Assessment of the Financial Implications Resulting From Requiring Blind Shear Rams in Surface Blowout Preventers

Cost-Benefit Analysis for Drilling on the OCS
Proposed Minerals Management Service Regulation
30 CFR 250.441, RIN 1010-AC43

Introduction
Revision of 30 CFR 250.441 as proposed will require that blind shear rams become a mandatory component in surface blowout preventer stacks, used to drill oil and gas wells on the OCS. A cost-benefit analysis was performed to assess the financial implications that may result from the requirement.

Conclusion
Use of blind shear rams in surface blowout preventer stacks will improve the safety of well control operations and save lives. Moreover, property damages incurred by lessees, drilling contractors and society will be reduced in a significant number of blowout cases. Blind shear rams were a factor in well control for approximately 20% of the blowout cases reviewed. Since some industry representatives object to the new blowout preventer requirement, they apparently are willing to accept the higher risk and additional damages inherent with the status quo drilling practice.

Recommendation
Publish the regulation at 30 CFR 250.441(b), requiring that all surface blowout preventer stacks include blind shear rams capable of shearing drill pipe, in the final rule. The change would become effective 3 years after publication of the final rule.

Analysis of Costs and Benefits
Our analysis indicates that implementation of the proposed regulation could result in net present value benefits to lessees and drilling contractors ranging from $0.8 million in the *Minimum Benefit Projection* to $39.8 million in the *Maximum Benefit Projection*, with a *Most Likely Benefit Projection* of $20.3 million, as shown on Exhibits 1, 2 and 3. These benefits can be achieved by investing in the acquisition and installation of blind shear rams for a present value cost of $13 million. Exhibit 4 demonstrates that baseline damages and costs avoided by the industry with blind shear rams far exceed the net present value cost of acquiring and installing the blind shear rams. The gross industry benefits from this regulation will be between $14 million and $52.6 million in present value.

Building the Database
Blowouts recorded in OCS Report MMS 92-0058, Accidents Associated With Oil and Gas Operations, OCS, 1956-1990, were reviewed to determine how often blind shear rams would have, or actually did have, a beneficial effect on well control operations involving surface blowout preventers. Only cases in OCS Report MMS 92-0058

occurring from 1977 to 1990 were considered, because information for earlier incidents is not adequate to determine the cause of the blowouts or the corrective action taken.

Over the time period reviewed, blind shear rams were in place and had a beneficial effect in 6 cases. Another 13 cases were identified where blind shear rams were not used, but could have potentially helped the operators control the wells. Overall, well control operations for approximately 1 in 5 of the blowouts did, or could have benefited from the use of blind shear rams. This is a substantial fraction of the total number of blowouts, and forms strong justification for revising the regulation for surface blowout preventer requirements.

Post 1990 blowout records were also reviewed to complete the list of cases where blind shear rams were, or could have been a factor in well control. Of the more recent cases, 5 blowouts were identified as relevant to the study, but only one involved a blowout preventer stack with blind shear rams. The addition of these cases increased the total number to 24, as shown in Exhibit 5.

Cost-Benefit Assumptions

<u>Input Data for Estimating Blind Shear Ram Costs</u>: Avoidance of future blowout related damages and costs, through the installation of blind shear rams on all existing drilling rigs with surface blowout preventer stacks, would constitute the potential benefits to lessees, their contractors and society. In the analysis conducted for this study, the benefits will be partially offset by the cost to the offshore oil and gas drilling industry to purchase and install blind shear rams, in surface blowout preventer stacks that don't already have them.

Offshore drilling contractors were surveyed to determine the number of blind shear rams needed to bring the entire fleet of offshore drilling rigs up to the new specification. Of the rigs that are currently active or ready to work, 100 blowout preventer stacks did not have blind shear rams. When rigs temporarily taken out of service are included, 170 sets of blind shear rams would be needed.

The cost of upgrading existing surface blowout preventer stacks to include blind-shear rams was based on 2 assumptions. First, it was projected that all rigs active or ready to work would remain in service for more than the next 3 years. Second, one-half of the rigs temporarily taken out of service would be placed back into long term service over the next 3 years. If the cost per blind shear ram is approximately $105,000, as estimated by one manufacturer recently interviewed, then the total cost for 135 rams is approximately $14.175 million. Spread out over 3 years, the annual cost is approximately $4.725 million.

<u>Input Data for Estimating Damages Avoided</u>: An attempt was made to estimate the blowout related costs incurred by lessees and their contractors for the 24 cases, from incident descriptions given in various blowout reports. These costs, in the form of 1) injuries to personnel and fatalities, 2) pollution, 3) well control costs, 4) lost productivity, 5) platform and well damages, and 6) drilling rig damages, were used as the basis for

projecting future blowout related costs avoided by installing blind shear rams. Cost projections are dependant on the frequency of occurrence for certain events. The table below summarizes information for some key categories of events. Figures for rig, platform and well damages are taken directly from the blowout reports. Damage descriptions are substituted when dollar estimates were not given.

Table 1

Period	# of Cases	# of Injuries	# of Fatalities	# of Relief Wells	$ Platform/ Well Damages	$ Rig Damages
'77 - '82	13	11	9	1	living quarters destroyed, living quarters and upper deck destroyed	$2.5mm, lost rig, fire damage, fire damage, lost rig
'83 - '92	6	11	0	2	$4.47mm, 13 wellheads and flowlines replaced, $0.15mm	$3.135mm, lost rig, $0.35mm, $0.25mm
'93 - '02	5	6	1	2	<$0.437mm	lost rig

During the rulemaking process, various government agencies need to agree on the costs associated with this regulation. In the case of fatalities, a standard treatment is not available, and different agencies use their own models for making such assessments. Accordingly, the costs per fatality were omitted from this analysis to avoid creating an unnecessary dispute over the dollar magnitude of this element of damages avoided. The cost distribution for injuries was estimated from the description of injuries found in the blowout reports.

