Regulatory Assessment
with
Regulatory Flexibility Analysis

Draft Regulatory Evaluation

Notice of Proposed Rulemaking--Pipeline Safety: Safety Standards for Increasing the Maximum Allowable Operating Pressure for Natural Gas Transmission Pipelines

[Docket ID PHMSA-2005-23447]

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1. INTRODUCTION

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is proposing changes to the Federal pipeline safety regulations in 49 CFR Part 192, which cover the transportation of natural gas by pipeline. Specifically, PHMSA proposes allowing natural gas transmission pipeline operators to use an alternative method to establish the maximum allowable operating pressure (MAOP) for certain pipelines (1) constructed of steel pipe manufactured using modern steel chemistry, rolling practices, and standards, and (2) inspected and tested to more rigorous standards.

This report examines the benefits and costs of the proposed regulatory changes. Additionally, the report includes the analysis required by the Regulatory Flexibility Act.

2. BACKGROUND

Gas transmission pipelines in the U.S. use steel pipe almost exclusively.[1] Under Federal pipeline safety regulations, steel transmission pipelines must use a MAOP corresponding to a stress level that is below the specified minimum yield strength (SMYS) of the steel pipe. Each pipeline class location has a different design factor and corresponding stress level, which are currently as follows:

- Class 1: 72% of SMYS
- Class 2: 60% of SMYS
- Class 3: 50% of SMYS
- Class 4: 40% of SMYS

The estimated percentages of transmission mileage in these four class locations are

- Class 1: 80%[2] to 90%[3] of mileage
- Class 2: 5%[4] to 10%[5] of mileage
- Class 3: Less than 5%[6] to 10%[7] of mileage
- Class 4: Approximately 0.5% of mileage[8]

[1] Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.
[2] Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.
[3] Richard B. Kuprewicz, Accufacts Inc., "Increasing MAOP on U.S. Gas Transmission Pipelines," a paper prepared for the Pipeline Safety Trust, PHMSA-2005-23447-50.
[4] Richard B. Kuprewicz, Accufacts Inc., "Increasing MAOP on U.S. Gas Transmission Pipelines," a paper prepared for the Pipeline Safety Trust, PHMSA-2005-23447-50.
[5] Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.
[6] Richard B. Kuprewicz, Accufacts Inc., "Increasing MAOP on U.S. Gas Transmission Pipelines," a paper prepared for the Pipeline Safety Trust, PHMSA-2005-23447-50.
[7] Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.
[8] Richard B. Kuprewicz, Accufacts Inc., "Increasing MAOP on U.S. Gas Transmission Pipelines," a paper prepared for the Pipeline Safety Trust, PHMSA-2005-23447-50.

When Federal regulations were adopted in 1970, 72% of SMYS was selected as the upper limit for the design factor to ensure conservative safety margins. The manufactured quality of steel pipe at the time necessitated the conservative safety margins.[9] Since then, manufacturers have dramatically improved the quality of steel pipe. Additionally, pipeline construction practices and operation and maintenance (O&M) procedures of pipeline operators have improved. In response to the material, construction, and O&M advances, several nations, including Canada and the United Kingdom, have allowed pipelines to operate at up to 80% of SMYS.[10] A few nations, including Japan and Germany, mandate a MAOP lower than 72% of SMYS.[11]

In 1970, Federal regulators allowed pipelines that had operated successfully for many years at a stress level greater than 72% of SMYS to continue to operate at the higher stress level. Currently, approximately five thousand miles of gas transmission pipelines in the U.S. are operating at a stress level that is greater than 72% of SMYS because of grandfathering.[12] Operators desiring a MAOP greater than 72% of SMYS may apply to PHMSA for waivers (i.e., special permits). When evaluating waiver applications, the key consideration for PHMSA is whether the pipelines can operate at higher stress level without compromising safety.

Beginning in 2006, PHMSA evaluated requests for special permits from three companies seeking to operate natural gas transmission pipelines at higher pressures than currently allowed by regulation. Those requests were made by

- Alliance Pipeline L.P.[13]
- Maritimes & Northeast Pipeline, L.L.C.[14]
- Rockies Express Pipeline LLC[15]

The requests were for proposed and existing pipelines, and all requested permission to operate at 80% of SMYS in the class 1 locations. Some requests also included increases in the MAOP for other class locations.

PHMSA afforded the public an opportunity to provide comments on each special permit request, and received favorable comments from both industry and the public. Additionally, PHMSA briefed its technical advisory committees, held a public meeting,

[9] Joy O. Kadner, PHMSA, "Reconsideration of Maximum Allowable Operating Pressures for Natural Gas Pipelines, PHMSA-2005-23447-46.
[10] Joy O. Kadner, PHMSA, "Reconsideration of Maximum Allowable Operating Pressures for Natural Gas Pipelines, PHMSA-2005-23447-46.
[11] Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.
[12] Richard B. Kuprewicz, Accufacts Inc., "Increasing MAOP on U.S. Gas Transmission Pipelines," a paper prepared for the Pipeline Safety Trust, PHMSA-2005-23447-50.
[13] See DOT Docket PHMSA-2005-23387.
[14] See DOT Docket PHMSA-2005-23448.
[15] See DOT Docket PHMSA-2006-23998.

and brought stakeholders into the development of permitting criteria. PHMSA received supportive comments at these meetings.

PHMSA granted all three requested special permits. In granting them, PHMSA required the operators to demonstrate compliance with certain design specifications and imposed additional safety standards.

3. STATEMENT OF THE PROBLEM

The proposed rule supports the Secretary of Transportation's priorities by improving performance and harnessing 21st Century technologies. Increasing operating pressure can ease supply constraints by boosting pipeline capacity by as much as 10 percent. Increasing capacity also enhances pipeline efficiency. This enhanced performance is made possible by technological advances in metallurgy and pipe manufacture, as well as by improved pipeline lifecycle management practices. Pipelines built with improved steel pipe and operated in compliance with improved lifecycle management practices can operate safely at higher stress levels. Incipient pipeline flaws can occur during pipe manufacture or installation. The technological advances decrease the risk of these flaws resulting in pipe failure over time due to the operating pressure. Furthermore, improved life cycle management practices, which include rigorous testing, allow operators to detect flaws well before failure. Because revised regulations allowing increased capacity encourage the use of newer pipeline materials and associated safety standards, the result should have a net positive effect on overall pipeline safety.

PHMSA's rulemaking proposal grows out of the agency's examination of the safety issues in allowing existing or proposed pipeline to operate at higher stress levels. From a policy perspective, the experience with last year's special permits has been very positive. One of the successful permitees, Maritimes & Northeast Pipeline, plans to take advantage of the extra capacity a higher stress level will allow to redirect gas supply to the New York City metropolitan area, the most capacity-strained market in the nation.

Incorporating the special permit standards into PHMSA's regulations would allow qualified pipelines to operate at higher pressure. The proposed rule would ease regulatory burdens, encourage the development of new infrastructure, improve regulatory certainty, and reduce the agency workload associated with granting individual applications.

4. RATIONALE FOR REGULATORY ASSESSMENT

Executive Order 12866 directs all Federal agencies to develop both preliminary and final regulatory analyses if their proposed regulations are likely to be "significant regulatory actions" with an annual impact on the economy of $100 million. The Order also requires a determination as to whether a proposed rule could adversely affect the economy or a section of the economy in terms of productivity and employment, the environment, public health, safety, or State, local or tribal governments. In accordance with the regulatory philosophy and principles provided in Sections 1(a) and (b) and Section 6(a)(3)(C) of

Executive Order 12866, an economic analysis of the proposed regulatory changes must be conducted. Furthermore, the Regulatory Flexibility Act of 1980, as amended, requires Federal agencies to conduct a separate analysis of the economic impact of proposed and final rules that have a significant impact on a substantial number of small entities. In addition, the Unfunded Mandates Reform Act also requires an impact analysis for rules that that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted for inflation) in any one year.

In accordance with the above directives, PHMSA has performed a preliminary evaluation of the potential compliance costs of the proposed rule and other feasible regulatory options, and identified those benefits that can be expressed in monetary terms. To the extent possible, this evaluation is based on the available data and information from a range of sources, including PHMSA's Incident Reporting Database and comments received from stakeholders. PHMSA estimates that the impact of implementing the proposed rule will be greater than $100 million annually. PHMSA does not expect the rule to adversely affect the economy or any sector of the economy in terms of productivity and employment, the environment, public health, safety, or State, local or tribal governments. PHMSA has also determined, as required by the Regulatory Flexibility Act, that the proposed rule will not have a significant economic impact on a substantial number of small entities in the United States. In addition, PHMSA has estimated that this proposed rule will not impose annual expenditures of $120.7 million or more on State, local, or tribal governments or the private sector, and thus will not require an Unfunded Mandates Reform Act analysis.

5. ALTERNATIVES CONSIDERED

In addition to taking no rulemaking action, PHMSA considered the following two alternatives with respect to MAOP:

- Delay rulemaking
- Undertake rulemaking

Each of these alternatives is evaluated below.

5.1 Take no rulemaking action

PHMSA could continue to address individual special permit applications on a case-by-case basis. Although this approach would give PHMSA additional oversight control, it would be less efficient for industry and for the agency than promulgating a regulatory standard. For this reason, this was not considered further, but rather will be used as the baseline by which to measure the costs and benefits of the other regulatory alternatives.

5.2 Delay rulemaking

Instead of embarking on the immediate development and implementation of a regulatory standard, PHMSA could delay rulemaking and continue to work with consensus standard-setting organizations. Current consensus standards already allow increased operating pressures, but without the additional safety requirements PHMSA has imposed in special permits. The standard-setting organization responsible for these standards is currently establishing a subcommittee to address operation of pipelines at higher pressures.

PHMSA could delay rulemaking in order to gain more experience with evaluating applications, and monitoring compliance and outcomes. Furthermore, the agency could wait until the new subcommittee of the standards organization has completed its work. A delay would provide the agency with more confidence in any proposed regulatory standard. Delaying the rulemaking, however, would necessitate continuing the less efficient permit process. Furthermore, promulgating a rulemaking does not preclude PHMSA, at some point in the future, from reconsidering or modifying safety requirements as a result of the standard setting organization's further research. For this reason, PHMSA rejected the option to delay the rulemaking, but specifically requests comment on the specific safety requirements this rule proposes.

5.3 Undertake rulemaking

The third alternative considered by PHMSA was to undertake a new rulemaking without undue delay. This would minimize the inefficiencies associated with the special permit process. For this reason, the rulemaking alternative was chosen by PHMSA. PHMSA will continue to entertain special permit applications for MAOP increases, to the extent permitted by the law, until such permits are determined unnecessary. The ongoing permit process will help inform any rulemaking outcome.

