Reference	Rule Change	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	10-Yr Total	Notes
§ 250.730(a)	BOP system must be capable of closing and sealing the wellbore at all times to the well’s maximum kick tolerance design limits.	\$32.69	\$24.84	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$57.53	①
§ 250.730(c)	Option for submitting failure reports removed.	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$1.50	②
§ 250.730(c)(2)	The operator starts a failure investigation and analysis within 90 days of the failure.	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	③
§ 250.732(b)	An independent third party must be accredited by a qualified standards development organization and that BSEE may review the independent third party accreditation and qualifications to ensure that it has sufficient capabilities to perform the required functions.	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	④
§ 250.733(b)(1)	An operator also must follow the BOP requirements of § 250.734(a)(1) when replacing an entire surface BOP stack on an existing floating production facility.	\$25.25	\$25.25	\$25.25	\$25.25	\$25.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$126.25	⑤
§ 250.734(a)(4)	The operator must have the Remotely Operated Vehicle (ROV) intervention capability to both open and close each shear ram, ram locks, and one pipe ram.	\$6.25	\$6.25	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50	\$16.50	⑥
§ 250.734(d)(2)(i)	If BSEE is unable to witness the testing, the operator must provide the initial test results to the appropriate District Manager within 72 hours after completion of the tests.	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	⑦
§ 250.734(d)(3)(iii)													
Annual Totals:		\$64.34	\$56.49	\$25.90	\$25.90	\$25.90	\$0.65	\$0.65	\$0.65	\$0.65	\$0.65	\$201.78	

NOTES:

- ① Estimated to take 21.5 months to comply with the proposed requirement.
- ② Reporting becomes mandatory. Effort to comply is minimal.
- ③ Effort to comply is minimal.
- ④ Assumes no delays due to BSEE reviews or additional cost for accreditation. Note, that in the 2019 WCR, BSEE never produced a list of approved I3P certifiers that they required, and the requirement was eventually removed. If BSEE reviews and rejects credentials and accreditations, there will be a delay in I3P services that could take up to a year to rectify. Here, they don't mention a list, but we have no guarantee that I3P providers will be approved if BSEE elects to review them. If BSEE reviews and rejects credentials and accreditations, there will be a delay in I3P services, it could take up to a year to rectify.
- ⑤ Assumed compliance effort: 8 facilities need no modification, 6 will require minor, 8 will require average, and one will require extensive modifications. Facility modifications are anticipated to take 5 years with the cost is spread evenly over that time period.
- ⑥ Assumes 25 SS BOP stacks are modified in each of the first 2 years and 2 per year thereafter.
- ⑦ Effort to comply is minimal.

The majority of this cost is expected in the first five years following adoption of the proposed rules, as seen in Figure 1.

