RFF REPORT

The 2016 Blowout Preventer Systems and Well Control Rule

Should It Stay or Should It Go?

Alan J. Krupnick and Isabel Echarte

RFF Report Series: *The Costs and Benefits of Eliminating or Modifying US Oil and Gas Regulations*

MAY 2018

RESOURCES FOR THE FUTURE

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This report is one in a series: The Costs and Benefits of Eliminating or Modifying US Oil and Gas Regulations.

Resources for the Future (RFF) is an independent, nonprofit research institution in Washington, DC. Its mission is to improve environmental, energy, and natural resource decisions through impartial economic research and policy engagement. RFF is committed to being the most widely trusted source of research insights and policy solutions leading to a healthy environment and a thriving economy.

Executive Summary

The Trump administration has prioritized increasing the production of US oil and natural gas, in part through reducing federal regulatory burdens that it says restrict development. President Trump signed Executive Order (EO) 13783 in March 2017, requiring agencies to review existing rules, guidance documents, and policies that potentially burden the development or use of domestically produced energy resources.[1] In response, the US Department of the Interior (DOI) flagged a 2016 Bureau of Safety and Environmental Enforcement (BSEE) safety rule governing offshore oil and gas development—herein referred to as the well control rule (also sometimes called the blowout preventer [BOP] rule)[2]—for review in a document outlining the agency's deregulatory efforts.[3]

The Trump administration has also focused on reducing regulatory costs across the federal government more broadly with EO 13771, which ordered that two regulations be removed for every regulation implemented.[4]

Subsequent guidance from the Office of Management and Budget (OMB)[5] for implementing EO 13771 emphasized that cost-benefit analysis is required for all major regulations being considered for elimination or modification (as has been the practice for new regulations since President Reagan's EO 12291).[6] But the OMB guidance and EO 13771 also laid out the controversial requirement that only the cost savings from repeal be considered in prioritizing rules for repeal; in other words, only cost savings (and not forgone benefits or net benefits) are to be counted when reviewing regulations under the two-for-one requirement. In a March letter to the Trump administration, 96 economists and other experts expressed concerns about this requirement.[7]

Following these actions, we sought to first catalog existing federal regulations promulgated after 2005 and non-regulatory

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[1] Executive Office of the President. 2017. Executive Order 13783: Promoting Energy Independence and Economic Growth. *Federal Register* 82(61): 16093, March 28. https://www.federalregister.gov/documents/2017/03/31/2017-06576/promoting-energy-independence-and-economic-growth.

[2] Bureau of Safety and Environmental Enforcement (BSEE). 2016. Oil and Gas and Sulfur Operations in the Outer Continental Shelf—Blowout Preventer Systems and Well Control. *Federal Register* 81: 25888, April 29. https://www.gpo.gov/fdsys/pkg/FR-2016-04-29/pdf/2016-08921.pdf.

[3] DOI. 2017. Final Report: Review of the Department of the Interior Actions That Potentially Burden Domestic Energy. *Federal Register* 82: 50532, October 24. https://www.federalregister.gov/documents/2017/11/01/2017-23702/final-report-review-of-the-department-of-the-interior-actions-that-potentially-burden-domestic.

[4] Executive Office of the President. 2017. Executive Order 13771: Reducing Regulation and Controlling Regulatory Costs. *Federal Register* 82(22): 9339, February 3. https://www.federalregister.gov/documents/2017/02/03/2017-02451/reducing-regulation-and-controlling-regulatory-costs.

[5] OMB. 2017. Guidance Implementing Executive Order 13771, Titled "Reducing Regulation and Controlling Regulatory Costs." April 5. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-21-OMB.pdf.

[6] Executive Office of the President. 1981. Executive Order 12291: Federal Regulation. *Federal Register* 46: 13193, February 17. https://www.archives.gov/federal-register/codification/executive-order/12291.html.

[7] Linn, Joshua, and Alan J. Krupnick, et al. 2017. Ninety-Six Regulatory Experts Express Concerns about Trump Administration Reforms. Washington, DC: Resources for the Future, May 24. http://www.rff.org/blog/2017/ninety-six-regulatory-experts-express-concerns-about-trump-administration-reforms.

federal activities of concern to the oil and gas industry.[8] We then turned toward assessing what the effects on industry and the public might be if some of these regulations were eliminated, modified, or delayed. To analyze these impacts, we updated the parameters used by each agency in their original Regulatory Impact Analyses (RIAs) and assessed the cost savings from and forgone benefits of repealing and modifying the following rules:

- the Bureau of Land Management's (BLM's) "Waste Prevention, Production Subject Royalties, and Resource Conservation" rule;
- the Environmental Protection Agency's (EPA's) "Oil and Natural Gas Sector: Emissions Standards for New, Reconstructed, and Modified Sources New Source Performance Standards" rule;
- BSEE's "Oil and Gas and Sulfur Operations in the Outer Continental Shelf—Blowout Preventer Systems and Well Control Rule";
- the Pipeline and Hazardous Materials Safety Administration's (PHMSA's) "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" rule;
- BSEE's and Bureau of Ocean Energy Management's (BOEM's) "Oil and Gas and Sulphur Operations on the Outer Continental Shelf—Requirements for Exploratory Drilling on the Arctic Outer Continental Shelf" rule; and
- PHMSA's "Pipeline Safety: Integrity Management Program for Gas Distribution Pipelines" rule.

This report analyzes the Obama administration's 2016 well control rule and the impacts of repeal or modification. With the rule, DOI sought to increase the safety of offshore drilling and reduce the risk of catastrophic oil spills following the 2010 *Deepwater Horizon* spill, mainly through increased requirements related to blowout preventer (BOP) systems and monitoring. In the accompanying RIA, BSEE estimated the rule would have net benefits over 10 years of $446 million to $533 million at 7 percent and 3 percent discount rates, respectively (in 2012$; see Table 1). Because the Trump administration flagged the rule for review, we assess the cost savings and benefits forgone associated with repealing the rule and the costs and benefits of modifying the rule.

As this report went to press, the Trump administration stated that it would be publishing its proposed revision of the well control rule soon.[9] Our analysis was conducted and written prior to publication of the proposed modification.

We replicated BSEE's 2016 analysis and reanalyzed the benefits and costs of the rule, taking into account any sunk costs that operators have incurred since the implementation of the rule. Our baseline scenario updates the rule by assuming that onetime costs from 2016 are sunk, which decreases the costs and raises the net benefits of keeping the rule. Our baseline likewise assumes that a deregulatory provision in the 2016 rule will not be repealed alongside the regulatory provisions. A large share of the rule's benefits (as estimated by BSEE) goes to industry because of this deregulatory provision, which reduces the frequency of a required test—from once every 7 days to once

[8] Information about this catalog will be included in a forthcoming report summarizing the results of the project.

[9] BSEE. 2018. "BSEE Sustains Safety and Environmental Protection while Reducing Regulatory Burden. April 27. https://www.bsee.gov/newsroom/latest-news/statements-and-releases/press-releases/bsee-sustains-safety-and-environmental.

every 14 days. This provision provides 98 percent of the benefits of the rule ($1.1 billion to $1.3 billion over 10 years), while the remaining 2 percent of benefits (as estimated by BSEE) are from the external benefits (i.e., to the environment) of the rule from reducing future oil spills.

Repealing the rule as a whole, using the estimates in BSEE's original RIA, results in net costs of $446 million to $533 million. But repealing only the regulatory provisions (and maintaining the deregulatory provision) results in large net benefits—of $578 million to $676 million over 10 years (see repeal baseline in Table 1) according to BSEE's original analysis. These results are highly uncertain and likely to be an underestimate according to the RIA. The input with the greatest influence on the magnitude of the external benefits of the rule—how much the rule will lower the probability of a major spill—is also the most uncertain. We explore this issue in the body of this report. Below, we estimate the risk reduction needed for the rule's external benefits to match its costs.