Furthermore, within this option, the agency has explored two options; adopt the current consensus standard as written, or adopt a rulemaking that has requirements similar to the additional safety requirements PHMSA has imposed in the special permits granted to date. Currently, the proposed rule is the latter of these options. OMB Circular A-119 and the National Technology Transfer and Advancement Act of 1995 direct Federal agencies to use voluntary consensus standards in lieu of government-unique standards in their regulatory and procurement activities, except where such standards are inconsistent with law or otherwise impractical. Therefore, this impact analysis separately estimates the impact of the additional safety requirements that differ from the consensus standard, describes why the agency believes this is the best approach, and takes comment on this conclusion.

6. ECONOMIC ANALYSIS

PHMSA proposes to revise the Federal pipeline safety regulations in 49 CFR Part 192 to allow use of an "alternative" MAOP when certain conditions are met. Under the proposed rule, the alternative MAOP for each class location would be as follows:

- Class 1: Greater than 72% of SMYS but less than or equal to 80% of SMYS
- Class 2: Greater than 60% of SMYS but less than or equal to 67% of SMYS
- Class 3: Greater than 50% of SMYS but less than or equal to 56% of SMYS
- Class 4: No alternative MAOP is proposed for class 4 locations

The conditions that must be met in order for a segment to be eligible for operation at the alternative (higher) MAOP include requirements relating to

- Design
- Construction
- O&M
- Notification

With respect to design, operators must comply with requirements for

- The properties of the steel used for the pipe
- The manufacturing standards for the pipe
- Fracture control
- Plate quality control
- Seam quality control
- Mill hydrostatic testing
- Coating
- Fittings and flanges

With respect to construction, operators must comply with requirements for

- Quality assurance
- Girth welds
- Depth of cover
- Initial strength testing
- Cathodic protection
- Interference currents

With respect to O&M, operators must comply with requirements for

- Responding to emergencies in high consequence areas (HCAs)
- Monitoring gas quality for internal corrosion control
- Controlling interference that can impact external corrosion
- Implementing external corrosion control – cathodic protection
- Implementing external corrosion control – close interval survey
- Implementing external corrosion control – annual readings
- Patrolling the right of way
- Maintaining the depth of cover
- Reevaluating the potential impact radius as necessary

- Notifying the public proximate to the pipeline
- Performing threat assessments
- Performing indirect assessments
- Performing baseline and periodic internal inspections
- Performing additional inspections
- Performing direct assessments when internal inspection is not possible
- Evaluating anomalies conservatively and repairing defects expeditiously

With respect to notification, operators must notify PHMSA when they choose to use an alternative MAOP.

The proposed rule does not require operators of gas transmission pipelines to make any changes. Rather, the rule provides operators with the option of using an alternative (higher) MAOP if their pipelines meet certain specific conditions. The choice of whether to meet those conditions and use an alternative MAOP is left to the operators.

In the remainder of this section, the impacted industry is identified and the affected mileage is estimated, and then the benefits and costs of the proposed rule are considered. All monetary values, unless otherwise indicated, are given in 2006 constant dollars.[16]

6.1 Impacted Industry

The proposed rule would cover all existing gas transmission pipelines, of which there are approximately 320 thousand miles currently,[17] as well as any future gas transmission pipelines.

PHMSA expects the MAOP for approximately 3,500 miles of existing pipeline to be uprated as a consequence of the proposed rule. As a practical matter, only a portion of the existing gas transmission pipeline mileage would be a candidate for a higher alternative MAOP due to the requirements associated with increasing the MAOP. Many pipeline operators are expected to find the cost of using the alternative MAOP to be too high. For instance, fitting and pressure vessel replacement costs may prevent some pipelines from converting to a higher MAOP. Additionally, the costs associated with converting non-piggable lines are expected to be prohibitive. Also, PHMSA expects that only post-1980 pipelines will be appropriate for converting to a higher MAOP.

PHMSA expects approximately 700 miles of new gas transmission pipeline certificated each year to take advantage of the proposed regulation and be operated at an alternative

[16] To convert nominal dollars into 2006 constant dollars, the implicit price deflator for Gross Domestic Product (GDP), transformed from 2000=100 to 2006=100, was used (for the implicit price deflators, 2000=100, see Table 1.1.9, Implicit Price Deflators for Gross Domestic Product, Bureau of Economic Analysis, National Income Accounts). The 2006 deflator (2000=100) was calculated by averaging the quarterly implicit price deflators for the first and second quarters of 2006. After the drafting of this analysis, GDP implicit price deflators have been updated for all of 2006; however, this update had no material impact on the results of the analysis.

[17] See PHMSA, Distribution & Transmission Annual Mileage Totals (1984-2005), http://ops.dot.gov/stats/stats.htm.

MAOP. This includes pipeline mileage in class 1, class 2, and class 3 locations. PHMSA expects that many operators will only select an alternative MAOP for their new pipelines in class 1 locations.

For this analysis, PHSMA expects that, in the first year after implementation of the proposed rule, 4,200 miles of pipeline would begin to be operated at an alternative MAOP. This consists of 3,500 miles of existing pipeline and 700 miles of new pipeline. Furthermore, PHMSA expects that in each subsequent year and additional 700 miles of new pipeline would begin to be operated at an alternative MAOP.

6.2 <u>Benefits</u>

The main expected benefits of the proposed rule would be the following:

- A reduction of the consequences (e.g., deaths, injuries, property damage, and lost gas) resulting from pipeline incidents
- Fuel cost savings
- A reduction in pipeline capital expenditures
- An increase in pipeline capacity
- An increase in line-pack
- A reduction in adverse environmental impacts

These benefits are discussed below. Following the discussion of each individual benefit, the total benefits and their present value are estimated. The benefits discussion concludes with a review of benefits uncertainties.

6.2.1 Reduced Incident Consequences from Pipeline Incidents

The operation of natural gas transmission pipelines at higher MAOP is not expected to increase the number or severity of pipeline incidents.[18] The proposed rule's requirements, such as right of way patrolling, additional internal inspections, and anomaly repair, are expected to prevent incidents that would have occurred in the absence of the proposed rule, and to help mitigate the consequences of the incidents that do occur.

A quantitative estimate of the benefits associated with reduced incident consequences is not developed for this analysis. While PHMSA expects the proposed rule to reduce the incidents and incident consequences on the pipeline mileage affected by the rule, quantification of the benefits resulting from those reductions would be difficult. For instance, differentiating the benefits attributable to increased right-of-way patrolling from those attributable to other regulatory safety requirements relating to the prevention or mitigation of excavation or natural forces damage would be very hard. As another example, differentiating the benefits attributable to additional internal pipeline

[18] See, for instance, Joy O. Kadnar, PHMSA, "Reconsideration of Maximum Allowable Operating Pressures for Natural Gas Pipelines," PHMSA-2005-23447-46; Alan Eastman, Mears Group, Inc., "Impact of 80% SMYS Operation on Time Dependent Threats," PHMSA-2005-23447-28.

inspections from those attributable to other regulatory safety requirements relating to corrosion damage prevention and control would also be very hard.

Additionally, PHMSA expects that many pipeline operators have already adopted the practices required by the proposed rule. As a consequence, the estimated benefits associated with the safety improvements attributable to the proposed rule would likely be relatively small.

6.2.2 Fuel Cost Savings

Natural gas engines or turbines are frequently used to drive the compressors that move the product through gas transmission pipelines. Industry expects the proposed rule to reduce fuel costs for pipelines using an alternative MAOP.

In a submission to PHMSA relating to its petition to increase the MAOP on 874.7 miles of pipeline in the U.S. from 72% of SMYS to 80% of SYMS, Alliance Pipeline estimated that it could save $11.9 million on its fuel costs in 2007 with the higher MAOP. In calculating this estimate, gas was assumed to cost $5.72 per million BTUs.[19]

For this analysis, PHMSA assumes that the annual fuel cost savings realized by operators of pipelines choosing to go with an alternative MAOP would be $14,000 per mile (≈ $11.9 million / 874.7 miles). This estimate is based on the fuel cost savings information provided by Alliance Pipeline.

For this analysis, PHMSA assumes that only existing pipelines choosing to go with an alternative MAOP would realize fuel cost savings. PHMSA assumes that new pipelines would have a choice of fuel cost savings or reduced capital expenditures, but not both, and would choose reduced capital expenditures. PHMSA requests comment on these assumptions.

Assuming that 3,500 miles of existing pipeline are initially affected in the first year, the total cost savings in that year would be $49,000,000 (= $14,000 x 3,500 miles). It should be noted that all fuel savings are annually recurring. That is, they will continue to be realized each and every year after an existing pipeline begins using an alternative MAOP.

6.2.3 Reduced Capital Expenditures

Using an alternative MAOP is expected by industry to reduce capital expenditures for new pipelines.[20] The reduced capital expenditures we can quantify would come primarily

[19] Submission by Alliance Pipeline, L.P., to PHMSA, Feb. 20, 2006, PHMSA-2005-23387-8. With increasing gas prices, the fuel cost savings could be substantially higher.

[20] See, for example, the response by BP Canada Energy Marketing Corp. to dockets PHMSA-2005-23387, PHMSA-2005-23447, and PHMSA-2005-23448 or Howard J. Murphy, Jr., Energy Experts International,

from a reduction in the required amount of steel for pipe. To determine the wall thickness of pipe (t) needed for a specific operating pressure (P), an operator would use the design formula specified in § 192.105 and solve for t as follows:

t = (P x D) / (2 x S x F)[21].

The increase in the design factor F proposed in this rulemaking results in a decreased value for t. The use of thinner walled pipe results in a savings in the amount of steel needed.

Information on the total capital expenditure savings attributable to the use of an alternative MAOP by new pipelines is not readily available. Neither is information on the capital expenditure savings attributable to the expected reduction in the required investment in compressors. PHMSA has developed an estimate for the capital expenditure savings attributable to the expected reduction in the required investment in pipe, which is based on information obtained by PHMSA from materials submitted in support of special permits for five pipeline projects. That information is presented in Table 1. PHMSA's estimate of the expected reduction in the required investment in pipe is $78,000 per mile (≈ ($1,644,426,018.22 - $1,482,036,468.80) / 2,075 miles). The estimate assumes that the cost of steel for pipe is $1,300 per ton.

TABLE 1. STEEL PIPE COST COMPARISON: PIPELINES OPERATING AT 72% OF SMYS VERSUS PIPELINES OPERATING AT 80% OF SMYS

PIPELINE PROJECT CHARACTERISTICS

	Project	Status	Pipe Size (Inches)	MAOP (Psig)	Grade of steel (Psi)	Project length (Miles)	Project length (Feet)
1	Gulf South	Special permit granted	42	1333	70000	212	1,119,360
2	CenterPoint	Special permit granted	42	1168	70000	170	897,600
3	REX	Special permit granted	42	1481	80000	1323	6,985,440
4	KMLP	Special permit granted	42	1440	70000	137	723,360
5	Ozark	Special	24	1200	70000	8	42,240

"Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.