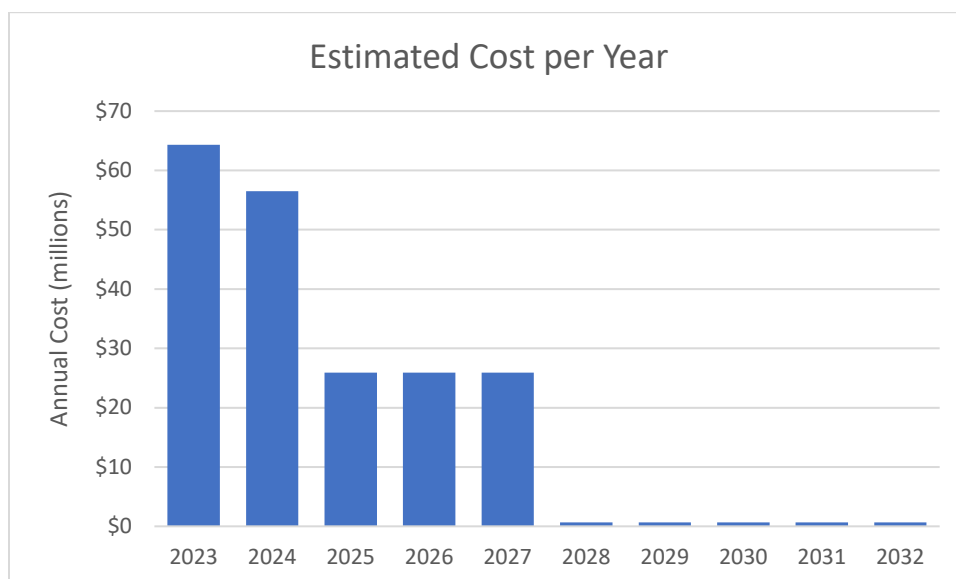


Figure 1: Industry Estimated Annual Cost of Compliance

The cost of compliance, estimated by industry, is significantly higher than the cost estimated by BSEE.

Two of the proposed rule changes account for the majority of the anticipated cost; § 250.730(a) and § 250.733(b)(1).

The estimated time required for industry to comply with changes to § 250.730(a), if testing is required for compliance, is just over two years (27 months) at an estimated cost of \$57.5 million. However, by prioritizing the configurations to be tested, compliance should be achievable in 2 years.

Facility modifications are expected to take much longer to implement, because a facility's structure may require significant change. The need and extent of each modification is largely determined by how BSEE interprets the Rule. If the rule change to 250.733(b)(1) is interpreted conservatively, the cost can be substantial. In any case, the actual calendar start time for facility modification is driven by the facility's need to change out a BOP stack in conjunction with the BOP 5-year tear-down and inspection requirement. The time to comply with this proposed rule change is set at 5 years. Facility modifications, if the Rule is interpreted conservatively, is anticipated to cost the industry approximately \$126 million over the 5-year period following adoption of the Rule change.

The following sections describe the rationale for this estimate.

4 § 250.730(a)

BOP system must be capable of closing and sealing the wellbore at all times to the well's maximum kick tolerance design limits.

BSEE defines kick tolerance as the maximum volume of gas kick influx that can be safely taken into the well bore and circulated out of the well without breaking down the surrounding formation.

The BOP manufacturers are being asked to provide equipment that will close and seal on a given well's kick tolerance design limits. Not knowing the well particulars, this will be difficult to estimate.

One approach might be to use operators' kick tolerance policies to estimate the surface shut in pressures where the shoe does not break down. Then calculate the associated flow. However, we still do not know the reservoir and influx properties to perform this second calculation.

Another approach would be to use statistical flow rate data from industry sources, such as SINTEF, and apply these flow rates at the BOP's rated working pressure.

A more accurate approach would be to calculate the inflow performance over a range of KH values typical for the US GOM and for the expected drawdown pressures during the initial flow phase, using a range of influx properties. With all these ranges defined, simulations can be performed to determine the range of initial flow rates and resulting shut in pressures. Finally, a flow scenario can be chosen that satisfies some acceptable level of confidence, and a flowing shut in and seal test designed accordingly.

The estimated time required to gather the data and perform the simulations needed to design the test is approximately 40 man-days at an estimated cost of \$153,000, if performed individually.

If a joint industry project (JIP) is formed to define the probability distributions for flow rate and shut in pressure, the total cost, to industry, is estimated at \$198,000, or \$66,000 per manufacturer. Regardless, each manufacturer will still have to select a flow scenario that satisfies their company's internal confidence criteria. This is expected to cost an additional \$15,000 per manufacturer.

Next, each manufacturer will need to construct a test apparatus, consisting of the BOP cavity, required instrumentation and a circulating system. This is estimated to cost \$2,183,333 per manufacturer, assuming test facilities are shared.