Although the degree to which the risk of an oil spill is reduced as a result of implementing the rule is effectively unknown, the 2016 RIA assumed a 1 percent reduction in risk, which it considered a very low estimate of the actual risk reduction.[10] The repeal baseline benefits forgone in Table 1 are therefore likely an underestimate of the external benefits of keeping the well control rule. Because of the large uncertainty regarding this estimate, we conduct a break-even analysis to explore the risk reduction level needed under a few scenarios that would allow the external benefits alone to match the costs of the keeping the rule (and the forgone benefits to match the cost savings when repealing the rule).

Table 1. Total 10-Year Net Benefits, Net Present Value (million 2012$)

	3% discount rate			7% discount rate		
KEEPING RULE						
	Costs	Benefits	Net benefits	Costs	Benefits	Net benefits
Original RIA	765	1,296	533	663	1,109	446
Baseline	698	1,297	598	597	1,109	512
REPEALING RULE						
	Costs avoided	Benefits forgone	Net benefits of repeal	Costs avoided	Benefits forgone	Net benefits of repeal
Original RIA	765	1,296	(533)	663	1,109	(446)
Repeal baseline	698	23	676	597	19	578

[10] In the original analysis, BSEE used a "lower bound" risk reduction figure of 1 percent but stated that "in BSEE's expert opinion, the actual risk reduction from the rule will likely be substantially higher than [one] percent" (BSEE 2016a, 62).

Table 2 produces the results for the break-even analysis. The percentages on the right show the risk reduction needed for the external benefits alone (excluding the benefits from the deregulatory provision) to match the costs of the rule over a number of scenarios. In most of our scenarios, the break-even risk reduction ranges from as low as 6 percent up to 32 percent, with only one break-even risk reduction level being implausible (i.e., it is above 100 percent).

TABLE 2. BREAK-EVEN RISK REDUCTION ANALYSIS

Scenario	Risk reduction needed to break even
Repeal baseline	31%
Lower per-barrel spill cost estimate*	148%
Higher onetime catastrophic cost estimates**	23%
BP onetime cost of catastrophic event†	6%
Lower frequency of catastrophic events‡	32%

*Social cost per barrel of $693 (from Cohen [1986] in 2012$ with oil prices at $50 per barrel).

**A measure of the aggregate willingness-to-pay to prevent events like the *Deepwater Horizon* well blowout, from Bishop et al. (2017) of $17.2 billion.

†Higher social cost of catastrophic event of about $50 billion, BP's total payments for the *Deepwater Horizon* blowout minus the BSEE-estimated social cost of the spill using the agency's per-barrel social cost metric.

‡Lower spill frequency of 0.00003, averaged BOEM estimates of probability of high-volume catastrophic spill events (BOEM 2012, 42).

We do not consider adjustments to cost assumptions, but we do consider a number of scenarios that affect the benefits of repealing the rule:

- lowering the estimate for the social cost per barrel (bbl) of oil spilled;
- raising the estimate for the social cost of a catastrophic oil spill;
- lowering the future catastrophic oil spill frequency;
- assuming a higher level of oil spill risk reduction; and
- using a higher risk reduction and higher social cost of a catastrophic oil spill.

The above scenarios for repealing the rule lead to net benefits, with one exception—the combination of a higher risk reduction and a higher social cost of a catastrophic oil spill. Given the lack of information regarding the effectiveness of the well control rule, the highly uncertain benefits, and the immense consequences of such a spill—including impacts on tourism and fishing in local economies, risks to human safety, and effects on ecosystems—a risk-averse regulator might choose to not repeal the regulatory requirements.

We also consider one scenario for modifying the rule:

- further relaxing the deregulatory provision, changing the pre-well control rule testing frequency from 14 days to 21 days.

Modification (including but not limited to the one scenario we analyze in this report) may be a viable alternative to repealing the rule that BSEE may consider. In our view, BSEE should conduct further research regarding the forgone external benefits prior to any adjustments.

1. Introduction

The Trump administration has identified increasing oil and natural gas production as a priority for the United States, in part through reducing federal regulatory burdens that the administration says restrict development. President Trump signed Executive Order (EO) 13783 in March 2017, requiring agencies to review existing rules, policies, guidance documents, and related materials that potentially burden the development or use of domestically produced energy resources.[11] This EO also specifically identified for review regulations applicable to the oil and gas sector.

The Trump administration has also focused on reducing regulatory costs across the federal government more broadly under EO 13771, which ordered that two regulations be removed for every regulation implemented.[12] Subsequent guidance from the OMB[13] for implementing EO 13771 emphasized that cost-benefit analysis is required for all major regulations being considered for elimination or modification (as well as for new regulations). But it also laid out the controversial requirement that only the cost savings from repeal be considered in prioritizing rules for repeal as well as in scoring against the costs imposed by new regulations.[14]

2. Objectives

The goals of our project were to catalog the regulations that may be reviewed by the Trump administration[15] and select several for in-depth assessments, including cost-benefit analyses to estimate the potential impacts on industry and the public if the regulations are eliminated, modified, or delayed. These impacts include cost savings and forgone benefits from changes to regulations (as costs and benefits are defined in Circular A-4),[16] and the effects on industry costs as well as any changes to environmental and health outcomes. This project includes two main products: the first is the forthcoming catalog, which inventories existing federal regulations promulgated after 2005 and other federal activities of concern to industry (e.g., permitting) relevant to the development and transportation of oil and gas resources. The second product is a report series that present our analyses of the cost savings and forgone benefits of the repeal or modification of six major regulations affecting the oil and gas sector (these are outlined in the executive summary).[17] The six rules were chosen to

[11] Executive Office of the President. 2017. Executive Order 13783: Promoting Energy Independence and Economic Growth. *Federal Register* 82(61): 16093, March 28. https://www.federalregister.gov/documents/2017/03/31/2017-06576/promoting-energy-independence-and-economic-growth.

[12] Executive Office of the President. 2017. Executive Order 13771: Reducing Regulation and Controlling Regulatory Costs. *Federal Register* 82(22): 9339, February 3. https://www.federalregister.gov/documents/2017/02/03/2017-02451/reducing-regulation-and-controlling-regulatory-costs.

[13] Office of Management and Budget. 2017. Guidance Implementing Executive Order 13771, Titled "Reducing Regulation and Controlling Regulatory Costs." April 5. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-21-OMB.pdf.

[14] Executive Office of the President. 2017. Executive Order 13771: Reducing Regulation and Controlling Regulatory Costs. *Federal Register* 82(22): 9339, February 3. https://www.federalregister.gov/documents/2017/02/03/2017-02451/reducing-regulation-and-controlling-regulatory-costs.

[15] We will discuss this catalog in a forthcoming summary report.

[16] Office of Management and Budget. 2003. Circular A-4, Regulatory Analysis. *Federal Register* 68: 58366, October 9. https://www.federalregister.gov/documents/2003/10/09/03-25606/circular-a-4-regulatory-analysis.

[17] As defined by EO 12866, a "'significant regulatory action' means any regulatory action that is likely to result in a rule that may: (1) Have an annual effect on the economy of $100 million or more", among other criteria.

cover a wide range of types of rules and are not meant to suggest relative importance or that any are most targeted by the Trump administration. They illustrate the technical challenges and opportunities presented in performing cost-benefit analyses to support the repeal or modification of the rules.

This report covers the BSEE well control rule.[18] A forthcoming summary report will include cross-cutting analyses to compare the results of these six analyses—in particular, ranking the results by net benefits (preferred by economists) and also cost savings, the metric emphasized by OMB's guidance related to EO 13771.