[21] D and S are defined in §192.105 as the nominal diameter of the pipe and its yield strength, respectively.

		permit pending					
	Ozark		36	1200	70000	225	1,188,000
	TOTAL					**2,075**	**10,956,000**

ESTIMATED COST OF STEEL WITH PIPELINE OPERATING AT 72% OF SMYS

	Project	Pipe Size (Inches)	Pipe wall thickness (Inches)	Weight of steel per foot (Pounds)	Total weight of steel (Tons)	Estimated total cost of steel*
1	Gulf South	42	0.56	246.0732	137,722.27	$179,038,953.54
2	CenterPoint	42	0.49	215.9717	96,928.11	$126,006,547.84
3	REX	42	0.54	239.332	835,919.65	$1,086,695,543.79
4	KMLP	42	0.60	265.5396	96,040.36	$124,852,471.29
5	Ozark	24	0.29	72.4302	1,529.73	$1,988,643.68
	Ozark	36	0.43	162.968	96,802.97	$125,843,858.08
	TOTAL					**$1,644,426,018.22**

ESTIMATED COST OF STEEL WITH PIPELINE OPERATING AT 80% OF SMYS

	Project	Pipe Size (Inches)	Pipe wall thickness (Inches)	Weight of steel per foot (Pounds)	Total weight of steel (Tons)	Estimated total cost of steel*
1	Gulf South	42	0.5	221.8175	124,146.82	$161,390,863.92
2	CenterPoint	42	0.438	194.6024	87,337.57	$113,538,840.38
3	REX	42	0.486	215.6793	753,307.56	$979,299,829.34
4	KMLP	42	0.54	239.332	86,561.60	$112,530,075.21
5	Ozark	24	0.258	65.48091	1,382.96	$1,797,843.89
	Ozark	36	0.386	146.9555	87,291.55	$113,479,016.07
	TOTAL					**$1,482,036,468.80**

*Cost of steel estimated at $1,300 per ton.

Source: Materials submitted to PHMSA in support of special permits.

Assuming that 700 miles of new pipeline are initially affected by the proposed rule in the first year and that 700 miles of new pipeline are added each year thereafter, the expected annual capital expenditure savings attributable to the reduction in pipe investment would be approximately $54.6 million (= $78,000 per mile x 700 miles). As indicated above, this estimate does not include any capital expenditure savings attributable to compressor investment, a savings that could be substantial.[22]

[22] For estimates of the potential savings on compressor investment on the Alaska Natural Gas Transportation System, see Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.

6.2.4 Increased Pipeline Capacity

In the case of new pipelines, the ability to use an alternative MAOP will make it possible to transport more product. Quantifying the value of this increased capacity is difficult, and no estimate has been developed for this analysis. Nonetheless, PHMSA expects the value of increased capacity due to use of alternative MAOP by gas pipelines to be significant. Estimates made with respect to the proposed trans-Alaskan gas pipeline include an estimated increase of 14.2 million standard cubic feet of gas per day [23] In areas where production is already well-established, there is an even greater potential for increased pipeline capacity. For example, one recipient of a special permit estimated a daily increase of at least 62 million standard cubic feet of gas [24] In addition to simply being better able to meet demand, increased capacity will eventually mean cost savings with the elimination of the need for some future pipelines (i.e., the capacity added by using an alternative MAOP may eliminate the need to construct a new pipeline with that capacity at some later date). PHSMA specifically requests comment and estimates of the potentially large benefits of increased pipeline capacity.

6.2.5 Increased Line Pack

Line pack is essentially the quantity of natural gas filling a pipeline or pipeline segment and the amount of line pack varies by the pressure in the pipeline. On pipelines using an alternative MAOP, the line pack would be greater than it would be if an alternative MAOP were not used. Line pack may be either owned by the pipeline operator or provided by its customers.

Increased line pack has several advantages. First, it reduces the amount of external storage that is needed for natural gas. The reduction in the amount of external storage needed may result in capital or O&M cost savings for pipelines or their customers. Currently in the U.S., an estimated 95% to 98% of external natural gas storage is underground in depleted oil or gas reservoirs that have been retrofitted to handle gas injection and withdrawal.[25] Added storage via increased line pack could be particularly important in areas where underground storage is limited, such as in the southwest.[26]

Second, increased line pack allows more product to be delivered to customers when segments of a pipeline must be (1) taken out of service for routine maintenance or (2) shut down due to pipeline accidents or problems with pipeline valves, compressors, or other equipment.

[23] Howard J. Murphy, Jr., Energy Experts International, "Reconsideration of Maximum Allowable Operating Pressure: Costs and Benefits – A Macroeconomic View," PHMSA-2005-23447-35.
[24] Special Permit Analysis and Findings, Gulf South Pipeline Company, PHMSA-2006-26533-4
[25] Jeffrey H. Foutch, "Times Are Changing for Gas Storage," http://www.falcongasstorage.com/_filelib/FileCabinet/Articles/Times%20are%20Changing.pdf?FileName=Times%20are%20Changing.pdf.
[26] Submission by Kern River Gas Transmission Company, Docket No. PHMSA-2005-23447-23.

Third, increased line pack allows pipelines greater latitude in covering peaks in natural gas demand. This would be of value serving certain natural gas consumers, such as electric utilities, "…with load profiles that are not uniform." [27]

The value of these and any other benefits attributable to increased line pack cannot be readily quantified, but may be substantial. PHSMA specifically requests comment and estimates of the potential benefits of increased line pack.

6.2.6 Reduced Adverse Environmental Impacts

Allowing pipelines to use an alternative MAOP would have environmental benefits. Because of the potential for increased capacity by pipelines using an alternative MAOP, fewer pipelines might be needed. In addition to the potentially large economic benefits of increased capacity discussed above, this means that, all other things equal, less local ecology would be disturbed by the construction of new pipelines, and fewer environmentally sensitive areas would be disturbed by operation and maintenance activities such as pipeline repairs. In addition, the new requirements are expected to reduce the likelihood of leaks, and thereby reduce the potential harm that natural gas escaping from those leaks could have on the atmosphere. The value of the environmental benefits resulting from the use of an alternative MAOP cannot be readily quantified. It may be substantial, however.

6.2.7 Other Expected Benefits

PHMSA notes that a number of additional benefits would result from the proposed rule. Those benefits include the reduction of certain costs, other than steel costs, associated with the construction of new pipelines (e.g., pipe transport, compressor, and welding costs). Although not quantified in this report, these additional benefits are expected to be quite substantial.

6.2.8 Total Benefits

Table 2 and presents a summary of the estimated benefits of the proposed rule.. As a consequence of the proposed rule, PHMSA estimates that pipeline operators will realize annually recurring benefits of $49.0 million that begin in the initial year after the rule goes into effect. Additionally, PHMSA estimates that each year pipeline operators will realize one-time benefits of $54.6 million (since 700 miles of new pipeline operating at an alternative MAOP are added each year, the one-time benefits resulting from this added mileage will be the same each year) In total, operators will realize $103.6 million (= $49.0 million + $54.6 million) in benefits per year. These estimates only include the benefits attributable to (1) fuel savings and (2) reduced capital expenditures related to pipe on new pipelines. They do not include any benefits attributable to (1) reduced incident consequences, (2) reduced capital expenditures related to compressors on new pipelines, (3) increased pipeline capacity, (4) increased line pack, (5) less environmental disturbance, or (6) other improvements, since those benefits were not quantified in this

[27] Submission by Kern River Gas Transmission Company, Docket No. PHMSA-2005-23447-23.

analysis. PHMSA believes these additional benefits could add millions, and potentially hundreds of millions, to the total benefits from the proposed rule, and specifically asks comment regarding these additional benefits.

TABLE 2. SUMMARY AND TOTAL FOR THE ESTIMATED BENEFITS OF THE PROPOSED RULE

Benefit	Estimate for Year 1 (Millions of dollars per year)	Estimate of Benefits Occurring in Each Subsequent Year (Millions of dollars per year)
Reduced incident consequences	Not quantified	Not quantified
Fuel cost savings	$49.0 (recurring)	$0.0 (recurring)
Reduced capital expenditures	$54.6 (non-recurring)	$54.6 (non-recurring
Increased pipeline capacity	Not quantified	Not quantified
Increased line pack	Not quantified	Not quantified
Reduced adverse environmental impacts	Not quantified	Not quantified
Other expected benefits	Not quantified	Not quantified
TOTAL	$49.0 recurring + $54.6 non-recurring	$54.6 non-recurring

The present and annualized values of the estimated benefits over 20 years using 3% and 7% discount rates are given in Table 3. When considering the estimates, it should be remembered that they do not include the non-quantified benefits, which are likely to be significant.

TABLE 3. PRESENT VALUE AND ANNUALIZED VALUE OF THE ESTIMATED BENEFITS CALCULATED OVER 20 YEARS

Discount Rate	Present Value of Benefits (Millions of dollars)	Annualized Value of Benefits (Millions of dollars)
3%	$1,541	$103.6
7%	$1,098	$103.6

6.2.8 Benefit Uncertainties

The benefit estimates developed for this proposed rule are built on several key assumptions:

- Pipeline operators using an alternative MAOP will experience annual fuel cost savings of $14,000 per mile. This estimate depends critically on the gas price.
- 4,200 miles of pipeline will adopt an alternative MAOP in the first year after implementation of the proposed rule and an additional 700 miles of pipeline will begin to use an alternative MAOP in each succeeding year.
- Pipeline operators with new pipelines using an alternative MAOP will experience a capital expenditure cost savings attributable to pipe of $78,000 per mile.

These assumptions introduce uncertainties into the benefits calculations. The impacts of these uncertainties on the benefits estimates are discussed below.

Impact of Fuel Cost Savings Per Mile

The fuel saving per mile when an alternative MAOP is used may be lower than the $14,000 used in this analysis, or it may be higher. Table 4 presents the benefits that would result if the fuel savings per mile were decreased or increased by 50% (i.e., decreased to $7,000 per mile or increased to $21,000 per mile).

TABLE 4. BENEFITS WITH FUEL COST SAVINGS PER MILE CHANGED BY PLUS OR MINUS 50%

Benefits	Fuel Cost Savings Per Mile decreased by 50% (Millions of dollars)	Fuel Cost Savings Per Mile increased by 50% (Millions of dollars)
	Estimate	**Estimate**
Recurring	$24.5	$73.5
One-time	$54.6	$54.6
Discount Rate and Number of Years	**Present Value**	**Present Value**
3% and 20 years	$1,177	$1,906
7% and 20 years	$838	$1,357

When the fuel cost savings are increased by 50%, the present value of the benefits increases to 124% of the present value of the benefits under the base case. When the fuel cost savings are decreased by 50%, the present value of the benefits decreases to 76% of the present value of the base case. Thus, a 50% change in the fuel cost savings generates a 24% change in the present value of the benefits.

