Regulatory Impact Analysis: Proposed Rule

Pipeline Safety: Expanding the Use of Excess Flow Valves in Gas Distribution Systems to Applications Other Than Single-Family Residences

PHMSA-2011-0009

Office of Pipeline Safety
Pipeline and Hazardous Materials Safety Administration (PHMSA)
U.S. Department of Transportation

Executive Summary

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is proposing to amend the Federal Pipeline Safety Regulations to require operators of gas distribution pipelines to install excess flow valves (EFV) on all new or replaced residential and commercial service lines where the known load does not exceed 1,000 Standard Cubic Feet per Hour (SCFH) and to install manual shutoff valves on all other new or replaced lines. The purpose of this proposed regulation is to improve safety by mitigating the damages from sudden pipeline ruptures and breaks by quickly shutting off the released gas. The rule addresses Section 22 in the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 (P.L. 112-90)[1] and National Transportation Safety Board (NTSB) recommendation P-01-2.[2] Section 22 of the Act requires PHMSA to issue a final report on the evaluation of the NTSB recommendation on EFVs in applications other than service lines serving one single family residence and, if appropriate, require by regulation the use of excess flow valves, or equivalent technology, where economically, technically, and operationally feasible on new or entirely replaced distribution branch services, multifamily facilities, and small commercial facilities. On December 4, 2009, PHMSA amended the pipeline safety regulations to require the use of EFVs for new or replaced gas lines servicing Single Family Residences (SFRs).[3] While this requirement met the mandate of the Pipeline Inspection, Protection, Enforcement and Safety Act (PIPES Act) enacted in 2006, distribution branched services, multi-family facilities, commercial properties, and industrial service lines were still not required to use EFVs. These structures are susceptible to the same risks as SFR service lines.[4]

In an effort to study the possible benefits and costs of expanding EFVs beyond SFR applications, PHMSA began development of the Interim Evaluation Report in early 2009.[5] Based on the Report and the comments received on the Report (see NPRM for discussion), PHMSA found that expansion of EFVs is technically, operationally, and economically feasible where loads do not exceed 1,000 SCFH irrespective of the customer classification. PHMSA acknowledges that EFVs may not be practical for large apartment buildings and industrial or commercial users due to inherent design complexity and continuous supply demands. PHMSA believes curb valves will provide the best possible option for improved safety at this time in those situations where loads exceed 1,000 SCFH. The Interim Evaluation Report was finalized by PHMSA based on

[1] Under the Act, PHMSA is required to study and issue a final report on EFVs and, if appropriate, to issue regulations requiring the use of EFVs or equivalent technology, where "economically, technically and operationally feasible", for new or entirely replaced distribution branch services, multi-family lines, and small commercial service lines.

[2] National Transportation Safety Board, *Natural Gas Explosion and Fire in South Riding, Virginia, July 7, 1998*, Pipeline Accident Report NTSB/PAR-01/01 (Washington, D.C.: NTSB, 2001).

[3] 74 FR 63906

[4] Please see the NPRM for Discussion of the 2010 Rule

[5] The report is in the docket at http://www.regulations.gov/#!docketDetail;dct=FR%252BPR%252BN%252BO%252BSR;rpp=10;po=0;D=PHMSA-2011-0009

the comments received and has been placed in the docket. The public is requested to comment on this final report.

The proposed rule would expand EFV coverage beyond the SFR requirement included in the Integrity Management (IM) rule that went into effect in 2010 to cover all lines that are suitable for an EFV and operate with known loads that do not exceed 1,000 SCFH.[6] The proposed rule would also require that manual shut-off valves (curb valves) be installed on all new or replaced lines where known loads exceed 1,000 SCFH and the line does not fit into the exceptions in § 192.383. The proposed regulation incorporates PHMSA's findings and its analysis of comments from the study mandated by the Section 22 of P.L. 112-90. The proposed rule would also require operators to notify customers of their right to request installation of EFVs on existing service lines (other than those being newly installed or replaced). In those cases, the appropriate State regulatory agency will determine all issues related to the costs of installation. The proposed requirements would pertain to all distribution operators, including operators of petroleum gas systems that serve fewer than 100 customers from a single source and operators of master meters.[7]

PHMSA collects information on gas distribution infrastructure (number of main miles, number of services, number of EFVs installed) through its gas distribution annual reports (PHMSA Form F 7100.1-1) and detailed information on incidents that met the incident definition in § 191.3 through the incident reports (PHMSA Form F 7100.1). None of the reports ask for information by customer classification or the load sizes. However, this regulatory impact assessment uses existing PHMSA data combined with the information available from published sources to quantify the costs and benefits of the proposed regulation by customer classification as defined in the Section 22 of the Act.