A vast majority of the blowouts occurred while drilling gas reservoirs. Oil spills are minimal for these incidents, so normal contract fees to retain clean-up services were considered adequate to handle pollution created by a typical blowout. These fees are incurred regardless of whether a blowout actually occurs, and for that reason, were not included as a cost related to blowouts.

High pressures and temperatures encountered while drilling deep gas wells, from depths of 15,000’ to more than 20,000’, make these wells some of the riskiest from a technical viewpoint. This is of concern because a higher proportion of future drilling targets will be to these deep depths, where substantial amounts of undiscovered natural gas resources reside. Relief well costs for deep gas reservoirs would be some of the most expensive, and are used to set the maximum value of $15 million in the relief well cost distribution.

Well control operating costs will vary considerably, depending on the duration of the incident. Durations for the cases studied ranged from less than 1 day to as many as 57 days. An in-depth effort to estimate these costs could not be completed within the timeframe for this study. In its place, actual costs submitted with daily reports for incident # 21 on Exhibit 5 were substituted, since this information was readily available. This blowout took 19 days to control and the total cost incurred provides a conservative estimate for the maximum value anticipated in the analysis. It is likely that a higher maximum value would have been derived through additional research, thereby adding more support to the argument for requiring blind shear rams.

Reductions in lease revenues from lost production were not included in the analysis. In more than 80% of the cases with pre-existing production, shut-in periods were relatively short and ranged from 1 day to less than a month. It also appears that most production rates for these cases returned to pre shut-in levels, or increased following the shut-ins. While this can be explained with reservoir depletion theory, it also shows that overall, damage to the reservoirs was minimal in these cases. In the remaining cases, cash flow was interrupted for several months or production ceased. Determination of the costs associated with lost production would require additional research. This work was not conducted, but had it been, the benefits from requiring blind shear rams would have increased, and further supported the argument for requiring blind shear rams.

In 6 of the 24 cases, there was major damage to the production facilities. The amount of damage among all cases varied considerably, depending on the severity of the incident. Platform and well damages for the cases studied ranged from none to the destruction of the living quarters and upper deck in one case, and the need to replace 13 wellheads and associated flowlines in another. A detailed cost estimate was not made for the high damage cases, given time constraints. Instead, well costs of $4.47 million reported for incident # 15 were used to set an upper limit on the damages avoided. This is considered a conservative maximum value. A higher maximum could be justified with current cost estimation methods, which would result in creating additional support for requiring blind shear rams.

Rigs in 10 of the 24 cases had major damage. When analyzing blowout damages to the drilling rigs, data points for the estimated financial costs tended to fall at the minimum or the maximum ends of the distribution. In general, a blowout is either controlled with a minimal amount of damage, or not controlled with total destruction of the rig. A cumulative distribution was applied to represent rig damages. The calculated mean value was $10.270 million.

Consideration was given to substituting insurance premiums paid by the lessees and drilling contractors for property damage estimates used in the analysis. This method was not adopted because it has a serious drawback: the total cost of insuring all lessees and contractors that are drilling wells on the OCS is spread among many insurance companies and covers many activities and types of accidents. Premiums charged by insurance companies for equal amounts of a particular type of insurance coverage will vary and be dependant on each lessee's and contractor's individual set of circumstances. Each insurance company has a different corporate structure and set of financial goals, adding to the difficulty already mentioned in using insurance premiums as a proxy for expected blowout damages.

Description of Damage Scenarios: Figures given in Table 1 indicate that there has been a downward trend in incidents over time. This change is accounted for in the cost-benefit projections attached as Exhibits 1 through 4. Scenarios for the projections are based on the parameters in Table 2.

Table 2

Scenario	# of Cases	# of Fatalities Avoided	# of Relief Wells Avoided
Maximum Benefit Projection	6	2	2
Most Likely Benefit Projection	4	1	1
Minimum Benefit Projection	2	0	0

Over the 6 year period from ’77 to ’82, 13 relevant blowout cases were identified, or more than 2 per year. In the 20 years to follow, only 11 more cases were found, a drop in annual occurrence to 1 blowout every other year. At that rate, a projected realization of only 2 blowouts over the next 20 years is unlikely but conceivable, and this number was adopted as the minimum number of incidents. If industry can only reduce the number of blowouts at one-half the historical rate, 6 blowouts might be expected over the next 20 years. This figure was used to set the maximum number of incidents avoided.

Only 1 fatality has occurred over the last 20 years. A projection of 0 fatalities avoided was chosen for the minimum to reflect an optimistic outlook. To set the maximum, 2 fatalities avoided was selected to give recognition to the fatality rate during the past 10 years, and to the hazardous nature of working conditions during well control operations.

There seems to be a higher occurrence of relief well drilling in more recent years, which may be interpreted as a risk reduction measure on industry’s part. The public is very sensitive to environmental matters related to oil, and a large oil spill could put severe limitations on future exploration and development activity. Relief wells have been drilled in about 1 of every 3 blowouts over the last 20 years, so that ratio was used in the projections to scale relief wells avoided.

Incidents were spaced allowing relatively equal amounts of time between occurrences, partly to preclude introducing bias from the effects of discounting.

If you have questions concerning this analysis, please contact Bob Mense, Petroleum Engineer, Economics Division, Minerals Management Service at (703)787-1518.