Impact of Pipeline Mileages with an Alternative MAOP

The actual pipeline mileages with which an alternative MAOP is used may be lower than those used in this analysis, or they may be higher. Table 5 presents the benefits that would result if the pipeline mileages were decreased or increased by 50%.

TABLE 5. BENEFITS WITH MILEAGE CHANGED BY PLUS OR MINUS 50%

Benefits	Mileage decreased by 50% (Millions of dollars)	Mileage increased by 50% (Millions of dollars)
	Estimate	Estimate
Recurring	$24.5	$73.5
One-time	$27.3	$81.9
Discount Rate and Number of Years	**Present Value**	**Present Value**
3% and 20 years	$771	$2,312
7% and 20 years	$549	$1,646

When the mileage is reduced to 2,100 miles in the first year with 350 miles in each subsequent year (i.e., by 50%), the present values are half of what was estimated using the 4,200 and 700 mileage values. When the mileage is increased to 6,300 miles in the first year with 1,150 miles in each subsequent year (i.e., by 50%), the present values also increase by 50%.

It is possible that the addition of new pipeline that would actually use an alternative MAOP might occur for a few years, rather than for 20 years following implementation of the proposed rule. PHMSA estimates that approximately 3,500 miles of new gas transmission pipeline certificated in the next 5 years would be operated at an alternative MAOP. Table 6 presents the benefits that would result if only those 3,500 miles of new pipeline were to use an alternative MAOP.

TABLE 6. THE ESTIMATED BENEFITS IF ADDITION OF 700 MILES PER YEAR ONLY OCCURS DURING FIRST 5 YEARS

Benefits	Estimate (Millions of dollars)
Recurring	$49.0
One-time	$54.6
Discount Rate and Number of Years	**Present Value (Millions of dollars)**
3% and 20 years	$979

7% and 20 years	$743

This change reduces the present value of the benefits to 64% or 68% of what it is under the base case. While this change would result in a reduction in the present value of the benefits of hundreds of millions of dollars, the resulting present values are still approach $1 billion.

Impact of Capital Expenditure Savings on Pipe for New Pipelines

The capital expenditure savings on pipe for new pipelines when an alternative MAOP is used may be lower than the $78,000 per mile used in this analysis, or it may be higher (especially since PHMSA did not include possible savings due to other capital expenditures besides steel cost). Table 7 presents the benefits that would result if the fuel savings per mile were decreased or increased by 50% (i.e., decreased to $39,000 per mile or increased to $117,000 per mile).

TABLE 7. BENEFITS WITH CAPTIAL EXPENDITURE SAVINGS FOR PIPE ON NEW PIPELINES CHANGED BY PLUS OR MINUS 50%

Benefits	Mileage decreased by 50% (Millions of dollars)	Mileage increased by 50% (Millions of dollars)
	Estimate	Estimate
Recurring	$49.0	$49.0
One-time	$27.3	$81.9
Discount Rate and Number of Years	**Present Value**	**Present Value**
3% and 20 years	$1,135	$1,947
7% and 20 years	$808	$1,387

When the capital expenditure savings are increased by 50%, the present value of the benefits increases to 126% of the present value of the benefits under the base case. When the capital expenditure savings are decreased by 50%, the present value of the benefits decreases to 74% of the present value of the base case. Thus, a 50% change in the capital expenditure savings generates a 26% change in the present value of the benefits.

6.3 Costs

The proposed rule does not require operators of natural gas transmission systems to use an alternative MAOP on their pipeline. Rather, it provides operators with pipeline in class 1, class 2, or class 3 locations the option of using an alternative MAOP under certain circumstances. The proposed rule will cost operators only if they choose to use an alternative MAOP on their pipeline; however, the benefits summarized above will only be realized under the assumption that these voluntary costs are also incurred.

For the most part, the proposed rule merely codifies existing best practices with respect to pipeline design, construction, and O&M. In many cases, pipeline operators have already adopted these best practices as part of their standard operating procedures; therefore, the costs associated with these practices already taking place are incorporated into the baseline of this analysis.

PHMSA expects costs attributable to the proposed rule are most likely to be incurred by operators for:

- Performing baseline internal inspections
- Performing additional internal inspections
- Performing anomaly repairs
- Installing remotely controlled valves on either side of high consequence areas (HCAs)
- Preparing threat assessments
- Patrolling pipeline rights-of-way
- Notifying PHMSA

These costs are discussed below. Following the discussion of each individual cost, total costs and the present value of those total costs are calculated. The uncertainties relating to the cost estimates are then discussed.

6.3.1 Performing Baseline Internal Inspections

The proposed rule requires the operators of new pipelines electing to use an alternative MAOP to do a baseline internal assessment. The assessment must use a high-resolution magnetic flux tool and be conducted within 3 years of placing the pipeline in service. In addition, the assessment requires the use of a geometry tool after the initial hydrostatic test and backfill, but no later than 6 months after placing the pipeline in service. The operators of existing lines electing to use an alternative MAOP must do a baseline assessment using the same tools within two years of raising the MAOP.

PHMSA expects operators to perform the required tests on new pipelines even without the proposed rule. Thus, new pipelines would incur no additional costs attributable to the baseline internal inspection requirement of the proposed rule. Existing pipelines that are uprated will need the two tests and, in the absence of the proposed rule, those tests would not ordinarily be performed.

Both of the tests on the existing pipeline mileage will be accomplished through the use of smart pigs. INGAA has previously estimated that the cost of smart pigging transmission pipelines is $3,669 per mile (in 2001 dollars).[28] This is $4,160 per mile when converted to 2006 dollars.

To simplify computation, both tests are assumed to be completed in the first year after the proposed rule is implemented.[29] The total cost of the tests would be approximately $29.1 million (= 3,500 miles of pipeline x $4,160 per mile x 2). This cost would be incurred only once.

6.3.2 Performing Additional Internal Inspections

The proposed rule requires periodic internal inspections using a high resolution magnetic flux tool on a frequency determined as if the segments were covered by 49 CFR 192 subpart O ("Gas Transmission Pipeline Integrity Management"). After baseline internal inspection has been completed, operators will need to use a smart pig (or equivalent) on their lines at least once every 10 years.

PHMSA estimates that the cost of smart pigging a pipeline is $4,160 per mile (see Section 6.3.1). Furthermore, PHMSA expects that this requirement would impact 4,200 miles of pipeline in the eleventh year after implementation of the proposed rule and 700 miles of pipeline each year thereafter.[30] In the eleventh year, pipeline operators would incur $17.5 million (= 4,200 miles x $4,160 per mile) in costs attributable to this requirement, while in years 12 through 20 they would incur $2.9 million (= 700 miles x $4,160 per mile) per year attributable to the requirement.

6.3.3 Performing Anomaly Repairs

The proposed rule requires that certain anomalies be repaired immediately, when identified, and certain others be repaired within one year of their discovery.

Given the requirements of 49 CFR 192.309, PHMSA does not expect that the repair requirements of the proposed rule will cause any newly laid pipelines to incur additional costs. Only existing pipelines are expected to incur additional costs attributable to the repair requirement. Furthermore, PHMSA expects the needed repairs to be identified primarily through internal inspections.

PHSMA does not have estimates of the immediate and one-year repair rates for transmission pipelines operating at a higher stress level. PHMSA does have immediate and one-year repair rates for transmission pipelines in HCAs, however. Those rates, derived from gas integrity management program performance metric submissions as of December 2006, are 0.03 immediate repairs per mile inspected and 0.08 one-year repairs

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[28] Final Regulatory Evaluation, Pipeline Integrity Management in High Consequence Areas (Gas Transmission Pipelines, p. 43, PHMSA-RSPA-2000-7666-356.

[29] This will increase the present value of the costs slightly, since the present value of $1 in the first year is greater than the present value of $1 in the second or third years.

[30] The cycle would begin over in the 21st year, which is beyond the scope of this analysis.

per mile inspected. Overall, the sum of immediate and one-year repair rates is 0.11 repairs per mile (= 0.03 immediate repairs per mile + 0.08 one-year repairs per mile).

PHMSA notes that these rates are for older pipelines, most not designed and constructed, or operated and maintained, to the rigorous standards required under the proposed rule. Furthermore, since inspections are prioritized based on risk, these estimates should be for the riskier pipeline segments within HCAs. Consequently, PHMSA expects that the rates for pipelines operating at higher stress levels would be significantly lower than 0.11 repairs per mile. For this analysis, PHMSA assumes that the immediate and one-year repairs will be 10% of the 0.11 repairs per mile, or 0.01 repairs per mile for gas transmission pipelines using an alternative MAOP. For ease of computation, it is assumed that all anomalies are discovered and repaired within the same year.

The U.S. Environmental Protection Agency has estimated that the total cost of repairing a 6-inch non-leaking defect by replacing the pipe in a 24-inch steel pipeline operated at 350 pounds per square inch gage (psig) with 10 miles between shutoff valves would be $22,746 (based on the publication date, this estimate is presumed to be expressed in 2003 dollars). This estimate includes the costs associated with (1) lost methane, (2) purge gas, (3) labor, (4) equipment and material, and (5) indirect costs.[31]

Duke Energy Gas Transmission and INGAA have estimated that the total cost of repairing a 6-inch non-leaking defect by replacing 6 feet of pipe in a 24-inch steel pipeline operated at 350 psig with 10 miles between block valves would be $15,300 (based on the publication date, this estimate is presumed to be expressed in 2004 dollars). This estimate includes the costs associated with (1) purge gas, (2) labor, (3) equipment and material, and (4) other. It does not include the value of lost methane, which was estimated to be $11,900 (presumably in 2004 dollars).[32]

For this analysis, the cost of repairing a steel pipeline is assumed to be $29,000. This is based on the estimates for replacing the steel piping by Duke and INGAA, including the value of lost gas. While using a composite wrap would cost significantly less (i.e., roughly 20% of the cost of replacing the steel pipe when the cost of lost gas is included), its appropriateness for use on pipelines operating at an alternative MAOP is unknown.