Finally, each manufacturer will need to test a variety of ram sets to demonstrate their closing and sealing capability. Assuming 18 ram types (7 pipe ram, 4 variable-bore, and 7 blind-shear ram) are tested (see Table 4), and that the test is performed on 8 ram size and pressure rating configuration (see Table 5), the estimated cost is estimated to be 49,680,000 over the first two years following adoption of the proposed rule.

The total cost of compliance, for implementing this rule change, follows at an estimated \$57,528,000, assuming that each manufacturer's equipment can pass the flowing shut in test without be modified.

Table 4: Assumed VBR, Pipe and Shear Ram Configurations Requiring Verification

Common Variable Bore Rams		Assumed for Estimate	Common Pipe and Shear Rams		Assumed for Estimate
BOP Size and Working Pressure	Pipe Size Range		BOP Size and Working Pressure	Pipe Size	
7-1/16" 3, 5, 10 & 15M	3-1/2" to 2-3/8" 4" to 2-7/8"		7-1/16" 3, 5, 10 & 15M	2-3/8" 2 7/8" 3 1/2" 4"	
11" 3 & 5M	5" to 2-7/8"				
11" 10M	5" to 3-1/2"				
11" 15M	5" to 2-7/8"	✓			
13-5/8" 3, 5, 10 & 15M	7" to 4-1/2" 5-7/8" to 3-1/2"		11" 3, 5, 10 & 15M	2 7/8" 3 1/2" 4" 5"	✓ ✓
13-5/8" 3, 5 & 10M	5-1/2" to 3-1/2" 5" to 2-7/8"				
13-5/8" 15M	7" to 5" 5-7/8" to 3-1/2" 5" to 3-1/2"	✓ ✓	13-5/8" 3, 5, 10 & 15M	3 1/2" 4" 5" 5 7/8" 6 5/8"	✓
16-3/4" 3 & 5M	7" to 3-1/2"				
16-3/4" 10M	7" to 5" 5" to 2-7/8" 5-1/2" to 3-1/2"		16-3/4" 3, 5 & 10M	3 1/2" 5" 5 7/8" 6 5/8"	
18-3/4" 10 & 15M	7-5/8" to 3-1/2"	✓	18-3/4" 10 & 15M	3 1/2" 5" 5 7/8" 6 5/8"	✓ ✓ ✓
21-1/4" 5 & 10M	5-7/8" to 2-7/8"		21-1/4" 5 & 10M	5" 5 7/8" 6 5/8"	✓

Table 5: Assumed Ram Cavity Configurations Requiring Verification

Common API SPEC 16A BOP's		Assumed for Estimate
(in.)	(psi)	
26 3/4	3,000	
	3,000	
21 1/4	5,000	✓
	10,000	✓
20 3/4	3,000	
18 3/4	10,000	✓
	15,000	✓
13 5/8	5,000	
	10,000	✓
	15,000	✓
11	5,000	
	10,000	✓
	15,000	✓
7 1/16	5,000	
	10,000	
	15,000	

5 § 250.730(c)

Option for submitting failure reports removed from the code.

This change makes failure reporting directly to BSEE mandatory. We expect minimal cost (\$150,000 per year) to generate new bi-monthly process for redacting reports, bi-monthly legal review and direct submission of reports to BSEE.

6 § 250.730(c)(2)

The operator starts a failure investigation and analysis within 90 days of the failure.

This change is not anticipated to financially impact the industry. Industry impact is anticipated relating to timing, since industry expects it takes approximately 120 days to remove equipment, transport to OEM or specific other location, and set up prior to starting failure analysis.

7 § 250.732(b)

An independent third party must be accredited by a qualified standards development organization and that BSEE may review the independent third party accreditation and qualifications to ensure that it has sufficient capabilities to perform the required functions.

This change is not anticipated produce a cost impact to the industry, assuming there are no delays arising from BSEE reviews or additional cost for accreditation.

Note, that in the 2016 WCR, BSEE never produced a list of approved I3P certifiers that they required, and the requirement was eventually removed. If BSEE reviews and rejects credentials and accreditations of potential I3P certifiers, there will be a delay in I3P services that could take up to a year to rectify.