3. Methods

The objective of each cost-benefit analysis was to calculate the cost savings and forgone benefits associated with repeal (also referred to as elimination) and modification of the rule or, in certain cases, delay the rule. To meet this objective, we carefully read each proposed and final rule and its associated RIA, as well as any technical support documentation available for the rule. We also noted stakeholder comments and concerns as addressed in the *Federal Register* notice for the final rule (the agency's formal response to commenters) as well as any text in the final rule addressing comments. We also searched for any parallel industry analyses and subsequent industry comments gathered as part of the Trump administration's regulatory reform initiative. Table 3 defines key terminology used in this report and across the series.

We took the following steps to conduct our analyses, for this report on the well control rule and across this series of reports: Each discussion of a rule begins with background on the purpose of the rule, its history, and its current status (e.g., has it been repealed, or is it slated for repeal or modification).

TABLE 3. DEFINITIONS OF KEY TERMINOLOGY

Term	Definition
Cost Savings or Avoided Costs	The amount saved by eliminating or modifying the rule (i.e., the opposite of the costs of implementing a rule).
Benefits Forgone	Benefits that would not be realized by eliminating or modifying the rule (i.e., the opposite of the benefits of implementing a rule).
Net Benefits of Repeal or Elimination	The cost savings of a rule minus the benefits forgone with a positive result, meaning eliminating the rule has a positive net welfare effect on society. Net benefits can be negative, in which case they could be termed net costs to society.
Replication	Re-created original RIA and changed nomenclature to put into rule elimination terms: defining costs as cost savings, benefits as benefits forgone and net benefits (costs) as net benefits (costs) of repeal or elimination.
Corrections	Changes to underlying assumptions to bring the replication up to date and comparable across different rules
Baseline	The result of corrections to the replication. All subsequent scenarios are compared to the baseline.
Repeal Baseline	The result of subtracting forgone benefits from costs saved (the inverse of the baseline).
Costs Adjustment Scenarios	Sensitivity analyses using changes to underlying cost parameters/assumptions in the original RIA
Benefits Adjustment Scenarios	Sensitivity analyses using changes to underlying benefit parameters/assumptions in the original RIA
Rule Modification	Changes to the requirements of rule itself (i.e., sources covered, frequency of surveying, as opposed to changes in parameters/assumptions used in the RIA)

[18] BSEE. 2016. Oil and Gas and Sulfur Operations in the Outer Continental Shelf—Blowout Preventer Systems and Well Control. *Federal Register* 81: 25888, April 29. https://www.gpo.gov/fdsys/pkg/FR-2016-04-29/pdf/2016-08921.pdf.

Next, we summarize the rule with details to provide context about the consequences of repeal or modification of all or some of its parts. We then replicated the cost-benefit analysis presented in the final RIA by creating a series of spreadsheets of extracted data and other information. We were able to replicate the analyses with only very minor differences.

3.1. Corrections to Generate a Baseline

In order to ensure that the cost savings, forgone benefits, and net benefits of elimination reflect the most accurate, currently available information, we changed some of the underlying assumptions of the RIA (and refer to these changes as “corrections”). We also made corrections where we could to address compliance issues for calculating the costs and benefits of repealing a regulation. These issues are explained below.

First, we updated data where possible—such as natural gas prices for the BLM and EPA methane rule analyses—though we note that we did not update data for the well control rule because there wasn’t any data to update in the RIA. Second, if an RIA originally subtracted cost savings from costs, we added cost savings to the benefits side of the equation (and made corresponding adjustments to the RIA cost estimates) so that our analyses remain consistent with recent guidance from the OMB guidance for EO 13771. Third, we also made some further accounting corrections for comparability across rules, including the start and end year analyzed (and, implicitly, the period analyzed). As regulations often have an indefinite lifetime, the endpoint for an analysis can be arbitrary. In comparing rules, those with longer periods analyzed will have greater net present values of both benefits and costs, other things equal. BSEE’s well control rule, for example, uses a 10-year period of analysis—whereas PHMSA’ tank car rule for hazardous materials uses a 20-year period of analysis and EPA’s methane rule uses the years 2020 and 2025 alone. To address this issue, in our forthcoming summary report, we will compare the net present values of costs, benefits, and net benefits over 10 years.

Once we updated and corrected the baseline, we created our “repeal baseline,” which we use to assess the cost savings and benefits forgone of repealing a regulation. We subtract the benefits forgone (i.e., a cost of repealing a rule) from the costs avoided (i.e., the benefit of repealing a rule) to calculate the net benefits of repeal. The first equation below illustrates the benefits of keeping the rule (termed “baseline”). Scenarios that modify the rule are compared against the baseline for keeping the rule rather than against the repeal baseline, as we do not believe the administration would modify the rule only to later repeal it. The second equation below describes the calculation of the net benefits of repeal, which we use to calculate the repeal baseline. Both baselines include the corrections outlined above.

BASELINE

Net benefits (of keeping or modifying the rule)
= Benefits – Costs

REPEAL BASELINE

Net benefits (of repeal)

= Costs avoided – Benefits forgone

The regulated entities may have already begun to comply with the regulation after its passage, until its repeal or until a plan to repeal or modify the rule is publicized. Capital expenditures spent to comply with a regulation are sunk costs, so they should not be counted as cost savings if a regulation is eliminated. Future operating costs, however, would count as costs saved if a regulation is eliminated. To the extent that compliance has already occurred, cost savings and forgone benefits would be lower. Where the RIA provided a clear schedule for compliance (as in this case for BSEE’s well control rule), an adjustment was made, though that is not always the case.

RIAs often account for overlapping or duplicative state regulations, for instance, by not counting costs and benefits from compliance in states with existing regulations. In between the time a regulation is finalized and eliminated, however, additional states may pass overlapping or duplicative regulations. Thus, if a federal regulation is eliminated, state regulations will still be in force and there will be less or no associated cost-savings from repeal in those states depending on the stringency of their regulations. One could also argue that states' proposed regulations should also be taken into account.[19] For the well control rule, no state regulations exist as this rule by definition applies only to federal waters.

3.2. Cost Adjustment Scenarios

Working from the repeal baseline, we build scenarios that change the underlying assumptions of the RIA to assess any changes to the costs of the rule if the compliance costs of certain provisions were more or less expensive.

First, we searched the RIA for alternative cost assumptions. Second, we searched the rule's docket for comments that provided enough information for us to use an alternative cost assumption. If we found compelling evidence in either source, we recalculated the cost savings, benefits forgone, and net benefits of repeal to account for this input. The comments we used were submitted by stakeholders including the American Petroleum Institute (API), the Independent Petroleum Association of America (IPAA), Western Energy Alliance, Sierra Club, Environmental Defense Fund, Pew Charitable Trust, and others. We also searched for comments submitted to the agencies in the spring of 2017, when they requested public input on the Trump administration's regulatory reform efforts.

3.3. Benefits Adjustment Scenarios

In addition to cost adjustments, we made adjustments to the benefits, using the same process described above and also making what we considered reasonable changes to various assumptions, such as using alternative estimates for the social cost of carbon (SCC) or a range of potential risk reduction levels.

Benefits measurements were often subject to large uncertainties, so for several rules we conducted break-even analyses, a method often employed in RIAs. Break-even analysis in the context of repealing a rule calculates what the uncertain parameter would have to be to equate forgone benefits to cost savings. If decisionmakers think the real value of this parameter is likely to be larger than the break-even parameter estimate, then repeal would not be warranted (in terms of economic efficiency). Symmetrically, if they think the parameter is lower, it may be economically efficient to repeal the rule. Of course, in the face of large uncertainty, a risk averse regulator may choose not to repeal a regulation when it is unclear whether the parameter is lower or higher than the break-even estimate.

Under guidance from the Trump administration, agencies are increasingly questioning the valuation of ancillary benefits (co-benefits) of various rules. These refer to benefits that come along with efforts aimed at addressing another pollutant or activity, such as the climate benefits of reducing mercury pollution, for example. Agencies sometimes forgo the valuation of ancillary benefits, particularly when benefits exceed costs by a wide margin. Agencies may choose to do so because they find it difficult or impossible to

[19] It may be a step too far to assume that some states will be incentivized to pass legislation offsetting the effect of eliminating a federal regulation.

quantify, and doing so in cases of large uncertainty may complicate interpretation of the results.