PHMSA acknowledges that gas distribution systems are generally safe, averaging 0.11 reportable incidents per 100,000 services in 2010-2013.[8] The proposed rule would target to

[6] Docket Number: PHMSA-RSPA-2004-19854, "Pipeline Safety: Integrity Management Program for Gas Distribution Pipelines."

[7] operators of petroleum gas systems which serve fewer than 100 customers from a single source and operators of master meters are exempt from submitting Annual reports in accordance with 191.11 http://www.gpo.gov/fdsys/pkg/CFR-2004-title49-vol3/xml/CFR-2004-title49-vol3-sec191-11.xml
And Master meter system is defined as means a pipeline system for distributing gas within, but not limited to, a definable area, such as a mobile home park, housing project, or apartment complex, where the operator purchases metered gas from an outside source for resale through a gas distribution pipeline system. The gas distribution pipeline system supplies the ultimate consumer who either purchases the gas directly through a meter or by other means, such as by rents; in 191.3 http://www.gpo.gov/fdsys/pkg/CFR-2004-title49-vol3/xml/CFR-2004-title49-vol3-sec191-3.xml

[8] Number of gas distribution incidents other than on mains divided by the number of services. Incident definitions and reporting thresholds are found in 49 CFR 191.3 and 49 CFR 191.9. In general, operators must report incidents that result in any deaths, injuries requiring hospitalization, property damage over $50,000, and/or loss of 3 million cubic feet of gas.

mitigate the consequences of rare but potentially high-consequence incidents on new and fully replaced services. Since the quantified benefit estimate depends on the existing incident database, the benefit may be underestimated as it is not possible to predict a high-consequence incident that would have be prevented by the safety measure extended through the proposed regulation. PHMSA's incident database is also limited to incidents that occurred on DOT-jurisdictional pipes and meet certain criteria (§191.3) and does not include EFV-preventable incidents that did not meet the criteria, nor EFV-preventable incidents that occurred downstream of the DOT-jurisdictional piping (such as in customer piping). On the other hand, the cost estimate assumes every single service line has either an EFV or a curb valve as it is impossible to estimate where multiple services are protected by a single EFV or a curb valve. This one-to-one correspondence of a valve and a service line could overestimate the cost of the proposed regulation with respect to smaller non-multifamily residences. However, to be conservative in cost estimation, PHMSA's analysis provided quantitative costs and benefits per valve, annualized at 7% and 3% discount rates.

Setting aside the proposal for SFRs, the benefits of the proposed rule that we were able to quantify are estimated to be $7.7 million when annualized and discounted at 7%, while the estimated costs, also discounted and annualized, are $10.5 million. Therefore, this rule is estimated to be a net-cost rule using a 7% discount rate given the limitation of the quantitative benefit data. Using the alternative 3% discount rate, the estimated quantified annualized benefits are $15.0 million per year, and the estimated total annualized costs are $11.9 million per year, which results in a net benefit of $3.1 million.

The incremental benefits and costs of the proposal to extend mandatory EFV installation to newly installed or replaced branched service lines for single-family residences could not be quantitatively estimated. PHMSA has no data with which to distinguish single versus branched services, which differ only in their underground configuration. As an upper bound with respect to the number EFVs required, the cost of the EFV provision for SFR as a whole – branched and non-branched – is estimated to range between $11 to $27 million per year in annualized benefits and $8 million per year in annualized costs.[9] The portion specifically attributable to branched SFR could not be estimated, though PHMSA believes that branched services represent a fairly small share of the overall total. (Due to these same data limitations, the Distribution Integrity Management Program (DIMP) rule estimated total impacts for SFR even though that rule did not apply to branched services.)

The following table summarizes the quantified cost-benefit estimates at a 7% discount rate.

[9]This is the estimate from the previous DIMP rule for EFVs on all SFR, single and branched, with an adjustment for the intervening change in USDOT guidance on the value of statistical life.
For the previous RIA, see www.regulations.gov/#!documentDetail;D=PHMSA-RSPA-2004-19854-0255

($ Millions)	Annualized Benefit (7%)	Annualized Cost (7%)
[Branched Line Single Family – Upper Bound][10]	*[11 - 27]*	*[8]*
Multifamily Residence	1.1	6.2
Small Commercial	1.4	1.1
Industrial/Other curb valve	5.2	3.0
Notification & recordkeeping	-	0.2
Total Benefits	7.7	10.5

In addition to the quantified benefits, the proposed rule is also expected to have benefits that we were unable to quantify. They include the following:

- Equity: Provides a fair and equal level of safety to members of society who do not live in single-family residences
- Additional incident costs avoided for which no PHMSA incident data are available: Mitigates the consequences (death, injury, property damage) of additional incidents that are not reflected in PHMSA records because customer piping or equipment is involved
- Additional incident costs which are not recorded in incident reports, including costs of evacuations, emergency response costs, and business downtime
- Environmental externalities associated with methane release (discussed in Appendix B)
- Peace of mind for operators and customers
- Protection against seismic events and intentional tampering

PHMSA requests public comments on methods and information to quantify or monetize these unquantified benefits. With respect to point raised above concerning equity, PHMSA specifically requests public comment on whether pipeline operators or customers tend to bear the costs of EFVs. PHMSA also requests public comments on whether the rule would have costs that are not quantified in this RIA. While the analysis could not quantify the benefits and costs of the proposal to require EFVs on new or replaced branched service lines servicing SFRs, and the quantified benefits for multi-family residences are estimated as less than the cost for installing EFVs on that customer classification, PHMSA nonetheless believes the potential unquantified safety benefits,

[10] Based on estimates from previous DIMP rule with updated value of statistical life. There are no data on branched versus single available to develop a more precise estimate. Benefits and costs for this category were already included in the DIMP estimates and, to avoid double-counting, are not included in the total estimated quantified costs and benefits of this proposed rule.

combined with the quantified monetary benefits, justify the estimated cost. The one-time cost of installing an EFV ($15-$50, best estimate $30[11]) during new service or replaced service is fairly small. According to the data analyzed, the benefits of incident prevention on a per-EFV basis are also small because incidents involving these classifications are rare. However, these incident prevention benefits will exist for up to 50 years, as PHMSA assumes that EFVs and curb valves have a lifespan of 50 years. The values are calculated based on the assumption that without the regulation, EFVs and curb valves would not be installed in service lines (other than lines serving SFRs under the existing regulations). With voluntary installation, the benefits and costs would be reduced proportionally. The proposed rule is assumed to affect approximately 1,289 natural gas distribution operators and on average 222,114 services per year.

In sensitivity testing, the quantified benefits fell in between the low and high cost estimates. The benefits of this proposal are based on high-cost, low-probability incidents. The incident data we analyzed suggests that incidents occurring on many of these service classifications are infrequent. However, PHMSA's Incident Report database does not capture service classification and less than a decade's worth of incident data (2004 to 2012) could be analyzed for this proposed rulemaking, it is, thus, unlikely that the cost-benefit analysis captured all of the incidents that could have been prevented or mitigated by an EFV. Further, several of the incidents noted by the NTSB when they made previous recommendations for EFV installation took place decades ago, such that comparable incident causation data are not available in the PHMSA database. PHMSA's historical data and NTSB investigations show that incidents do occur on these lines, and when they do, they are typically high-consequence events. Key incidents identified by NTSB include the 1994 explosion at a retirement home in Allentown, PA, which resulted in a fatality, 66 injuries, and $5 million in property damage, and the 1998 explosion in St. Cloud, MN, which demolished a pizzeria, apartments, a law office, a bar, and took four lives.[12]

Because this rule aims to provide an extra level of protection in areas where there are high concentrations of people, a prevented or mitigated incident could prevent several injuries or fatalities (and sometimes extensive property damage), thereby producing significant quantifiable benefits. Further, while the unquantifiable benefits include avoided evacuations, avoided emergency response costs, and seismic event and tamper protections, there is substantial value in the perception of the safety and integrity of the natural gas distribution system. Currently, certain SFR residents are the only people who have the added protection of EFVs by federal regulation:

[11] The average cost of an EFV, ranging from $15-$50 is $32.50. PHMSA used $30 in this analysis as a ball-park as the analysis does not have any basis for assuming what would be a weighted average cost (how many EFVs at $15 and how many at $50 or in between. The analysis also does not account for future technology/manufacturing progress which typically reduces the unit cost.

[12] National Transportation Safety Board, *UGI Utilities, Inc., Natural Gas Distribution Pipeline Explosion and Fire, Allentown, Pennsylvania, June 9, 1994*, Pipeline Accident Report NTSB/PAR-96/01 (Washington, D.C.: NTSB, 1996) and National Transportation Safety Board, *Natural Gas Pipeline Rupture and Subsequent Explosion, St. Cloud, Minnesota, December 11, 1998*, Pipeline Accident Report NTSB/PAR-00/01 (Washington, D.C.: NTSB, 2000)

anyone who is residing in a multi-family residence (MFR), no matter if it is by choice or circumstance, is not being provided an equal opportunity to avoid incidents like the ones that occurred at Allentown, PA, and St. Cloud, MN.

The Initial Regulatory Flexibility Analysis, included as a separate document in the docket, noted that the natural gas distribution industry contains a substantial number of small entities. However, while there may be a small (and disproportionate) impact on small entities due to the ability of larger companies to save by buying valves in bulk, the impact is not significant due to the very low cost per valve.