In total, the cost per mile of repairing defects is estimated to be $290 per mile (= 0.01 per mile x $29,000). Repairs will be undertaken after internal inspection. A total of 3,500 miles of existing pipeline will be internally inspected in the first year after implementation of the proposed rule (see Section 6.3.1). After this inspection, pipeline operators will incur repair costs of $1.0 million (= 3,500 miles x $290 per mile). In the eleventh year after implementation a total of 4,200 miles of pipeline will be internally inspected (see Section 6.3.2). After this inspection, pipeline operators will incur repair

[31] "Lessons Learned From Natural Gas STAR Partners: Composite Wrap for Non-Leaking Pipeline Defects," U.S. EPA, July 2003, http://www.epa.gov/gasstar/pdf/lessons/ll_compwrap.pdf. .
[32] "Composite Wrap for Non-Leaking Pipeline Defects," Duke Energy Gas Transmission, INGAA, and EPA's Natural Gas STAR Program, September 22, 2004, http://www.epa.gov/gasstar/workshops/houston-sept22/CompositeWrapforPipelineDefects.ppt.

costs of $1.2 million (= 4,200 miles x $290 per mile). In each subsequent year, a total of 700 miles of pipeline will be internally inspected (see Section 6.3.2). After each of these inspections, pipeline operators will incur repair costs of $203,000 (= 700 miles x $290 per mile).

6.3.4 Installing Remotely Controlled Valves at HCAs

The proposed rule requires that mainline valves on either side of an HCA be remotely controlled via a SCADA (Supervisory Control and Data Acquisition) system, or other alternative method, if personnel response time to the valves exceeds one hour. The valves covered by this requirement are not necessarily at the boundary of each HCA, but rather are the closest valves to the HCA on the pipeline. PHMSA notes that many operators currently choose to automate these valves.

PHSMA expects that the proposed rule will result in the installation of 12 additional remotely controlled mainline valves per thousand miles of pipeline. PHMSA estimates that the cost for these valves for a 42-inch gas transmission pipeline would be approximately $70,000.

For this analysis, PHMSA assumes that the cost of remotely controlled valves would be $70,000. This probably overstates the cost, since valves for pipelines with smaller diameters would cost less than those used with a 42-inch pipeline.

The cost of the requirement to install remotely controlled valves at HCAs when the response time for personnel exceeds one hour will be $840,000 per thousand miles of pipeline (= 12 remotely controlled valves x $70,000 per valve). Assuming that an alternative MAOP would be adopted for 4,200 miles of pipeline in the first year after the proposed rule is implemented, the total cost of the requirement in the first year would be $3.5 million (= 4,200 miles x $840,000 per thousand miles). The total cost in each subsequent year would be $588,000 (= 700 miles x $840,000 per thousand miles). These would be one-time costs.

For new pipelines, these estimates probably overstate actual costs, since pipeline operators would likely be purchasing remotely controlled valves in place of valves that are not remotely controlled. For all pipelines, the estimated cost, $70,000 per valve, probably overstates the average cost of the remotely controlled valves that operators would purchase. Consequently, the estimates developed here probably overstate the actual costs of the requirement.

6.3.5 Preparing Threat Assessments

The proposed rule requires operators electing to use an alternative MAOP to develop a threat matrix identifying and comparing the increased changes in risk of operating their pipelines at the increased stress level. Additionally, operators must describe the procedures they will take to mitigate the risk.

Kinder Morgan has been involved in the preparation of threat assessments for three pipelines seeking approval to use the alternative method to establish MAOP: (1) Rockies Express, (2) Kinder Morgan Louisiana, and (3) Midcontinent Express. Those threat assessments are reported to have cost $16,000, $7,000, and $8,000, respectively. The costs are made up entirely of labor charges. The analytical tool used for the threat assessments had been previously acquired to perform the threat assessments needed for gas transmission pipeline Integrity Management. The data used for the threat assessments had been acquired to support Federal Energy Regulatory Commission permitting requirements for the pipelines.[33]

Based on this information, PHMSA estimates that each threat assessment required for the proposed rule will cost $10 thousand.[34]

The number of pipelines needing to prepare threat assessments is unknown and must be estimated.

In 2006, PHMSA received 1393 reports covering 320,532 miles of gas transmission and gathering system pipeline. On average, each report covered approximately 230 miles of pipeline (= 320,532 miles / 1393 reports).

Assuming that each report covered, on average, one pipeline, PHMSA expects the 4,200 miles of pipeline adopting an alternative MAOP in the first year if the proposed rule is implemented to consist of 18 pipelines (= 4,200 miles / 230 miles per pipeline). The 700 miles of additional pipeline that is expected to adopt an alternative MAOP in subsequent years is estimated to consist of 3 pipelines (= 700 miles / 230 miles per pipeline).

Based on the foregoing, the costs resulting from preparing threat assessments are expected to be $180,000 in the first year if the proposed rule is implemented (= $10,000 x 18) and $30,000 in each subsequent year (= $10,000 x 3). For this analysis, this is treated as a one-time cost. In reality, updates would be required if and when changes in risk occurred. These updates would not be expected to cost as much as the original threat assessments.

6.3.6 Patrolling Rights-of-Way

The proposed rule requires patrolling of the rights-of-way for pipelines using an alternative MAOP. Patrols must be no further than three weeks apart. The purpose of the patrols is to inspect for excavation activities, ground movement, wash outs, leakage, or other activities or conditions affecting pipeline integrity.

Currently, under Section 192.705, gas transmission lines must be patrolled periodically. At highway and railroad crossings, pipelines in class 1, 2, and 3 locations must be patrolled at least 4 times per year. At all other places, pipelines in class 1 and 2 locations

[33] Communication between M. Dwayne Burton, KinderMorgan, and Paul Zebe, Volpe Center, August 3, 2007.
[34] $10,000 ≈ ($16,000 + $7,000 + $8,000)/3.

must be patrolled at least 1 time per year, while pipelines in class 3 locations must be patrolled at least 2 times per year.

PHMSA estimates that it costs $25,000 to patrol 250 miles of pipeline (i.e., $100 per pipeline mile). This cost estimate includes the fully loaded cost of one person plus the cost of ground transport along the pipeline.

For this analysis, PHMSA assumes that the new patrolling requirement would add 24 additional patrols per pipeline mile per year. PHMSA assumes that currently 2 patrols occur on average during a year, and that under the proposed rule a total of 26 patrols would be needed (i.e., one every two weeks). The cost of the 24 added patrols would be $2,400 per pipeline mile per year (= 24 patrols per year x $100 per pipeline mile). If the proposed rule were to be implemented, in the first year 4,200 miles of pipeline would need to be patrolled. The total added cost of patrolling 4,200 miles would be $10.1 million per year (= $2,400 per mile per year x 4,200 miles). In subsequent years, an additional $1.7 million would be added annually (= $2,400 per mile per year x 700 miles) to the patrolling cost of the previous year. Table 8 presents the estimated patrolling costs for the first 20 years after implementation of the proposed rule.

TABLE 8. ESTIMATED PATROLLING COSTS

Year	Patrolled Mileage	Patrolling Cost (Thousands of Dollars)
1	4,200	$10,080
2	4,900	$11,760
3	5,600	$13,440
4	6,300	$15,120
5	7,000	$16,800
6	7,700	$18,480
7	8,400	$20,160
8	9,100	$21,840
9	9,800	$23,520
10	10,500	$25,200
11	11,200	$26,880
12	11,900	$28,560
13	12,600	$30,240
14	13,300	$31,920
15	14,000	$33,600
16	14,700	$35,280
17	15,400	$36,960
18	16,100	$38,640
19	16,800	$40,320
20	17,500	$42,000

6.3.7 Notifying PHMSA of the Decision to Use an Alternative MAOP

Operators electing to implement an alternative MAOP on any eligible segments of their pipeline must notify PHMSA of that decision at least 30 days before implementing it. A senior executive officer of the pipeline company must sign the certification. Additionally, records documenting that the segment is in a class 1, 2, or 3 location and meets the design, construction, and O&M requirements of the proposed rule must be maintained for the useful life of the pipeline segment. The costs of the preparation and transmittal of the notification and the maintenance of the required records are expected to be nominal. In fact, PHMSA expects that operators would keep the required records even in the absence of the requirement to do so included in the proposed rule.

6.3.8 Total Costs

Tables 9 and 10 present summaries of the estimated costs of the proposed rule over 20 years, along with the calculated totals for those costs by year. In total, the costs of the proposed rule are expected to be $43.9 million in the first year, go from $12.4 million in the second year to $25.8 million in the tenth year, be $46.2 million in the eleventh year, and then go from $32.3 million in the twelfth year to $45.7 million in the twentieth year.

TABLE 9. SUMMARY AND TOTALS FOR THE ESTIMATED COSTS OF THE PROPOSED RULE

Cost Item	Cost By Year After Implementation (Thousands of dollars)			
	1st	2nd – 10th	11th	12th – 20th
Baseline internal inspections	$29,119	None	None	None
Additional internal inspections	None	None	$17,471	$2,912 each year
Anomaly repairs	$1,015	None	$1,218	$203 each year
Remotely controlled valves	$3,528	$588 each year	$588	$588 each year
Threat assessments	$180	$30 each year	$30	$30 each year
Patrolling	$10,080	$11,760 to $25,200 (see Table 8)	$26,880	$28,560 to $42,000 (see Table 8)
Notifying PHMSA	Nominal	Nominal	Nominal	Nominal
TOTAL	$43,922	$618 each year plus patrolling costs in Table 8	$46,187	$3,733 each year plus patrolling costs in Table 8

TABLE 10. ESTIMATED TOTAL COSTS BY YEAR

Year	Total Cost (Thousands of Dollars)
1	$43,922
2	$12,378
3	$14,058
4	$15,738
5	$17,418
6	$19,098
7	$20,778
8	$22,458
9	$24,138
10	$25,818
11	$46,187
12	$32,293
13	$33,973
14	$35,653
15	$37,333
16	$39,013
17	$40,693
18	$42,373
19	$44,053
20	$45,733

PHSMA expects that the estimates in Table 10 overstate the true costs of the proposed rule. The cost of remotely controlled mainline valves overstates the additional cost that would be experienced by pipeline operators meeting the requirements of the proposed rule.

The present and annualized values of the estimated costs over 20 years using 3% and 7% discount rates are given in Table 11.

TABLE 11. PRESENT VALUE AND ANNUALIZED COSTS OF THE ESTIMATED TOTAL COSTS CALCULATED OVER 20 YEARS

Discount Rate	Present Value of Costs (Thousands of dollars)	Annualized Costs (Thousands of Dollars)
3%	$435,460	$29,270
7%	$293,121	$27,669

6.3.9 Cost Uncertainties

The cost estimates developed for this proposed rule are built on a number of key assumptions:

- 4,200 miles of pipeline will begin to use an alternative MAOP in the first year after implementation of the proposed rule and an additional 700 miles of pipeline will begin to use an alternative MAOP in each succeeding year.
- Smart pigging will cost $4,160 per mile.
- 0.01 repairs per mile will need to be made.
- The cost of repairing a pipeline anomaly will be $29,000.
- The remotely controlled valves will each cost $70,000.
- 12 additional remotely controlled valves will be needed per thousand miles of pipeline.
- Threat assessments cost $10,000 to prepare.
- 18 threat assessments will need to be prepared in the first year and 3 will need to be prepared in each year thereafter.
- No updates to the threat assessments will be prepared.
- Patrolling rights-of-way will cost $100 per pipeline mile.
- 24 additional pipeline patrols will be needed annually
- The cost of notification will be nominal.