The Trump administration critiqued the inclusion of ancillary benefits in RIAs, arguing that they mask the “true net costs” of rulemakings (EPA 2017). When looking at the forgone benefits of repeal, however, ignoring forgone ancillary benefits is not justifiable because they still would have accrued to society regardless of whether these benefits were the target of a regulation. Counting these ancillary benefits ensures that an analysis accurately describes the true net costs of a rulemaking (Krupnick and Keyes 2017). Nevertheless, in this project we were not able to account for ancillary benefits if they were missing from the original RIA.

3.4. Rule Modification Scenarios

There are innumerable ways any given rule can be modified, including changes to the sources covered or the frequency of monitoring and reporting, for instance. We limited the possibilities for modification to what was quantifiable based on agency estimates for alternative requirements, quantitative estimates provided by industry or other stakeholder comments, and our judgment about what would make for an enlightening modification. Coming from industry, the requested modifications would generally lower the costs of a rule but may also lower the benefits. Symmetrically, the requested modifications coming from environmental groups would generally increase the benefits of a rule but may also increase the costs. Because the modifications are highly specific to individual rules, we address them in turn—in detail in the respective reports in this series describing our analysis of each rule’s RIA.

3.5. Discussion and Conclusions

After presenting the multiple cost-benefit analyses for repeal and modification of each rule, we provide a qualitative discussion of aspects of repealing or modifying a rule that we could not quantify. These were often driven by comments that criticize some aspect of a rule but provide no basis for empirical analysis of how the costs and benefits would change if the rule were altered to address the comment. We also tracked the agency’s response to comments as well as the non-monetized effects of the rules (often indirect or distributional), such as impacts on jobs or commodity prices.

We conclude each report by summarizing the rule-specific analyses and generalize about whether certain types of modifications or repeal make sense from an economic efficiency (net benefit) perspective. We do not compare our results across rules in each individual report. A forthcoming summary report will include cross-cutting analyses and comparisons.

4. Background: 2016 Blowout Preventer Systems and Well Control Rule

4.1. Purpose

Following the 2010 *Deepwater Horizon* blowout, the federal government took broad action to prevent similar incidents and stem the risk of losses of well control in offshore drilling on the Outer Continental Shelf (OCS). The response included an overhaul of the regulatory body managing offshore oil drilling, the creation of several investigative bodies, and the implementation of new safety rules to prevent future losses of well control and blowouts.

The Minerals Management Service split into three independent agencies to separate its conflicting missions: BOEM, to be in charge of planning and leasing; BSEE, to be in charge of safety and environmental issues; and the Office of Natural Resources Revenue, to collect revenues.

BSEE released several safety rules following the incident, including an interim final rule in 2010 (finalized in 2012),[20] which sought to address some immediate concerns and near-term recommendations outlined in DOI's report "Increased Safety Measures for Energy Development on the Outer Continental Shelf" (DOI 2010).[21]

The 2016 well control rule seeks to enhance oversight of and controls on offshore drilling to "reduce operational risk and prevent future well-control incidents" (BSEE n.d.e). Details on the rule's requirements are outlined below.

4.2. Regulatory History and Current Status

The well control rule was finalized in April 2016, and most of the provisions are now in effect, though some provisions will not go into effect until 2023. As part of the broader federal efforts to comply with the Trump administration's goal of expanding energy production and reducing "regulatory burden," BSEE is currently reviewing the regulation and adjustments that could be made to "encourage energy exploration and production on the OCS" to comply with EO 13783 and EO 13795.[22]

BSEE held a public forum in September 2017 on reducing the regulatory burden of the rule, and in an online summary of the forum, BSEE states that it "has identified some provisions in the well control rule that could potentially be revised" (n.d.b). Industry's concerns and suggestions for improving the rule are discussed below in Section 6. Most recently, the rule was highlighted in DOI's "Final Report: Review of the Department of Interior Actions That Potentially Burden Domestic Energy," which states that the department intends to revise the rule following stakeholder outreach (2017). So far, the document has outlined six requirements that could be revised, including one recommendation we were able to quantify as a modification.

4.3. Rule Summary

The well control rule implements a combination of prescriptive requirements and performance standards to be phased in over time, from July 2016 to April 2023. The rule is mainly concerned with ensuring the adequate construction, use, and maintenance of blowout preventers (BOPs), which BSEE defines as "a special assembly of heavy-duty valves, commonly called the BOP stack, installed on top of a well which can be closed to prevent high-pressure oil or gas from escaping (a blowout) from the well hole during drilling operations" (n.d.a). A BSEE fact sheet outlines the requirement, stating that the rule does the following:

1. Incorporates the latest industry standards that establish minimum baseline requirements for the design, manufacture,

[20] 75 FR 63346, "Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf; Final Rule," October 14, 2010, https://www.gpo.gov/fdsys/pkg/FR-2010-10-14/pdf/2010-25256.pdf; and 77 FR 50856, "Oil and Gas and Sulphur Operations on the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf; Final Rule," August 22, 2012, https://www.bsee.gov/sites/bsee.gov/files/federal-register-notice/proposed-rules/aa02-fr-publication-08-22-12-1.pdf.

[21] BSEE has also released several other offshore safety regulations, some of which have similar names to the rules listed here, but they are not the focus of this discussion.

[22] Executive Office of the President. 2017. Executive Order 13783: Promoting Energy Independence and Economic Growth. *Federal Register* 82(61): 16093 March 28. https://www.gpo.gov/fdsys/pkg/FR-2017-03-31/pdf/2017-06576.pdf; and Executive Office of the President. 2017. Executive Order 13795: Implementing an America-First Offshore Energy Strategy. *Federal Register* 82(84): 20815, May 3. https://www.gpo.gov/fdsys/pkg/FR-2017-05-03/pdf/2017-09087.pdf.

repair, and maintenance of blowout preventers (BOPs),
2. Requires more controls over the maintenance and repair of BOPs,
3. Requires the use of dual shear rams in deepwater BOPs, which is now included in a baseline industry standard (American Petroleum Institute [API] Standard 53),
4. Requires that BOP systems include a technology that allows the drill pipe to be centered during shearing operations,
5. Requires more rigorous third party certification of the shearing capability of BOPs,
6. Expands accumulator capacity and operational capabilities for increased functionality,
7. Requires real-time monitoring capability for deepwater and high-temperature/high-pressure drilling activities,
8. Establishes criteria for the testing and inspection of subsea well containment equipment in the regulations,
9. Increases the reporting of BOP failure data to BSEE and the OEMs,
10. Adopts criteria for safe drilling margins consistent with recommendations arising out of the *Deepwater Horizon* tragedy,
11. Requires the use of accepted engineering principles and establishes general performance criteria for drilling and completion equipment,
12. Establishes additional requirements for using remotely operated vehicles (ROV) to function certain components on the BOP stack,
13. Requires adequate centralization of casing during cementing,
14. Makes the testing frequency of BOPs used on workover and decommissioning operations the same as drilling operations. (BSEE n.d.d)

BSEE's estimates for the costs of the various provisions in the rule are provided in Appendix A.

5. Analysis

5.1. Replication

We were largely able to replicate BSEE's benefit-cost analysis; our numbers differ slightly (between $1 million and $2 million, as can be seen in the costs column of Table 4) largely due to rounding. The net benefits in our replication are smaller by 0.18 to 0.24 percent.