PHMSA determined that the rule would not impose annual expenditures on State, local, or tribal governments of the private sector in excess of $147.6 million and thus does not require an Unfunded Mandates Act analysis.[13]

[13] The Unfunded Mandates Act threshold was $100 million in 1995. Using the non-seasonally adjusted CPI-U (Index series CUUR0000SA0), that number is $147.6 million in 2011 dollars.

1 Introduction

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is proposing to amend the requirements of §192.383 (b) by requiring the installation of excess flow valves (EFV) beyond single-family residence (SFR) service lines to cover new or replaced branched service lines, multi-family residences, and small commercial service lines serving a single customer with a known load that does not exceed 1,000 SCFH. Additionally, PHMSA is proposing to add §192.385 to require the installation of manual shutoff valves (curb valves) on all new or replaced lines where the installed meter capacity exceeds 1,000 SCFH.

The National Transportation Safety Board (NTSB) has identified, between 1970 and 2011, 11 significant incidents that could have been mitigated by the presence of an EFV and has issued more than 20 recommendations concerning the installation of EFVs for both residential and commercial applications. The NTSB's recommendations culminated in the most recent Safety Recommendation P-01-2, which states that PHMSA "require that excess flow valves be installed in all new and renewed gas service lines, regardless of a customer's classification, when the operating conditions are compatible with readily available valves."

PHMSA published an ANPRM (76 FR 72666, November 25, 2011) that included an Interim Evaluation report on expanding the EFV requirement beyond single-family residences. The Interim Evaluation, which had been posted online and received extensive feedback from stakeholders, recommended that an economic analysis be performed that would take into account alternatives, particularly curb valves; differentiate among the various classifications of customers; and reflect the increase in EFVs already installed. The Interim Evaluation noted that a survey would have to be performed in order to identify incidents and to find operators with experience and data on operating EFVs beyond SFRs.

While the ANPRM was open for comments, President Obama signed the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 into law. Section 22 of that law required PHMSA to issue a final report on the evaluation of the NTSB's recommendation on EFVs in applications other than service lines serving one single family residence, and "if appropriate, require by regulation the use of excess flow valves, or equivalent technology, where economically, technically, and operationally feasible on new or entirely replaced distribution branch services, multifamily facilities, and small commercial facilities."

This proposed rule addresses Section 22 of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 and NTSB Recommendation P-01-2. Section 22 of the Act requires PHMSA to conduct a study on the expanded use of EFVs in applications other than SFR service

lines. Based on the study[14] and the comments received on the study (see NPRM for discussion), PHMSA has determined that expanding EFV installation will provide protection for the vast majority of gas customers, irrespective of customer classification where known load size is less than or equals 1,000 SCFH, and is technically, operationally, and economically feasible. PHMSA acknowledges that EFVs may not be practical for large apartment buildings and industrial or commercial users due to inherent design complexity and continuous supply demands. PHMSA believes curb valves will provide the best possible option for improved safety at this time in situations where loads exceed 1,000 SCFH. PHMSA believes this proposed rule will satisfy the NTSB recommendation and promote better public safety by ensuring all service lines, regardless of the customer classification, have adequate protection through the installation of either an EFV or a curb valve. The interim report was finalized by PHMSA based on the comments received and has been placed in the docket. The public is requested to comment on this final report.

The proposed requirements for distribution pipeline operators are described below.

1.1 Excess Flow Valves

The proposed rule would revise 49 CFR part 192 §383 by adding four new categories of service for which EFV installation will be required on all new or replaced lines. The four new categories that will be added to the existing requirement for SFRs served by a single service line are:

- Branched service lines to a SFR installed concurrently with the primary SFR service line (a single EFV may be installed to protect both lines)
- Branched service lines to an SFR installed off a previously installed SFR service line that does not contain an EFV
- Multi-family residences with known customer loads at time of service installation, based on installed meter capacity, not exceeding 1,000 SCFH per service
- A single, small commercial customer, served by a single service line, with known customer load at time of service installation, based on installed meter capacity, not exceeding 1,000 SCFH per service.