These assumptions introduce uncertainties into the cost calculations. The impacts of these uncertainties on the costs of the proposed rule are discussed below.

<u>Impact of Mileage Estimates</u>

The most important of the assumptions underlying the cost estimates are those relating to the mileage that is expected to begin using an alternative MAOP. The mileage estimates – 4,200 miles the first year and 700 miles each year thereafter – are used in the derivation of every cost estimate, with the exception of notification. The actual pipeline mileages adopting an alternative MAOP may vary from these estimates. Table 12 presents the costs that would result if the pipeline mileages were changed by plus or minus 50%. Table 13 gives the present values of the costs if the pipeline mileages were changed by plus or minus 50%.

TABLE 12. TOTAL COSTS BY YEAR WHEN MILEAGE IS CHANGED BY PLUS OR MINUS 50%

Year	Total Cost by Year When Mileage Is Increased by 50% (Thousands of Dollars)	Total Cost by Year When Mileage Is Decreased by 50% (Thousands of Dollars)
1	$65,884	$21,962
2	$18,572	$6,194
3	$21,092	$7,034

Year	Total Cost by Year When Mileage Is Increased by 50% (Thousands of Dollars)	Total Cost by Year When Mileage Is Decreased by 50% (Thousands of Dollars)
4	$23,612	$7,874
5	$26,132	$8,714
6	$28,652	$9,554
7	$31,172	$10,394
8	$33,692	$11,234
9	$36,212	$12,074
10	$38,732	$12,914
11	$67,459	$22,490
12	$48,445	$16,152
13	$50,965	$16,992
14	$53,485	$17,832
15	$56,005	$18,672
16	$58,525	$19,512
17	$61,045	$20,352
18	$63,565	$21,192
19	$66,085	$22,032
20	$68,605	$22,872

TABLE 13. PRESENT VALUE OF THE ESTIMATED TOTAL OVER 20 YEARS WHEN MILEAGE IS CHANGED BY PLUS OR MINUS 50%

Discount Rate	Present Value When Mileage Is Increased by 50% (Thousands of dollars)	Present Value When Mileage Is Decreased by 50% (Thousands of dollars)
3%	$651,944	$217,364
7%	$438,865	$146,322

When the mileage is reduced to 2,100 miles in the first year with 350 miles added in each subsequent year (i.e., by 50%), the annual total costs and the present values are essentially half of what was estimated using the 4,200 and 700 mileage values of the base case. When the mileage is increased to 6,300 miles in the first year with 1,150 miles in each subsequent year (i.e., by 50%), the annual total costs and the present values also increase by approximately 50%.

Adding 700 miles per year for 20 years may overstate the new pipeline mileage that would actually use an alternative MAOP. The addition of new pipeline might occur only over a shorter period, rather than every year for the 20 years following implementation of the proposed rule. PHMSA estimates that approximately 3,500 miles of new gas transmission pipeline certificated in the next 5 years would be operated at an alternative MAOP. Tables 14 and 15 display the annual total costs and present values that would result if only those 3,500 miles of new pipeline (with 700 miles added in each of the 5 years) were to use an alternative MAOP.

TABLE 14. TOTAL COST BY YEAR IF ADDITION OF 700 MILES PER YEAR ONLY OCCURS DURING THE FIRST 5 YEARS

Year	Total Cost (Thousands of Dollars)
1	$43,922
2	$12,378
3	$14,058
4	$15,738
5	$17,418
6	$16,800
7	$16,800
8	$16,800
9	$16,800
10	$16,800
11	$34,889
12	$20,533
13	$20,533
14	$20,533
15	$20,533
16	$16,800
17	$16,800
18	$16,800
19	$16,800
20	$16,800

TABLE 15. PRESENT VALUE OF TOTAL COST OVER 20 YEARS IF ADDITION OF 700 MILES PER YEAR ONLY OCCURS DURING THE FIRST 5 YEARS

Discount Rate	Present Value (Thousands of dollars)
3%	$292,278
7%	$211,458

Adding 700 miles per year of new pipeline only during the first 5 years after implementation of the proposed rule has a fairly dramatic impact on costs. The present value of the total costs is approximately 33% less than the base case estimate at the 3% discount rate. This is a significant change.

Impact of the Cost of Smart Pigging

The cost of smart pigging, $4,160 per mile, is based on an estimate previously provided PHMSA by INGAA, an industry group representing interstate natural gas pipeline operators. Since INGAA should have a fairly good understanding of the costs of smart pigging for natural gas pipelines, and since the estimate was provided to PHMSA relatively recently, the uncertainties associated with the estimate are expected to be minor. The impacts of those uncertainties on the total costs of the proposed rule are expected to be minimal.

Impact of Anomaly Repairs Per Mile

The base case assumes that 0.01 anomaly repairs per pipeline mile will be needed. This value is based on PHMSA's expectation that more stringent requirements concerning design, construction, and O&M will result in fewer anomaly repairs. Information on natural gas transmission pipelines indicates that they are experiencing 0.11 repairs per mile that need to be repaired immediately or within one year of discovery. This is a reasonable upper limit on the number of anomaly repairs that could be expected. PHMSA has hopes that the stringent requirements included in the proposed rule could drive the repair rate down to where the rate per mile is approximately 0.00. This would a reasonable lower limit on the number of anomaly repairs that could be expected. Tables 16 and 17 present the total cost and present values when the anomaly repair rates are 0.11 per mile or 0.00 per mile.

TABLE 16. TOTAL COST BY YEAR WHEN THE ANOMALY REPAIR RATE IS INCREASED TO 0.11 PER MILE OR DECREASED TO 0.00 PER MILE

Year	Total Cost by Year When Repair Rate Is Increased to 0.11 Per Mile (Thousands of Dollars)	Total Cost by Year When Repair Rate Is Decreased to 0.00 Per Mile (Thousands of Dollars)
1	$54,072	$42,907
2	$12,378	$12,378
3	$14,058	$14,058
4	$15,738	$15,738
5	$17,418	$17,418
6	$19,098	$19,098
7	$20,778	$20,778
8	$22,458	$22,458
9	$24,138	$24,138
10	$25,818	$25,818
11	$44,969	$44,969
12	$34,323	$32,090
13	$36,003	$33,770
14	$37,683	$35,450
15	$39,363	$37,130
16	$41,043	$38,810
17	$42,723	$40,490
18	$44,403	$42,170
19	$46,083	$43,850
20	$47,763	$45,530

TABLE 17. PRESENT VALUE OF THE ESTIMATED TOTAL COSTS OVER 20 YEARS WHEN THE ANOMALY REPAIR RATE IS INCREASED TO 0.11 PER MILE OR DECREASED TO 0.00 PER MILE

Discount Rate	Present Value When Repair Rate Is Increased to 0.11 Per Mile (Thousands of dollars)	Present Value When Repair Rate Is Decreased to 0.00 Per Mile (Thousands of dollars)
3%	$455,853	$432,453
7%	$308,312	$290,966

With an anomaly repair rate of 0.11 per mile, the present value of costs increases by approximately 5% at the 3% discount rate. With an anomaly repair rate of 0.00, the present value of costs decreases by approximately 1% at the 3% discount rate. The impact of changing the repair rate on costs would appear to be relatively small.

Impact of Cost of Anomaly Repairs

The base case assumes that the cost of repairing anomalies on gas transmission lines will be $29,000 per anomaly. Although this value is based on information obtained from Duke and INGAA, the actual average cost of repairing anomalies could be higher or lower than this value. In part, the value will depend on the value of the gas lost during repair. In the Duke/INGAA estimate, the value of the lost gas comprised over 40% of the total cost of the repair. Tables 18 and 19 present the total costs and present values when the cost of anomaly repairs is increased or decreased by 50%.

TABLE 18. TOTAL COST BY YEAR WHEN COST OF ANOMALY REPAIRS IS INCREASED OR DECREASED BY 50%

Year	Total Cost by Year When Repair Costs Are Increased by 50% (Thousands of Dollars)	Total Cost by Year When Repair Costs Are Decreased by 50% (Thousands of Dollars)
1	$44,430	$43,415
2	$12,378	$12,378
3	$14,058	$14,058
4	$15,738	$15,738
5	$17,418	$17,418
6	$19,098	$19,098
7	$20,778	$20,778
8	$22,458	$22,458
9	$24,138	$24,138
10	$25,818	$25,818
11	$44,969	$44,969
12	$32,395	$32,192
13	$34,075	$33,872
14	$35,755	$35,552
15	$37,435	$37,232
16	$39,115	$38,912
17	$40,795	$40,592
18	$42,475	$42,272
19	$44,155	$43,952
20	$45,835	$45,632

TABLE 19. PRESENT VALUE OF ESTIMATED TOTAL COSTS OVER 20 YEARS WHEN COST OF ANOMALY REPAIRS IS INCREASED OR DECREASED BY 50%

Discount Rate	Present Value When Repair Costs Are Increased by 50% (Thousands of dollars)	Present Value When Repair Costs Are Decreased by 50% (Thousands of dollars)
3%	$435,647	$433,520
7%	$293,333	$291,756

Comparing the results in Tables 18 and 19 with those in Tables 10 and 11, it is evident that the cost of anomaly repairs has a minimal impact on total costs. The present value of costs changes less than 1% at the 3% discount rate.

Impact of Valve Cost

For the base case costs, remotely controlled valves are assumed to cost $70 thousand each. The actual cost of valves may be higher or lower than this. Tables 20 and 21 present the total costs and present values when valve costs are increased or decreased by 50%.

TABLE 20. TOTAL COST BY YEAR WHEN THE VALVE COST IS INCREASED OR DECREASED BY 50%

Year	Total Cost by Year When Valve Costs Are Increased by 50% (Thousands of Dollars)	Total Cost by Year When Valve Costs Are Decreased by 50% (Thousands of Dollars)
1	$45,686	$42,158
2	$12,672	$12,084
3	$14,352	$13,764
4	$16,032	$15,444
5	$17,712	$17,124
6	$19,392	$18,804
7	$21,072	$20,484
8	$22,752	$22,164
9	$24,432	$23,844
10	$26,112	$25,524
11	$45,263	$44,675
12	$32,587	$31,999
13	$34,267	$33,679

Year	Total Cost by Year When Valve Costs Are Increased by 50% (Thousands of Dollars)	Total Cost by Year When Valve Costs Are Decreased by 50% (Thousands of Dollars)
14	$35,947	$35,359
15	$37,627	$37,039
16	$39,307	$38,719
17	$40,987	$40,399
18	$42,667	$42,079
19	$44,347	$43,759
20	$46,027	$45,439

TABLE 21. PRESENT VALUE OF TOTAL COST OVER 20 YEARS WHEN VALVE COSTS ARE INCREASED OR DECREASED BY 50%

Discount Rate	Present Value When Valve Cost Is Increased by 50% (Thousands of dollars)	Present Value When Valve Cost Is Decreased by 50% (Thousands of dollars)
3%	$440,381	$428,779
7%	$297,031	$288,054

Changing the valve cost by 50% changes the present value of the total costs by approximately 1% to 2% at the 3% discount rate. The impact of changing the valve cost, therefore, would be relatively minor.