5.2. Corrections to Generate a Baseline

We made one change to create a new baseline, against which we compare our following scenarios. This adjustment updates the rule to account for any sunk costs—that is, onetime costs that industry incurred in 2016 and would not be returned if the rule is repealed.[23] We assumed that 100 percent of these onetime costs are sunk. The total value of these sunk costs is small compared with the rest of the rule (accounting for about 10 percent of the total cost of the rule), and we do not have any evidence to support an assumption that less than 100 percent of these onetime costs were sunk costs (i.e., that some operators are not in compliance). This adjustment reduces costs by $67 million over the 10-year period of analysis.

With this adjustment, our baseline for the rule has slightly lower costs and the same benefits

[23] When we assume these costs are sunk, we subtract the onetime costs, often equipment purchase and installation, from year one of the analysis. The costs that remain are recurring costs, often associated with labor and maintenance. We assess the rule over a period of 10 years (the same period as the original), so the analysis is comparable to the original RIA.

as the replication,[24] resulting in net benefits for keeping the rule of $512 million to $598 million, depending on the discount rate, as shown in Table 4.

The baseline in Table 4 is what we use to calculate the costs avoided and the benefits forgone when repealing the rule (shown in at the bottom of Table 4). The costs avoided have the same value as the costs in the baseline. The benefits forgone, however, differ significantly from the benefits in the baseline: we assume the deregulatory provision that was part of the 2016 rule—responsible for the majority of the benefits of implementing the rule—would be maintained (as described in the executive summary). We therefore assume only the external benefits from reducing the risk of oil spills will be forgone if the regulatory provisions of the rule are repealed. We note here that the RIA describes its measure of external benefits as likely to be an underestimate because of the large uncertainty surrounding the level of risk reduction from implementing the well control rule. We therefore clarify that we do not believe the net benefits of repeal will be as large as stated in the table; rather, we believe that break-even analysis is necessary for adequate information regarding the potential impacts of repealing the rule. Lastly, the net benefits of repeal are the costs avoided minus the benefits forgone. Section 3.1 displays the equation and discusses the intuition behind this calculation. According to our repeal baseline, repealing the rule results in net benefits of $578 million to $676 million over 10 years, depending on the discount rate.

Table 4. Generating a Baseline, Net Present Value over 10 Years (million 2012$)

KEEPING RULE						
	3% discount rate			**7% discount rate**		
	Costs	**Benefits**	**Net benefits**	**Costs**	**Benefits**	**Net benefits**
Original RIA	765	1,296	533	663	1,109	446
Replication	765	1,297	531	664	1,109	445
*% difference**	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Baseline	**698**	**1,297**	**598**	**597**	**1,109**	**512**
*% difference***	*–9%*	*0%*	*12%*	*–10%*	*0%*	*15%*
REPEALING RULE						
	Costs Avoided	**Benefits Forgone**	**Net Benefits of Repeal**	**Costs Avoided**	**Benefits Forgone**	**Net Benefits of Repeal**
Repeal baseline	**698**	**23**	**676**	**597**	**19**	**578**
*% difference***	*–9%*	*–98%*	*227%*	*–9%*	*–98%*	*230%*

*From original RIA.
**From replication.

[24] Sunk costs have the potential to result in sunk benefits as well. For example, if industry has invested in a piece of equipment, that piece of equipment could be associated with the reduced risk of an oil spill. That sunk cost could result in sunk benefits if that equipment is associated with a reduction in spill risk (that benefit would now be part of the baseline). If the rule is repealed, industry will not recover the cost of that equipment but may continue to use the equipment, meaning the forgone benefits are slightly smaller. But the use of that equipment could also be associated with operating expenses, and industry may choose to forgo its use if the rule is repealed, meaning the forgone benefits do not change with sunk costs. Because of the uncertainty in how individual provisions of this rule affect spill risk, we are unable to calculate whether this rule incurs sunk benefits as well, so we do not count sunk benefits.

5.3. Cost Adjustment Scenarios

BSEE's cost estimates are generally composed of BSEE's own enforcement costs and industry's labor costs, capital costs, and service costs. Most of these estimates were based on BSEE's experience, as well as communications with industry and academic experts. Industry comments on the proposed rule generally did not provide information relevant to the final rule in sufficient detail to conduct sensitivity analyses related to differing cost assumptions. Furthermore, because there are so many inputs to the cost estimates (there were 26 sections of the RIA each dedicated to one or more cost components), adjusting one or a few would have little impact on the overall estimate, so we chose to focus our analysis on the benefits.

5.4. Benefits Adjustment Scenarios

In this section, we discuss only the external benefits of the rule (and do not assess the benefits to industry from the deregulatory change discussed above). The purpose of this section is to outline the uncertainty in the external benefits calculation and, given that uncertainty, assess whether the external benefits forgone may outweigh the avoided costs when repealing the rule (i.e., the likelihood that repealing the rule could lead to net costs). These external benefits arise from valuing the reduction in the risk of oil spills, such as the value people have for avoiding impacts on the ecosystem, the market value of lost oil, spill containment and cleanup costs, lost recreation value, and losses to commercial fishing. The valuation of these negative impacts is collectively termed damages (if damages are avoided, they are termed benefits, using standard nomenclature). In the original rule, BSEE estimated the rule's value from reducing the risk of oil spills in a "conservative" manner at $3 million per year (2016a, 63).

BSEE assesses external benefits by looking at the effect of the rule as a whole, rather than assessing the benefits of each provision of the rule. First, we conduct a sensitivity analysis by adjusting some of BSEE's assumptions. Second, we use BSEE's original methodology to conduct a break-even analysis, which informs the potential risk reduction range needed so that the external benefits alone "break even" with the private costs of the rule, excluding the cost savings from less frequent testing. Such analysis can inform policymakers on whether repealing the rule (while keeping the deregulatory provision) can result in net costs or net benefits to society.

BSEE's Methodology. BSEE's social benefits for this rule (which we term external benefits) are calculated using the following equation:

$$\begin{aligned}
&External\ Benefits\ of\ Well\ Control\ Rule \\
&= \%\ Risk\ Reduction \\
&\times\ [(\#Wells\ Drilled \\
&\times Avg.Oil\ Spilled\ per\ Well \\
&\times Damages\ per\ Oil\ bbl\ Spilled) \\
&+ (Additional\ Damages\ if\ Catastrophic\ Event \\
&\times Freq.of\ Catastrophic\ Event)]
\end{aligned}$$

Thus, the benefits of the rule are the sum of damages from routine oil spills and the expected value of damages from a catastrophic event, all multiplied by the percentage risk reduction from implementing the rule. For the routine spills, data are obtained on the number of wells expected to be drilled, the amount of oil that will be spilled per well, and the damage per barrel spilled. For the catastrophic events, the damage per event is multiplied by the historical frequency of that event. We detail how BSEE arrived at the estimates used in this equation in the following paragraphs.

First, BSEE estimated the average amount of oil spilled per well per year by calculating the weighted average of the amount of oil spilled in incidents (with at least 10 barrels spilled in a year),[25] dividing this number by the number of wells drilled that year. This number is estimated to be 222 barrels per year, including the *Deepwater Horizon* incident. A table of the wells drilled and oil spilled since 1988, used by BSEE for this analysis, is reproduced in Appendix B. This figure is then multiplied by BSEE's estimate for future drilling activity (320 wells per year over the next 10 years) and the social cost per oil barrel spilled, which includes natural resource damages, cleanup and containment costs, and the lost value of the oil spilled (assuming a $50 per barrel oil price). The damage-per-barrel estimates are from a BOEM document that models the costs and benefits of its offshore drilling plans and estimates damages at $3,537 per barrel of oil spilled (2012).[26]

Next, BSEE calculated the average damage from a catastrophic oil spill, defined as 900,000 to 7.2 million barrels of oil spilled.[27] The additional costs of a catastrophic event are estimated to be $211 million, based on commercial fishing and recreation losses from the BOEM document. This figure is then multiplied by the occurrence rate of a catastrophic event, which is estimated to be 0.02. This figure is based on the fact that only one catastrophic event, *Deepwater Horizon*, occurred in the past 47 years, following an overhaul of DOI's offshore regulatory program (1 divided by 47 is about 0.02). Estimating the frequency of these extreme events is extremely difficult considering the sample size, as only one spill qualifies as catastrophic. Even smaller spills and incidents that the well control rule could prevent are rare.[28] The 1 in 47 years figure is, however, within the range reported by one study using extreme value theory and more rigorous statistical analysis to assess the frequency of such events. That study, Ji et al. (2014), reports the return period of such a catastrophic spill as 165 years, with a confidence interval between 41 and more than 500 years. Thus, we have independent evidence that DOI was not being conservative in choosing its estimate of 1 in 47 years, which is at the risk-averse end of the Ji et al. estimates. Nonetheless, this estimate does not have a large impact on the benefits estimates, as analysis below illustrates.