PHMSA believes the first two categories of branched service lines to SFRs cover the majority of branched services. The benefits and costs of installing EFVs on service lines to SFRs were analyzed as part of the DIMP rulemaking in 2009. As there is no data available for which

[14] The report is in the docket at http://www.regulations.gov/#!docketDetail;dct=FR%252BPR%252BN%252BO%252BSR;rpp=10;po=0;D=PHMSA-2011-0009

installed lines are single-service or branched service[15], and because incident data doesn't distinguish the two types of lines, there was no practical way to exclude branched lines from the overall SFR calculations for DIMP. Indeed, the only difference between whether a service line is single-service or branched is in the underground configuration, which is determined by the installing operator on a case-by-case basis. The 2009 DIMP analysis found that installing EFVs on lines serving SFRs would yield annual benefits in the range of $7 million to $17 million against costs of $8 million. The safety benefits were calculated using the then-current $5.8 million value per statistical life and would thus be substantially higher using today's $9.1 million value. While PHMSA is not aware of a practical way to break down the benefits and costs of EFV installation on branched lines serving SFRs specifically, installing EFVs on branched lines is expected to have positive net benefits in light of the overall SFR results. Branched SFR is excluded from the remainder of this analysis as the cost and benefits are unquantifiable due to data limitation and to avoid duplication of the costs and benefits incorporated in the DIMP analysis. PHMSA seeks public comments on the benefits and costs of its proposal to require installation of EFVs on new or replaced branched service lines servicing SFRs and any information that would help overcome the data limitations regarding the number of branched and non-branched services lines.

The present analysis categorizes the estimated new and replaced services by multifamily, commercial, and industrial classifications and ensures every service line has the protection of either an EFV or a curb valve, thereby accounting for the cost of either an EFV or a curb valve for every service (the cost may be slightly overestimated as one can potentially have an EFV or a curb valve servicing multiple customers/services).

The proposed rule would continue to include exceptions for excess flow valves for cases where installation would not be feasible. These exceptions, now in part (c) of section 383, are:

- When the service line does not operate at a pressure of 10 psig or greater throughout the year
- When the operator has prior experience with contaminants in the gas stream that could interfere with the EFV's operation or cause loss of service to the customer
- When an EFV could interfere with necessary operations or maintenance activities, such as blowing liquids from the line
- When an EFV meeting performance standards in 192.381 is not commercially available to the operator.

The exceptions reduce the potential cost of the regulation by acknowledging that there are reasonable conditions that render EFV installation not operationally and technically feasible. As there is no data available to estimate the proportion of lines that are exempt, the analysis will

[15] PHMSA's Natural Gas Distribution Annual reports (PHMSA F7100.1-1) collect information on the number of services per operator in each state as an aggregate number without service type classification.

assume that all lines with known loads under 1,000 SCFH have operating conditions suitable for an EFV, thereby overestimating the cost.

The revision also adds a part (d) to section 383 that allows optional installation of EFVs if requested by a customer. The analysis does not estimate the number of customer requests that may occur in any given year or the resulting transfers.

Based on the findings and the comments on the Interim Report, PHMSA has determined that expanding the installation of EFVs will provide protection for the vast majority of gas distribution customers, irrespective of the customer classification, where loads does not exceed 1,000 SCFH. PHMSA has also deemed that EFVs may not be practical for large apartment buildings and industrial or commercial users due to inherent design complexity and continuous supply demands. For those situations (loads exceeding 1,000 SFCH), PHMSA believes curb valves will provide the best possible option for improved safety at this time.

1.2 Curb Valves

The proposed rule adds §385 to Part 192. The addition would require operators to install a manual service line shut-off valve (curb valve) on any new or replaced service line on which an EFV is not installed in accordance with section 192.383(b).

The proposed required use of curb valves for large commercial (greater than 1,000 SFCH) goes beyond the Section 22 language of the Pipeline Safety, Job Creation, and Regulatory Certainty Act of 2011, however it is based on ANPRM comments received from industry, trade associations and other stakeholders. PHMSA and industry in general believe that EFVs are not suitable for larger commercial facilities over 1,000 SFCH. As mentioned above, curb valves are the best alternative to an EFV and provide an effective added level of safety for these facilities. These valves also are a feasible alternative based on the cost/benefit analyses.

PHMSA's authority for regulating natural gas pipelines was first established by the Natural Gas Pipeline Safety Act of 1968, Pub. L. No. 90-481, and has since been enlarged by additional legislation. The Pipeline Safety Laws specifically delegate authority to DOT to develop, prescribe, and enforce minimum Federal safety standards for the transportation of natural gas. PHMSA has used this statutory authority to promulgate comprehensive minimum safety standards. While the 2011 Act specifically directed PHMSA to require the installation of EFVs on new and replaced branched lines serving SFRs, multi-family and small commercial facilities, DOT's underlying prior statutory authority under 49 USC § 60104 provides PHMSA with the authority to require the installation of curb valves for large commercial facilities.