Impact of Number of Valves Installed

The base case assumes that 12 additional remotely controlled valves will be needed per thousand miles of pipeline. The impact of increasing the assumed number of valves installed per mile by 50% will be identical to the impact of increasing the cost of the valves by 50%. The impact of decreasing the assumed number of valves installed by 50% will be identical to the impact of decreasing the cost of the valves by 50%. The total cost and present value when the cost of the valves is increased or decreased by 50% are presented in Tables 20 and 21. Based on the results presented in those tables, the impact of changing the number of valves installed is expected to be relatively minor.

Impact of Cost of Threat Assessments

The base case assumes that threat assessments cost $10,000 to prepare. Tables 22 and 23 present the total costs and present value of those total costs when the cost of preparing a threat assessment is increased or decreased by 50%.

TABLE 22. TOTAL COST BY YEAR WHEN COST OF THREAT ASSESSMENTS IS INCREASED OR DECREASED BY 50%

Year	Total Cost by Year When Cost of Threat Assessments Is Increased by 50% (Thousands of Dollars)	Total Cost by Year When Cost of Threat Assessments Is Decreased by 50% (Thousands of Dollars)
1	$43,832	$43,832
2	$12,363	$12,363
3	$14,043	$14,043
4	$15,723	$15,723
5	$17,403	$17,403
6	$19,083	$19,083
7	$20,763	$20,763
8	$22,443	$22,443
9	$24,123	$24,123
10	$25,803	$25,803
11	$44,954	$44,954
12	$32,278	$32,278
13	$33,958	$33,958
14	$35,638	$35,638
15	$37,318	$37,318
16	$38,998	$38,998
17	$40,678	$40,678
18	$42,358	$42,358
19	$44,038	$44,038
20	$45,718	$45,718

TABLE 23. PRESENT VALUE OF TOTAL COST OVER 20 YEARS WHEN COST OF THREAT ASSESSMENTS IS INCREASED OR DECREASED BY 50%

Discount Rate	Present Value When Cost of Threat Assessments Is Increased by 50% (Thousands of dollars)	Present Value When Cost of Threat Assessments Is Decreased by 50% (Thousands of dollars)
3%	$434,876	$434,284
7%	$292,772	$292,314

Changing the threat assessment costs by plus or minus 50% changes the present value of the total costs by less than 0.5% at the 3% discount rate. Therefore, the impact of changing the threat assessment cost is relatively minor.

Impact of Number of Threat Assessments

In the base case, it is estimated that 18 threat assessments would be needed in the first year after implementation of the proposed rule and 3 in every year thereafter. The actual number of threat assessments may be higher or lower than these estimates. The impact of increasing the assumed number of threat assessments by 50% will be identical to the impact of increasing the cost of threat assessments by 50%. The impact of decreasing the assumed number of threat assessments valves by 50% will be identical to the impact of decreasing the cost of threat assessments by 50%. The total cost and present value when the cost of threat assessments is increased or decreased by 50% are presented in Tables 22 and 23. Based on the results presented in those tables, the impact of changing the number of threat assessments is expected to be relatively minor.

Impact of No Threat Assessment Updates

The base case cost estimate includes no estimates of the costs associated with updating the threat assessments. Updates will be required when conditions on, or surrounding, the pipelines change. There is no way to predict the nature of the changes. Consequently, there is no way to predict the costs of making those changes. At most, the cost of an update will be equal to the cost of the original threat assessment, but it should usually be significantly less. Given that the impact of preparing the original threat assessments is expected to be minimal, the impact of not including threat assessment updates in the cost analysis of the base case is also expected to be minimal.

Impact of Patrolling Cost

The base case estimates the cost of patrolling to be $100 per pipeline mile. The cost may be higher or lower than that estimate. Tables 24 and 25 present the total costs and present values when the cost of patrolling is increased or decreased by 50%.

TABLE 24. TOTAL COST BY YEAR WHEN COST OF PATROLLING IS INCREASED OR DECREASED BY 50%

Year	Total Cost by Year When Patrolling Costs Are Increased by 50% (Thousands of Dollars)	Total Cost by Year When Patrolling Costs Are Decreased by 50% (Thousands of Dollars)
1	$48,962	$38,882
2	$18,258	$6,498
3	$20,778	$7,338
4	$23,298	$8,178

Year	Total Cost by Year When Patrolling Costs Are Increased by 50% (Thousands of Dollars)	Total Cost by Year When Patrolling Costs Are Decreased by 50% (Thousands of Dollars)
5	$25,818	$9,018
6	$28,338	$9,858
7	$30,858	$10,698
8	$33,378	$11,538
9	$35,898	$12,378
10	$38,418	$13,218
11	$58,409	$31,529
12	$46,573	$18,013
13	$49,093	$18,853
14	$51,613	$19,693
15	$54,133	$20,533
16	$56,653	$21,373
17	$59,173	$22,213
18	$61,693	$23,053
19	$64,213	$23,893
20	$66,733	$24,733

TABLE 25. PRESENT VALUE OF TOTAL COSTS OVER 20 YEARS WHEN THE COSTS OF PATROLLING ARE INCREASED OR DECREASED BY 50%

Discount Rate	Present Value When Patrolling Costs Are Increased by 50% (Thousands of dollars)	Present Value When Patrolling Costs Are Decreased by 50% (Thousands of dollars)
3%	$616,073	$253,087
7%	$411,044	$174,041

Changing the patrolling cost by plus or minus 50% changes the present value of the total costs by 41% to 42% at the 3% discount rate. Roughly, a change of 10% in the patrolling cost results in an 8% change in the present value of total costs. The impact associated with changing the patrol cost is therefore relatively significant.

Impact of Number of Patrols

Based on the current regulatory requirements concerning patrolling, PHMSA assumes that the proposed rule would add 24 patrols annually. This probably overstates the actual number of additional patrols that would be undertaken if the proposed rule were to be implemented. Tables 26 and 27 present the total costs and present values when the required number of additional patrols annually is decreased to 12 (i.e., by 50%).

TABLE 26. TOTAL COST BY YEAR WHEN THE NUMBER OF ADDITIONAL PATROLS IS REDUCED TO 12

Year	Total Cost by Year When the Number of Additional Patrols Is Reduced to 12 (Thousands of Dollars)
1	$38,882
2	$6,498
3	$7,338
4	$8,178
5	$9,018
6	$9,858
7	$10,698
8	$11,538
9	$12,378
10	$13,218
11	$31,529
12	$18,013
13	$18,853
14	$19,693
15	$20,533
16	$21,373
17	$22,213
18	$23,053
19	$23,893
20	$24,733

TABLE 27. PRESENT VALUE OF TOTAL COST OVER 20 YEARS WHEN NUMBER OF ADDITIONAL PATROLS IS REDUCED TO 12

Discount Rate	Present Value When Number of Additional Patrols is Reduced to 12 (Thousands of dollars)
3%	$253,087
7%	$174,041

Reducing the number of additional patrols to 12 reduces the present value of the total costs by approximately 42% at the 3% discount rate. Roughly, each additional annual patrol adds approximately 3.5% (= 41% / 12 patrols) to the present value of the total costs. The impact associated with changing the number of patrols is relatively significant.

Impact of the Cost of Notification

PHMSA currently requires natural gas transmission pipeline operators to submit annual reports. Those reports are estimated to require 12 hours to prepare. The hourly cost of the personnel preparing those reports is estimated to be $64.75, fully loaded. Therefore, an annual report will cost an estimated $777 (= 12 hours x $64.75 per hour). Preparing a notification required by the proposed rule is not expected to be any more complicated or time-consuming than preparing an annual report. In fact, preparing an annual report is likely to be more complicated and time-consuming. As a consequence, the impact of the uncertainties associated with the cost of notification is expected to be minimal.

Impact Summary

In summary, changes in pipeline mileage, changes in patrolling costs, and changes in the number of patrols all appear to have significant impacts on the costs of the proposed rule. The impacts on costs attributable to changing other assumptions are expected to be relatively minor.

6.4 Comparison of Benefits and Costs

The benefits resulting from the proposed rule are estimated to be $103 million per year, consisting of $49.0 million in recurring benefits and $54.6 million in one-time benefits. The costs of the proposed rule, by year, are presented in Table 10. Those costs are expected to be $43.9 million in the first year, increase linearly from $12.4 million in the second year to $25.8 million in the tenth year, be $46.2 million in the eleventh year, and then increase linearly from $32.3 million in the twelfth year to $45.7 million in the twentieth year. Table 28 gives the present values for these estimated benefits and costs over 20 years at 3% and 7% discount rates.

TABLE 28. PRESENT VALUES OF THE BENEFITS AND COSTS OF THE PROPOSED RULE CALCULATED OVER 20 YEARS
(All dollars in millions)

Discount Rate	Benefits	Costs
3%	$1,541	$435
7%	$1,098	$293

As can be seen from Table 28, the present value of the estimated benefits of the proposed rule would be expected to significantly exceed the present value of the estimated costs. The present value net benefits of the proposed rule are expected to be positive: $1.1 billion at the 3% discount rate and $0.8 billion at the 7% discount rate. The proposed rule is expected to be cost-beneficial.

It might be argued that the proposed rule effectively has much smaller benefits and costs than those estimated in this analysis, relative to the ability of pipeline operators to gain special permits that would put in place many of the same requirements of these rules. Those upgrading their pipelines under the proposed rule may be likely to apply for special permits absent the proposed rule. Consequently, the benefits of the alternative MAOP could eventually be achieved even without the rule. Furthermore, the costs to operators of using the alternative method to establish MAOP under the proposed rule would be similar, if not identical, to those incurred to meet the requirements mandated by PHMSA for special permits. The primary benefit of the rule, if this argument is accepted, would be that it would relieve PHMSA of the cost and resource burden associated with evaluating and approving or rejecting special permits. Even if one accepts this argument, however, PHMSA has concluded that the more efficient process outlined in this proposed rule will likely lead to a faster deployment of these new requirements, and therefore will likely accelerate the realization of the net benefits associated with adopting an alternative MAOP.