These two damage estimates are then summed and multiplied by the percentage risk reduction from the well control rule. BSEE assumed a "conservative" level of risk reduction of 1 percent in its analysis (2016a, 63).

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[25] BSEE does not include in its oil spill figures events (losses of well control, gas releases, deaths, and more) that did not also result in oil spills of 10 barrels or more.

[26] We report BSEE's figures in 2012$, while their RIA reports these numbers in 2014$.

[27] BSEE states that the BOEM planning document "defines a catastrophic oil spill in the [Gulf of Mexico] as one ranging in size from 900,000 to 7,200,000 barrels" (2016a, 64), but the BOEM document lists those amounts only as part of a table illustrating the potential costs of a spill for four spill sizes, including a low amount of 900,000 barrels and a high amount of 7.2 million barrels. BOEM defines a catastrophic spill as "any high-volume, long-duration oil spill from a well blow-out, regardless of its cause" (2012, 38). This issue does not affect BSEE's analysis or assumptions, as the *Deepwater Horizon* blowout is still the only catastrophic event in its database, but this definition is arbitrary.

[28] BOEM highlights the issue in its 2012–2017 offshore leasing program document: "From 1964–2010 over 48,000 wells were drilled with only 283 loss of well control instances. Of the loss of well control instances, only 61 resulted in an oil spill. Almost all oil spills resulting from loss of well control were very small. The median spill size of these 61 events is only two barrels" (2012, 41).

As stated earlier, we believe the assumptions used in BSEE's 2016 RIA highly uncertain figures that lead to an external benefits estimate that is underestimated. To illustrate how this damage function operates and why we believe BSEE's inputs may underestimate the impacts of an oil spill, we use the *Deepwater Horizon* blowout (the only catastrophic oil spill from a well in the OCS) as an example. We multiply the number of barrels spilled, 3.14 million barrels,[29] by the damage-per-barrel estimate DOI uses for the routine spill, $3,537, which yields a damage estimate of $11 billion. We add BSEE's onetime costs of a catastrophic spill, $211 million, and with rounding, the figure increases to $12 billion. But the estimate provided by original studies of the *Deepwater Horizon* spill for the National Oceanic and Atmospheric Administration, required under the Oil Pollution Act, yields an estimate of $17.2 billion, suggesting that the estimates BSEE uses in this equation are too low.[30] A caveat is that it is certainly possible that marginal damages (costs per barrel) from additional barrels spilled increase with the size of the spill rather than stay constant as they do in this equation irrespective of the size of the spill, which brings the BP spill comparison into question.

Additionally, BSEE used an assumption that the rule would reduce spill risks by only 1 percent. In the RIA, the authors state they did not want "to overstate the potential risk reduction," though they state that "the actual risk reduction from the rule will likely be substantially higher" and that "the potential risk reduction benefits with this rule are likely understated" (BSEE 2016a, 61–62). The RIA notes that this approach was "conservative" and that these measurements should be considered "a lower-bound estimate of the true benefit to society that results from decreasing the risk of oil spills" (BSEE 2016a, 60). BSEE furthermore presents a sensitivity analysis with a risk reduction ranging from 1 to 20 percent, though it does not justify the selection of that range using any research or data.

Sensitivity Analysis. In Table 5, we provide estimates for the costs avoided, benefits forgone, and net benefits of repeal for scenarios that adjust individual assumptions used in BSEE's external benefits calculations. This analysis changes assumptions such as the social cost of oil spills, catastrophic spill frequency, and risk reduced by the rule to assess how differing assumptions influence the economic efficiency of repealing the rule. Overall, changing only one assumption at a time generally does not have a large influence on the results, save for assuming a higher risk reduction from the rule.

The first scenario uses a lower estimate of the per-barrel social costs of a spill and results in net benefits from repealing the rule for both discount rates, ranging from $593 million to $694 million. In the second scenario, we use a higher estimate for the costs of a catastrophic event taken from BP's costs from the oil spill. We subtract $11 billion (the per-barrel cost estimate multiplied by the gallons spilled from *Deepwater Horizon*) from the $61 billion paid by BP,[31] which provides us with an upper-bound estimate of about $50 billion for additional onetime costs associated with a catastrophic spill instead of BSEE's $211 million figure, described above. The BP figure is significantly larger than BSEE's. We elect to use this figure for illustrative purposes because, in theory, the amount BP paid as a result of the oil spill (which includes cleanup costs) could be illustrative of the

[29] Described in Bishop et al. (2017) as the best estimate of the spill volume, though other estimates have placed the volume as high as 4.9 million barrels.

[30] The $17.2 billion figure from Bishop et al. (2017) is based primarily on a stated preference study of the willingness to pay to avoid the impacts from a future spill.

[31] Cost estimates reported in the media from the total BP payments resulting from the spill ($65 billion) were assumed to be in 2016$ and were discounted to 2012$ (Bousso 2018).

additional onetime costs associated with a catastrophic spill. We believe this number may overestimate the actual damages, as courts may impose fines on BP that do not reflect the actual damages; for example, a court may impose a large fine to deter other companies from similar behavior, regardless of the measured economic damages. This number reduces the net benefits of repeal between $80 million and $100 million over 10 years. The change in net benefits is small, despite the large change in the onetime spill costs, because that cost is multiplied by the frequency of spills (0.02) and then by the risk reduction (0.01), so the overall effect of this part of the benefits calculation is quite small. Because such a large change had a small effect on the overall results, we chose not to include the Bishop et al. (2017) estimate of $17.2 billion, as it would not be informative in the sensitivity analysis (though we do include this estimate in the break-even analysis below).

In the third scenario, we substitute a lower catastrophic spill frequency of 0.00003, a figure BOEM estimated in 2012. This figure is much smaller than BSEE's estimate of 0.02, described above. The BOEM estimate results in very little change to the net benefit results. The fourth scenario, a higher risk reduction from the rule (20 percent, which is the high end of the plausible range mentioned in the RIA), decreases the net benefits of repeal by almost two-thirds and increases benefits forgone from repeal by $366 million to $427 million. This adjustment has by far the largest impact on the benefits forgone and the net benefits of repeal, so we explore this figure more extensively below in a break-even analysis. And the last scenario in Table 5 combines the BP onetime costs of a catastrophic event estimate with a slightly higher risk reduction of 10 percent. These changes result in net costs of repeal, showing that a slightly higher risk reduction and adjusting one other assumption can result in a totally different outcome.