The remainder of this report analyzes the benefits and costs of the regulatory changes as required by Section 1 of Executive Order 12866 (as amended by E.O.s 13258 (2002), 13422 (2007), and

13497 (2009)) and Section 1 of Executive Order 13563 (2011). The initial Regulatory Flexibility Analysis is filed separately in the docket.[16]

2 Background

EFVs are designed to automatically stop the flow of a gas when the flow increases suddenly and significantly, such as during a pipeline separation. They are used in the United States and around the world to mitigate damage resulting from a sudden pipeline rupture caused by a natural disaster, excavation damage, or other third-party damage. However, because they shut automatically based on changes in flow, they can also shut when customers suddenly increase their gas load, causing an inconvenience for the customer and the company. Manual shutoff valves, known as curb valves, are an alternative that avoids a false closure but requires a trained responder to be on site to shut the valve, increasing the amount of gas that is released after an incident.

PHMSA has moved towards greater installation rates of EFVs over the years while continuing to recognize that EFV closures pose hazards of their own.[17] In 1996, PHMSA added 49 CFR 192.381 to the Pipeline Safety Regulations, which contains performance standards for EFVs. In 1998, responding to statutory mandates in Section 104 of the Pipeline Safety Act of 1992 (Pub. L. 102-508), PHMSA added a requirement[18] that required operators to notify customers in writing about EFV availability; the safety benefits derived from installation; and any installation, maintenance, and replacement costs[19].

In 2006, the Pipeline Integrity, Protection, Enforcement, and Safety (PIPES) Act of 2006 required that EFVs be installed on all new or replaced service lines serving one SFR where:

- The service line continuously operates at a pressure at or above 10 psig
- The service line is not connected to a gas stream with a prior history of contaminants
- The installation is not likely to cause a loss of service to the residence or to interfere with necessary operations and maintenance
- EFVs are commercially available.

[16] The text of E.O. 12866 can be found here: http://www.archives.gov/federal-register/executive-orders/pdf/12866.pdf and E.O. 13563 here: http://www.whitehouse.gov/sites/default/files/omb/inforeg/eo12866/eo13563_01182011.pdf

[17] See FR Doc No: 94-18771, "Excess Flow Valve Installation on Service Lines" August 2, 1994 for discussion of EFV closure costs and PHMSA's 1996 cost-benefit analysis summarized in 61 FR 31449.

[18] http://www.gpo.gov/fdsys/pkg/CFR-2002-title49-vol3/pdf/CFR-2002-title49-vol3-sec192-383.pdf

[19] Distribution Integrity Management Rule (http://primis.phmsa.dot.gov/dimp/docs/DIMPFINALRULE.PDF) removed this requirement in 2009.

PHMSA issued Advisory Bulletin 08-04 encouraging operators to begin installing EFVs in accordance with the Act. The final rule on natural gas distribution IM programs was officially published December 4, 2009, and applied to lines installed or replaced after February 2, 2010 (74 FR 63906). However, the NTSB issued a response to PHMSA's status update urging PHMSA to make the rule applicable to all customers "regardless of their classification."[20]

PHMSA then published an ANPRM that included an Interim Evaluation report on expanding the EFV requirement beyond single-family residences (76 FR 72666, November 25, 2011)[21]. The Interim Evaluation recommended that an economic analysis be performed that would take into account alternatives, particularly curb valves; differentiate among the various classifications of customers; and reflect the increase in EFVs already installed. The Interim Evaluation noted that a survey would have to be performed in order to identify incidents and to find operators with experience and data on operating EFVs beyond SFR applications.

Nineteen entities submitted comments to the ANPRM docket (PHMSA-2011-0009). Eleven comments were from utility companies or associations, two were from manufacturers, one was from a State regulator, one was from the NTSB, one was from a city government, and the remainders were from the public.

In general, utilities supported an expansion of EFV installation, with limits on feasibility. The American Gas Association, American Public Gas Association, Northeast Gas Association, Southwest Gas Corporation, Nicor Gas Company, National Grid, Avista, and Laclede Gas all supported a limited expansion. Mid-American Gas and the City of Ellensburg, WA, supported an expansion as long as curb valves and EFVs were viewed as perfect substitutes for one another and companies could select which valve best suited operational conditions. The Texas Pipeline Association focused specifically on service lines extending from transmission and gathering lines. Three companies (Southwest, Mid-American, and Nicor) cited maintenance issues with ensuring access to curb valves, as well as delays in shutting off the gas in the event of a break. Reasons cited for delays included the valve's accessibility during an incident and the potential, because curb valve boxes are above-ground, that curb valves could be buried or damaged by third-parties, thereby making the valve inaccessible or inoperable. PHMSA requests further comment on reasons why using a curb valve to shut off gas in the event of an incident might be delayed. The State regulator noted that upstream above-ground valves are already present on many large commercial and industrial properties. The comments also noted that the categories provided in the Interim Evaluation were not specific enough. The American Gas Association (AGA) and others suggested that the threshold between small and large should be a load size of 1,000 SCFH (PHMSA 2011-0009-0024).