6.5 Benefit and Cost Uncertainties

A number of assumptions were made in the calculation of the benefits and costs of the proposed rule. Those assumptions could potentially impact whether the net benefits of the proposed rule are positive or negative. Present value estimates have been calculated for various benefit and cost assumption alternatives. Table 29 below presents the net benefits for those alternatives when evaluated over 20 years with a 3% discount rate (the conclusions drawn using the 3% discount rate will be similar to those drawn using a 7% rate). Table 29 also includes the benefit and cost base cases, so that they can be compared with the alternatives, as well.

TABLE 29. NET PRESENT VALUE OF THE BENEFITS FOR THE BASE CASE AND FOR BENEFIT AND COST ALTERNATIVES AT THE 3% DISCOUNT RATE
(Millions of dollars)

		BENEFIT ALTERNATIVES						
COST ALTERNATIVES	**Base case**	**Mileage increased by 50%**	**Mileage decreased by 50%**	**Only 700 miles of new pipeline per year for first 5 years after rule goes into effect**	**Fuel cost savings increased by 50%**	**Fuel cost savings decreased by 50%**	**Capital expenditure savings increased by 50%**	**Capital expenditure savings decreased by 50%**
Base case	$1,106	-	-	-	$1,906	$1,177	$1,947	$1,135
Mileage increased by 50%	-	$1,660	-	-	-	-	-	-
Mileage decreased by 50%	-	-	$554	-	-	-	-	-
Only 700 miles of new pipeline per year for first 5 years after rule	-	-	-	$687	-	-	-	-

COST ALTERNATIVES		BENEFIT ALTERNATIVES						
	Base case	Mileage increased by 50%	Mileage decreased by 50%	Only 700 miles of new pipeline per year for first 5 years after rule goes into effect	Fuel cost savings increased by 50%	Fuel cost savings decreased by 50%	Capital expenditure savings increased by 50%	Capital expenditure savings decreased by 50%
goes into effect								
Number of repairs=0.00	$1,085	-	-	-	$1,450	$721	$1,491	$679
Number of repairs=0.11	$1,109	-	-	-	$1,474	$745	$1,515	$703
Repair costs increased by 50%	$1,105	-	-	-	$1,470	$741	$1,511	$699
Repair costs decreased by 50%	$1,107	-	-	-	$1,472	$743	$1,513	$701
Valve costs increased by 50%	$1,101	-	-	-	$1,466	$737	$1,507	$695
Valve costs decreased by 50%	$1,112	-	-	-	$1,477	$748	$1,518	$706
Threat assessment preparation costs increased by 50%	$1,106	-	-	-	$1,471	$742	$1,512	$700
Threat assessment preparation costs decreased by 50%	$1,107	-	-	-	$1,472	$743	$1,513	$701
Number of threat assessments increased by 50%	$1,106	-	-	-	$1,471	$742	$1,512	$700
Number of threat assessments decreased by 50%	$1,107	-	-	-	$1,472	$743	$1,513	$701
Patrolling costs increased by 50%	$925	-	-	-	$1,290	$561	$1,331	$519
Patrolling costs decreased by 50%	$1,288	-	-	-	$1,653	$924	$1,694	$882
Number of additional patrols=11	$1,288	-	-	-	$1,653	$924	$1,694	$882

Table Key: "-": Mileage assumptions of benefit and cost alternatives are inconsistent with each other, so no net benefits were calculated.

There are a total of 73 benefit/cost combinations with a calculated net present value of benefits in Table 29. In all cases, the present value of benefits exceeds the present value of costs. That is, there are positive net benefits. Those net benefits range from $554 million to $1,947 million. Under all benefit/cost combinations evaluated, the implementation of the proposed rule would be cost-beneficial.

7. SUMMARY AND CONCLUSIONS

PHMSA proposes to revise the Federal pipeline safety regulations to allow operators of natural gas transmission pipelines to raise the stress level for certain pipelines (1) constructed of steel pipe manufactured using modern steel chemistry and rolling practices and standards, and (2) inspected and tested to more rigorous standards. Under the proposed rule, an alternative method to determine MAOP, by class location, would be:

- Class 1: Greater than 72% of SMYS but less than or equal to 80% of SMYS
- Class 2: Greater than 60% of SMYS but less than or equal to 67% of SMYS
- Class 3: Greater than 50% of SMYS but less than or equal to 56% of SMYS
- Class 4: No alternative MAOP is proposed for class 4 locations

This proposed rule mandates no action by the gas transmission pipeline operators. As a result of the proposed rule, however, 3,500 miles of existing natural gas transmission pipeline are expected to be uprated to an alternative MAOP. Furthermore, the proposed rule is expected to result in the operators of an additional 700 miles of new pipeline electing to use an alternative MAOP each year in the future.

The quantified benefits resulting from the proposed rule are estimated for the first year after the rule goes into effect to be $49.0 million of annually recurring benefits (these benefits are realized in the first and in each subsequent year) and $54.6 million of one-time benefits. For the 700 miles of new pipeline added in each subsequent year, the quantified benefits are estimated to be $54.6 million each year from savings in capital expenditures. The quantified benefits consist of:

- Fuel cost savings on existing pipelines
- Capital expenditure savings on pipe for new pipelines

The costs of the proposed rule are estimated to be $43.9 million in the first year, go from $12.4 million in the second year to $25.8 million in the tenth year, be $46.2 million in the eleventh year, and then go from $32.3 million in the twelfth year to $45.7 million in the twentieth year. The costs attributable to the proposed rule are most likely to be incurred by operators for:

- Performing baseline internal inspections
- Performing additional internal inspections
- Performing anomaly repairs
- Installing remotely controlled valves on either side of high consequence areas (HCAs)
- Preparing threat assessments
- Patrolling pipeline rights-of-way
- Notifying PHMSA

The present value of the quantified benefits of the proposed rule is estimated to be $1.541 million calculated over 20 years using a 3% discount rate and $1,098 million calculated over 20 years using a 7% discount rate. The present value of the estimated costs of the proposed rule would be expected to be $435 million over 20 years using a 3% discount rate and $293 million over 20 years using a 7% discount rate. The quantified benefits of the proposed rule exceed the costs. Net benefits would be $1.1 billion at the 3% discount rate and $0.8 billion at the 7% discount rate. The benefit-cost ratio for the proposed rule would be 3.5 at the 3% discount rate and 3.7 at the 7% discount rates. The proposed rule is expected to be cost-beneficial.

The quantified benefits, it should be noted, do not capture the full benefits of the proposed rule. Expected benefits of the proposed rule that cannot be readily quantified include

- Reductions in incident consequences
- Increases in pipeline capacity
- Increases in line pack
- Reductions in capital expenditures on compressors for new pipelines
- Reductions in adverse environmental impacts
- Other expected benefits

PHMSA believes that these non-quantified benefits significantly increase the spread between the benefits and costs associated with the proposed rule.

Because of potentially significant uncertainties in the benefit and cost estimates, alternative benefit and cost estimates were developed and alternative net benefits were calculated. The net benefits for all alternatives were positive. This would appear to support the conclusion that the proposed rule is cost-beneficial.

Regulatory Flexibility Analysis

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) requires an agency to review regulations to assess their impact on small entities unless the agency determines that a rule is not expected to have a significant impact on a substantial number of small entities.

Need for the Notice of Proposed Rulemaking: The proposed rule supports the Secretary of Transportation's priorities by improving performance and harnessing 21st Century technologies. Increasing operating pressure can ease supply constraints by boosting pipeline capacity by as much as 10 percent. Increasing capacity also enhances pipeline efficiency. This enhanced performance is made possible by technological advances in metallurgy and pipe manufacture, as well as by improved pipeline lifecycle management practices. Pipelines built with improved steel pipe and operated in compliance with improved lifecycle management practices can operate safely at higher internal pressures. The technological advances decrease the risk of incipient flaws from manufacture or installation that can grow to failure over time due to the operating pressure. Furthermore, improved life cycle management practices, which include rigorous testing, increase the opportunity for operators to detect flaws well before failure. Because revised regulations allowing increased capacity encourage the use of newer pipeline materials and associated safety standards, the revised regulations should have a net positive effect on overall pipeline safety.

Description of Actions: The Pipeline and Hazardous Materials Safety Administration (PHMSA) is proposing changes to the Federal pipeline safety regulations in 49 CFR Part 192, which cover the transportation of natural gas by pipeline. Specifically, PHMSA is proposing to allow operators of natural gas transmission pipelines to calculate an alternative maximum allowable operating pressure (MAOP) based on higher design factors for certain pipelines (1) constructed of steel pipe manufactured using modern steel chemistry, rolling practices, and standards, and (2) inspected and tested to more rigorous standards. Operators meeting the required conditions may be allowed to use an "alternative" MAOP. Under the proposed rule, the alternative MAOP for each class location in which pipelines may be operating would be as follows:

- Class 1: Greater than 72% of specified minimum yield strength (SMYS) but less than or equal to 80% of SMYS
- Class 2: Greater than 60% of SMYS but less than or equal to 67% of SMYS
- Class 3: Greater than 50% of SMYS but less than or equal to 56% of SMYS
- Class 4: No alternative MAOP is proposed for class 4 locations

Identification of potentially affected small entities: The proposed rule would affect operators of gas transmission and gathering pipelines. Based on submissions of annual reports, PHMSA estimates that approximately 1,450 local gas distribution utilities and 1,450 gas transmission and gathering systems potentially would be affected by the proposed rule. The size distribution of these operators is unknown and must be estimated.

The affected gas transmission and gathering systems all belong to NAICS 486210, Pipeline Transportation of Natural Gas. In accordance with the size standards published by the SBA, a business with $6.5 million or less in annual revenue is considered a small business in this NAICS.

Based on information from Dunn & Bradstreet for August 2006, on firms in NAICS 486210, PHMSA estimates that 33% of the gas transmission and gathering systems have $6.5 million or less in revenue. Thus, PHMSA estimates that 479 (= 1,450 x 33%) of the gas transmission and gathering systems affected by the proposed rule will have $6.5 million or less in annual revenue. For this analysis, PHMSA does not expect that any local gas distribution companies will be taking advantage of the potential to use an alternative MAOP.

The proposed rule mandates no action by gas transmission pipeline operators. Rather, it provides those operators with the option of using an alternative MAOP in certain circumstances and when certain conditions can be met. Consequently, it imposes no economic burden on the affected gas pipeline operators, large or small.

Related Federal rules and regulations: There are no related rules or regulations issued by other departments or agencies of the Federal Government.

Alternate proposals for small businesses: The Regulatory Flexibility Act directs agencies to establish exceptions and differing compliance standards for small businesses, where it is possible to do so and still meet the objectives of applicable regulatory statutes.

The proposed rule mandates no action by the gas pipeline operators. Consequently, alternative proposals for small business are unnecessary.

Conclusion: It can be concluded that this proposed rule applies to a substantial number of small entities. No small entities, however, would experience a significant adverse economic impact as a result of the proposed rule.