8 § 250.733(b)(1)

An operator also must follow the BOP requirements of § 250.734(a)(1) when replacing an entire surface BOP stack on an existing floating production facility.

To comply with § 250.734(a)(1), the existing surface BOP arrangement may have to be augmented to include the required number of ram-type BOP's. The existing surface BOP requirements call for one annular, two pipe rams and one shear ram. The proposed requirement adds one additional shear ram.

If not already configured so, the additional ram increases the BOP stack height by approximately 2.5 to 4 feet. If the topside structure does not accommodate this BOP stack height increase, it will have to be modified.

These modifications conceptually include the following:

- Cease production and temporarily suspend all wells at the facility.
- Increase the well bay deck height by approximately three feet.
- Modify all ancillary piping, BOP conveyance systems, electrical systems, plumbing and safety systems to accommodate the deck height change.
- Verify that the height increase does not affect the facility's stability.
- Unsuspend the wells and resume production.

This impact is very difficult to estimate. Assuming a spar or TLP's total cost is on the order of \$1 billion, and assuming 2.5% of that cost will be required for a retrofit, we estimate the average retrofit cost to be \$25,000,000 per facility requiring modification. We note that retrofit costs could be substantially higher, or not required at all, and this uncertainty is largely controlled by BSEE's interpretation of the Rule.

On the low end, we can assume no changes, and no associated cost, are required.

For minor upgrades, we assume that no platform modifications will be required, other than re-piping and minor structural changes to accommodate the increased stack height. This cost is estimated at \$250,000 for piping and \$1,000,000 for minor structural changes.

On the high end, we will limit the retrofit cost to 10% of total facility cost. Given this assumption, we estimate the cost to be as high as \$100,000,000 per retrofit, if required. Anything beyond this would likely become uneconomic for the facility's operator.

To estimate the number of facilities, and the level of effort required to comply, we note that out of the nearly 3,200 offshore facilities in the GOM, 50 are in water depths greater than 1,000 ft of water. We note that only a portion of these support drilling operations.

For this exercise, we will assume that there are 25 facilities that will potentially be affected, with the following levels of modification:

- 8 facilities requiring no modification
- 6 facilities requiring minor modification
- 10 facilities requiring average modification
- 1 facility requiring extensive modification

The cost of compliance is then estimated as shown in Table 6.

Table 6: Industry Estimated Cost to Comply with § 250.733(b)(1)

Level of Effort to Comply	Affected Facilities	Cost per Facility	Cost to Industry
No modification	8	\$0	\$0
Minor modification	6	\$1,250,000	\$7,500,000
Average modification	10	\$25,000,000	\$250,000,000
Extensive modification	1	\$100,000,000	\$100,000,000
Totals:	25		\$126,250,000

Assuming these changes are completed in a five-year timeframe, the total cost to industry to comply with this rule change is estimated at \$25,250,000 per year, for the first 5 years following the rule change.

9 § 250.733(a)(4)

The operator must have the Remotely Operated Vehicle (ROV) intervention capability to both open and close each shear ram, ram locks, and one pipe ram.

Installation of a new ROV panels on each SS BOP stack is estimated to be \$250,000 each. Assuming 50 deepwater rigs operate in the GOM in a given year, and that all their ROV panels can be modified in a two-year period, the estimated cost is \$6,250,000 per year for the first two years following adoption of the rule.

Assuming that two rigs enter the GOM on an annual basis that require this modification, the annual cost, following the initial modification period, is \$500,000 per year.

10 § 250.734(d)(2)(i) and § 250.734(d)(3)(iii)

If BSEE is unable to witness the testing, the operator must provide the initial test results to the appropriate District Manager within 72 hours after completion of the tests.

There is no anticipated cost impact for this rule change, and the effort to comply is minimal.