[20] NTSB response dated 9/22/2009. Correspondence available on the NTSB website here: http://www.ntsb.gov/safetyrecs/private/history.aspx?rec=P-01-002&addressee=PHMSA
[21] Ibid 2

Following the ANPRM, PHMSA developed a draft survey document aimed at identifying incidents and operators with experience operating EFVs beyond SFRs. As a key component of the survey, the research team developed customer categories based on the Interim Evaluation, ANPRM comments, and discussions with operators. Key variables identified to separate customers included load size, customer type, and load variability.[22] The analysis eventually resulted in seven categories: single family residential, small multi-family residential, large multi-family residential, small space and water heat non-residential customers, large space and water heat non-residential customers, small other non-residential customers, and large other non-residential customers. The distinction between small and large was the 1,000 SCFH load size mentioned in comments to the ANPRM.

Using the customer categories, the research team developed the survey recommended by the Interim Evaluation report, aimed at gathering data on EFV and curb valve costs and benefits. The survey was to be sent to all operators because industry comments suggested that experience with EFV installation beyond SFRs was rare, so a sample may have excluded operators with relevant data. The goal was to have a better understanding of the costs of EFVs on installations beyond SFRs from operators who already deployed the technology and on the costs and effectiveness of curb valves.

Nine companies were asked to pilot the census, and a copy was published in the Federal Register as part of a notice of information collection on May 15, 2012 (77 FR 28669). The purpose of the pilot was to ensure that operators were able to provide the requested data, that the questions were clearly worded, and that the response categories cover the full range of possible responses. Additionally, because the survey was developed using an online survey tool, Survey Gizmo, the pilot also served as a test of the online functionality. The nine companies selected varied by size (defined by number of service lines) and region of the country (East, Midwest, South, and West) in order to ensure that there was variation along key factors that might impact responses. All respondents had installed EFVs in the previous calendar year according to PHMSA's annual report data.

The pilot was conducted from May 24 to July 17, 2012. PHMSA sent an introductory letter to all nine participants explaining the purpose and importance of the data collection. The Volpe Center followed up with an email that described the study purpose and included the survey link. To boost response, Volpe contacted participants by email and phone to encourage participation and to answer any questions operators might have about the survey. The Volpe Center also conducted telephone debriefs with each of the nine pilot respondents to obtain more detailed feedback on their experience completing the survey.

[22] Demand for heat and water is less variable that demand for other uses such as cooking or clothes drying, so space and water heat customers were separated from other customers with more complex needs.

Of the nine pilot respondents, only four attempted to complete the survey, but in most cases they entered "0" as their response because the data was not available. Only one operator, whose company comprised a small system of approximately 3,000 service lines that installed EFVs only on single-family residences, provided responses by the different customer classifications. It took the respondent 3 hours to sort their service lines into the requested categories. In the debrief calls, the other respondents (five) indicated they could not provide the data being requested.

Both the census pilot and the docket comments on the notice of information collection (PHMSA 2012-0086) quickly revealed that company databases are not currently set up to provide the necessary data. Load and customer type data are stored separately from data on EFVs and from data on incidents, and grouping customers into the census categories would, according to these pilot respondents, be a time-intensive and costly undertaking. Because only one respondent was able to complete the survey, no data from the survey is included in this RIA.

As a result of the survey experience and feedback from pilot participants and industry comments on the docket, including AGA's docket comment (PHMSA 2012-0086-0003) stating a preference for putting forth a consensus regulation rather than continuing the data collection efforts, PHMSA moved to continue the rulemaking process authorized by Section 22 of the Pipeline Safety, Job Creation, and Regulatory Certainty Act of 2011 without further information collection in order to avoid undue industry burden.

3 Regulatory Analysis

Executive Orders 12866 and 13563 direct all Federal agencies to consider the costs and benefits of "significant regulatory actions." Federal agencies are directed to develop a formal Regulatory Impact Analysis consistent with Office of Management and Budget (OMB) Circular A-4 for all "economically significant" rules, or those rules estimated to have an impact of $100 million in 1995 dollars or more in any one year. The Order also requires a determination as to whether a rule could adversely affect the economy in terms of productivity and employment, the environment, public health, safety, or State, local, or tribal governments. This requirement applies to rulemakings that rescind or modify existing rules as well as to those that establish new requirements. The goal of the analysis is to provide decision makers with a clear indication of the most efficient alternative—that is, the alternative that generates the largest net benefits to society ignoring distributional effects.

This proposed rule falls below the $100 million a year in annual impact threshold. This regulatory analysis:

- Identifies the target problem, including a statement of the need for the action
- Identifies available alternative approaches
- Defines the baseline

- Defines the scope and parameters of the analysis
- Defines and evaluates the costs and benefits of the action and the main alternatives identified by the analysis
- Compares the costs and benefits
- Interprets the cost and benefit results.