TABLE 5. BENEFITS SCENARIOS, NET PRESENT VALUE OVER 10 YEARS (MILLION 2012$)

	REPEALING RULE					
	3% discount rate			7% discount rate		
	Costs avoided	Benefits forgone	Net benefits of repeal	Costs avoided	Benefits forgone	Net benefits of repeal
Repeal baseline	**698**	**23**	**676**	**597**	**19**	**578**
Lower per-barrel spill cost estimate*	698	5	694	597	4	593
*% change***	*0%*	*–80%*	*3%*	*0%*	*–80%*	*3%*
BP onetime cost of catastrophic event***	698	119	579	597	102	496
*% change***	*0%*	*428%*	*–14%*	*0%*	*428%*	*–14%*
Lower catastrophic spill frequency****	698	21	677	597	18	579
*% change***	*0%*	*–5%*	*0%*	*0%*	*–5%*	*0%*
Risk reduction of 20% (from 1% for low benefits)	698	450	248	597	385	212
*% change***	*0%*	*1900%*	*–63%*	*0%*	*1900%*	*–63%*
Risk reduction of 10% and BP onetime cost of catastrophic event	698	1,121	(423)	597	959	(362)
*% change***	*0%*	*4880%*	*–163%*	*0%*	*4881%*	*–163%*

*Social cost per barrel of $693 (from Cohen 1986 in 2012$ with oil prices at $50 per barrel).

**Percentage change from repeal baseline.

***Higher social cost of catastrophic event of about $50 billion, BP's total payments for the Deepwater Horizon blowout minus the BSEE-estimated social cost of the spill using the agency's per-barrel social cost metric (discussed above).

****Lower spill frequency of 0.00003, averaged BOEM estimates of probability of high-volume catastrophic spill events (BOEM 2012, 42).

Said another way, we calculate how large the risk reduction has to be to match the annual private costs in several scenarios. If the risk reduction figure is above these estimates, repealing the rule would result in net costs. If the opposite were true, repealing the rule would result in net benefits. We likewise looked into conducting break-even analyses for other estimates used in the external benefits calculation. Most of those estimates are thoroughly covered in relevant literature, and those that are not were minimally influential on the external benefits calculation. We therefore chose not to include other break-even analyses, because we did not find them to be informative.

In Table 6, we show the results of our break-even analysis for a number of scenarios:

- The lower per-barrel spill cost estimate reduces the external benefits and is used as a sensitivity analysis.
- The higher onetime catastrophic cost estimates use the $17.2 billion figure from Bishop et al. (2017).
- The BP onetime cost of catastrophic event is the amount paid by BP following the *Deepwater Horizon* spill and is used as a social cost of catastrophic spill estimate. This figure is $50 billion, the amount paid by BP minus the result of multiplying BSEE's per-barrel social cost by the amount spilled so as not to double count.
- The lower frequency of catastrophic events uses BOEM's (2012) estimate for the frequency of catastrophic events, 0.00003, the result of a modeling exercise, instead of BSEE's estimate of 0.02, the result of counting the number of catastrophic events (1) as a share of years of US offshore drilling (around 47).

The results of this analysis show that all but one figure are within a minimally plausible risk reduction range (by minimally plausible, we mean between 0 and 100 percent). Because the RIA gives a risk reduction range of 1–20 percent but could point to no quantitative or qualitative information to support this range, we judge break-even values for this parameter exceeding 20 percent but below 100 percent to be plausible.

Using the BP onetime catastrophic cost estimates, the risk reduction from the rule would only need to be at or above 6 percent for the external benefits alone to meet or exceed costs (and for forgone benefits to meet or exceed cost savings). With this catastrophic cost estimate and a slightly higher risk reduction, repealing the rule would result in net costs. A lower per-barrel social cost, however, would require a 148 percent risk reduction, which is impossible, in order to break even.

Table 6. Risk Reduction Break-Even Analysis

Low-Benefits Scenario	
Scenario	**Risk Reduction**
Repeal baseline	31%
Lower per-barrel spill cost estimate*	148%
Higher onetime catastrophic cost estimates**	23%
BP onetime cost of catastrophic event†	6%
Lower frequency of catastrophic events‡	32%

*Social cost per barrel of $693 (from Cohen 1986 in 2012$ with oil prices at $50 per barrel).
**A measure of the aggregate willingness to pay to prevent events like the *Deepwater Horizon* well blowout from Bishop et al. (2017) of $17.2 billion.
†Higher social cost of catastrophic event of about $50 billion, BP's total payments for the *Deepwater Horizon* blowout minus the BSEE-estimated social cost of the spill using the agency's per-barrel social cost metric (discussed above).
‡Lower spill frequency of 0.00003, averaged BOEM estimates of probability of high-volume catastrophic spill events (BOEM 2012, 42).

Overall, these figures show that the benefits estimate is highly dependent on the risk reduction, which is likewise the greatest unknown in this RIA. To illustrate this point, we calculated the benefits of the rule with a 50 percent risk reduction: the external benefits forgone would be $1 billion to $1.2 billion, and the net costs of repealing the rule would be $333 million to $390 million. Given the large uncertainty and the potential for catastrophic events, a risk-averse regulator would therefore exercise caution when deciding whether to repeal this rule.

5.5. Rule Modification

BSEE may choose to modify the rule rather than repeal it. The agency included in the original RIA a cost analysis for further reducing the pressure-testing frequency to 21 days (the final rule reduced the frequency from 7 to 14 days). This information enables us to analyze this possible modification to the rule. Such a scenario is salient because the Trump administration has said it will consider adopting the 21-day frequency testing requirement "in some situations" (DOI 2017, 22).

While we report on the cost savings from this relaxed testing requirement below, we cannot pair the cost adjustment with a benefit adjustment, as BSEE measures the benefits for the rule as a whole and does not attribute changes in the risk of a spill to any individual element of the rule. BSEE likewise does not have information specifically on how this reduction in testing frequency affects the risk of loss of well control. We therefore are unable to quantify any potential changes to benefits in our analysis.

Although it seems obvious that as testing frequency falls, the risks of a spill or blowout rises, industry has argued that the risk of a spill actually decreases with less frequent testing, as the parts being tested are subject to reduced wear and tear. BSEE agreed with the point but was skeptical of the argument overall, stating, "The more frequently BOPs are tested, the more likely the equipment is to wear out prematurely, [though] it does not follow that every extension of test intervals always increases reliability … in the long term" (BSEE 2016a, 57). As BSEE said in rejecting the industry's request for a 21-day testing frequency, the comments "did not provide adequate data and information [on risk effects] to support adopting a 21-day testing interval" (2016a, 57).

As Table 7 shows, the possible cost savings associated with this further reduction from a 14-day to a 21-day testing frequency are very large—a more than $3 billion increase in benefits from the baseline at the 3 percent discount rate. The resulting benefits of a modified rule range from $3.8 billion to $4.5 billion over the 10-year analysis period. Again, we could not adjust the external benefits, but this result suggests that DOI would need to place a large value on the potential reduction in external benefits to justify maintaining the current 14-day testing frequency.

TABLE 7. COST SAVINGS FOR REDUCING PRESSURE TESTING FREQUENCY, NET PRESENT VALUE (MILLION 2012$)

KEEPING RULE						
	3% discount rate			7% discount rate		
	Costs	Benefits	Net benefits	Costs	Benefits	Net benefits
Baseline	**698**	**1,297**	**598**	**597**	**1,109**	**512**
21-day testing frequency*	698	4,482	3,784	597	3,834	3,236
% difference	*0%*	*246%*	*532%*	*0%*	*246%*	*532%*

*The costs and benefits listed here are not marginal—meaning the estimates for the 21-day testing frequency include the costs and benefits of the baseline scenario (maintaining the 2016 rule) but simply add the benefits of further reducing the testing frequency (i.e., baseline scenario costs and benefits are not in the baseline). To assess the marginal costs and benefits of implementing a 21-day testing frequency, simply subtract the baseline's costs and benefits from the 21-day testing frequency's figures. The marginal costs would be $0 and the benefits would be $3.2 billion, with the net benefits the same as the benefits.

6. Discussion

6.1. Public Comments

Environmental groups were largely supportive of the well control rule, whereas industry was more critical of a few provisions and some language. In their comments to DOI following Trump's executive orders, environmental groups expressed support for the rule and argued that it should not be weakened. EarthJustice, the Sierra Club, the Center for Biological Diversity, and the Gulf Restoration Network, together in a joint comment, argued that the rule should be strengthened by including a requirement for dual blind shear rams, which cut drill pipes in the well in emergency situations. They argue that the redundancy of the second blind shear ram would "ensure reliability during emergency response" (Sarthou et al. 2017). These organizations cite a National Academies report in support of this statement; however, that report argues that the goal of high reliability in blowout preventers "need not be prescriptively specified in regulation and may or may not require multiple [blind shear rams]" (NASEM 2012, 52).

Industry, on the other hand, is still critical of a few provisions in the final rule, though industry did call the final version "greatly improved" from the proposed rule (Hopkins et al. 2017, 2). In general, industry would prefer that the regulation not exceed the API Standard 53, voluntary standards issued by the trade association for blowout preventers in 2012. In industry's comments submitted to DOI in May 2017, the majority of the requested revisions relate to clarifying requirements in the regulation.

Industry argues that a few of the provisions in the rule might in fact reduce safety and increase the risk of a loss of well control, such as the safe drilling margin requirement.[32] In particular, industry comments highlight the potential for unintended consequences related to the remote real-time monitoring (RTM) requirement, which is responsible for almost half the rule's costs. Industry's concerns mostly relate to potential adverse effects of requiring RTM, such as confusion in the line of responsibility and accountability and the shifting of decisionmaking authority from wellsite personnel to onshore personnel. Another National Academies report, which was conducted at BSEE's request, states that remote RTM technology "could become widely available to industry and a part of its tool kit," though the committee studying the technology did not argue in favor of mandating remote RTM on all wells (NASEM 2016, 84). Rather, the committee argued in favor of performance-based standards. The report outlines a number of benefits of remote RTM, including enabling the collection and aggregation of data that can be used in predictive modeling and increased efficiency in BSEE's inspection activities. Remote RTM can also benefit companies in terms of decreased downtime, reduced equipment damage, and more. Issues with the expansion of remote RTM include cybersecurity risks and costs.

Finally, industry argues that the BSEE-approved verification organizations are unnecessary,[33] as "certification can be done by third party organizations" without BSEE approving them (Hopkins et al. 2017, 2).

[32] A safe drilling margin is defined by BSEE as "the pressure between the estimated pore pressure and the fracture gradient" (n.d.c).

[33] These organizations, which are third parties approved by BSEE, are required for certain certifications and verifications under the well control rule.

6.2. Nonmonetized or Indirect Impacts

The final rule's RIA does not discuss nonmonetized impacts, though it does recognize that some indirect impacts of the rule are not considered as part of its analysis because such analysis would be outside the scope of what is required of an RIA (particularly when an analysis would be speculative). Industry, for example, argues that the proposed rule would cause an "immediate and long-term reduction of US offshore oil and natural gas development and production" (Hopkins et al. 2015, 12). Because offshore development is such an expensive activity, the rule (particularly the final rule) is unlikely to make up a significant share of costs. Rather, as BSEE points out, oil prices have a larger effect on offshore production.

Commenters likewise suggested that this reduction in drilling could affect US and global energy security and employment, though estimating the amount of drilling reduced by the rule and its impacts in these areas would be highly speculative.

7. Conclusion

In terms of the Trump administration's "energy dominance" agenda,[34] the well control rule is not a prime candidate for full repeal, as the majority of the rule's benefits go to industry because of a deregulatory action within the rule. Those benefits are so large that they outweigh the costs of the rule, even without the benefits from reduced oil spill risk.

The administration, however, could seek to repeal only the regulatory provisions of the rule. In this case, the net impact to society is unclear. BSEE's original estimate of the external benefits (from reducing oil spill risk) indicates that repealing only the regulatory provisions of the rule would result in large net benefits. BSEE stated that because the deregulatory benefits of the rule were so large, it chose to underestimate the parameters for calculating the external benefits, in particular, for the percentage of risk reduced by the rule. But our sensitivity analyses show that adjusting this parameter along with some others can result in net costs from repealing the rule. A risk-averse social planner might therefore exercise caution when modifying or repealing the rule, as a large oil spill could have high consequences.

As noted, DOI is due to release a rule change very soon. Assessing changes to the costs and benefits from DOI's proposed changes will be difficult given the significant uncertainty regarding the value of reducing oil spill risk as well as uncertainty about changes to the risk itself. One idea is to convene a group of experts and do a formal expert elicitation (as described in Colson and Cooke [2018]) on at least the share of risk reduced from implementing the rule. Without such analysis, we think repeal would be unwarranted given the lack of information regarding forgone benefits and the potentially severe consequences of an oil spill.

[34] White House. 2017. National Security Strategy of the United States of America. December. https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

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Appendix A. Costs by Rule Requirement

Table A-1. BSEE's Total 10-Year Costs of Requirements, Undiscounted (2012$)

Requirement	Total undiscounted cost	Share of total cost
A) Additional information in the description of well-drilling design criteria	$276,642	0.03%
B) Additional information in the drilling prognosis	$69,160	0.01%
C) Prohibition of a liner as conductor casing	$7,685,991	0.89%
D) Additional capping stack testing requirements	$2,186,959	0.25%
E) Additional information in the APM for installed packers	$98,831	0.01%
F) Additional information in the APM for pulled and reinstalled packers	$383,919	0.04%
G) Rig movement reporting	$68,421	0.01%
I) Foundation requirements for MODUs	$3,542,701	0.41%
J) Real-time monitoring of well operations	$391,550,488	45.44%
K) Additional documentation and verification requirements for BOP systems and system components	$17,232,735	2.00%
L) Additional information in the APD, APM, or other submittal for BOP systems and system components	$486,551	0.06%
M) Submission of a mechanical integrity assessment report	$47,422,693	5.50%
N) New surface BOP requirements	$2,416,978	0.28%
O) New subsea BOP system requirements	$48,339,566	5.61%
P) New accumulator system requirements	$2,362,014	0.27%
Q) Chart recorders	$1,088,029	0.13%
R) Notification and procedures requirements for testing of surface BOP systems	$91,228	0.01%
S) Alternate BOP control station function testing	$241,697,832	28.05%
T) ROV intervention function testing	$4,028,039	0.47%
U) Autoshear, deadman, and EDS system function testing on subsea BOPs	$48,436,246	5.62%
V) Approval for well control equipment not covered Subpart G	$225,380	0.03%
W) Breakdown and inspection of BOP system and components	$41,572,027	4.82%
X) Additional recordkeeping for RTM	$14,102	0.00%
Y) Industry familiarization with the new rule	$19,051	0.00%
Z) BAVO application costs	$422,534	0.05%
Grand Total	**$861,718,120**	**100.00%**

Note: APM = application for permit to modify; MODU = mobile offshore drilling unit; BOP = blowout preventer; APD = application for permit to drill; EDS = emergency disconnect system; BAVO = BSEE-approved verification organization.

Appendix B. Oil Spill Volumes

Table B-1. Oil Spill Volumes by Year for Oil Spills Greater Than 10 Barrels

Year drilling started	Barrels of oil spilled	Wells	Spilled barrels per started well
1988	0	1,118	0.00
1989	0	1,076	0.00
1990	0	1,180	0.00
1991	0	848	0.00
1992	100	611	0.16
1993	0	1,030	0.00
1994	0	1,150	0.00
1995	0	1,190	0.00
1996	0	1,291	0.00
1997	0	1,500	0.00
1998	0	1,164	0.00
1999	125	1,051	0.12
2000	774	1,398	0.55
2001	0	1,286	0.00
2002	350	979	0.36
2003	10	916	0.01
2004	11	932	0.01
2005	0	844	0.00
2006	35	793	0.04
2007	1,061	633	1.68
2008	0	574	0.00
2009	262	340	0.77
2010	4,928,100	268	18,388.43

Source: BSEE 2016a.