4 Identification of the Problem and the Need for the Rule

Executive Order 12866 states that "Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people ..." Executive Order 13563 states that, to the extent permitted by law, agencies must (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor its regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

PHMSA's mission is to ensure the safety of the natural gas system. Recognizing the safety benefits of EFV installation in natural gas distribution systems, Section 22 of the Pipeline Safety, Job Creation, and Regulatory Certainty Act of 2011 directed PHMSA to, if appropriate, require the installation of EFVs or equivalent technology, where economically, technically, and operationally feasible on new or entirely replaced distribution branch services, multifamily facilities, and small commercial facilities. In addition, PHMSA is responding to NTSB recommendation P-01-2, which recommends that PHMSA "require that excess flow valves be installed in all new and renewed gas service lines, regardless of a customer's classification, when the operating conditions are compatible with readily available valves."

As mentioned before, based on the study[23]and the comments received on the study (see NPRM for discussion), PHMSA has determined that the overall benefits of expanding the installation of EFVs as proposed in the rule justify the costs.

The proposed rule requires operators of gas distribution pipelines to install EFVs on all new or replaced residential and commercial service lines where the known load does not exceed 1,000 SCFH and install manual shutoff valves on all other new or replaced lines.

There is a market failure that the EFV requirements will help address. Natural gas distribution operators do not always bear the full costs of an incident or explosion stemming from a service line puncture or rupture. Even in cases where operators provide compensation for losses that can be monetized, those monetary penalties do not necessarily capture the full impact on affected parties, especially when a death or injury occurs. As a result, there is a negative externality present in which the company may not take the full cost of a possible incident into account in its decision-making. The negative externality can alter the company's decision about safety precautions, leading to a need for government to set minimum levels of safety precautions, such as the installation of EFVs. In this particular case, some companies are already installing EFVs beyond single-family residences, so the proposed rule would bring all companies up to this safety standard where economically and technically feasible and require manual shut-off valves on all other new or replaced lines.

5 Identification of Available Alternative Approaches

PHMSA considered several alternatives to assure the necessary protection from incidents caused by the puncture or rupture of service lines, with the intention of selecting the alternative that was likely to result in the highest net benefits. PHMSA considered the following approaches:

- Baseline or "no action" scenario
- Customer notification requirement only
- Implement NTSB's full recommendation and require that EFVs be installed in all new and renewed gas service lines, regardless of a customer's classification, when the operating conditions are compatible with readily available valves
- Develop a hybrid approach by requiring EFVs where loads are smaller and more stable, making EFVs more feasible and requiring that any line not protected by an EFV be protected by a manual shut-off valve.

[23] The report is in the docket at http://www.regulations.gov/#!docketDetail;dct=FR%252BPR%252BN%252BO%252BSR;rpp=10;po=0;D=PHMSA-2011-0009

After considering all of the alternatives, PHMSA selected the hybrid option.

5.1 No Action

This was used as the baseline against which PHMSA compared all other alternatives.

Regulatory analyses typically consider an alternative in which the agency would not take any action because it would maintain the status quo. No new requirements would be levied. No costs would be incurred to implement new requirements. No new benefits would result.

The status quo scenario is that some companies would begin or continue voluntary installation of EFVs beyond SFRs based on their perceived business case for doing so. In its comments to the information collection docket, the AGA noted that its board of directors had voted to begin installing EFVs beyond single-family residences starting June 2013 (PHMSA 2012-0086-003). However, voluntary installation does not lead to uniformity. Uniformity ensures consistency and enforceable oversight, ensuring the safety of natural gas service lines throughout the United States.

By not taking action, the Agency would be unresponsive to the congressional mandate in Section 22 of the Pipeline Safety, Job Creation, and Regulatory Certainty Act and to NTSB recommendation P-01-2. Although this alternative would not lead to increased compliance costs, there would be little reduction in the societal costs associated with the deaths, injuries, and property damages associated with service line ruptures and punctures beyond SFRs. Additionally, voluntary installation would not ensure uniformity and would leave many lines without shutoff valves, especially the lines that would be covered by manual shutoff valves under the proposed rule. This alternative results in zero net benefits.

5.2 Notification requirement only

Under this alternative, PHMSA would not extend mandatory installation of EFVs beyond the current rule covering single-family residences, but would issue new regulations requiring that gas distribution operators inform customers of the option to have an EFV or curb valve installed, with additional notifications when a service was replaced or newly installed. Costs, schedule, and other details of the EFV installation would be determined by the appropriate State regulatory agency. PHMSA rejected this alternative as unlikely to be effective in achieving widespread EFV coverage and the associated safety benefits, due to low public awareness of EFVs and relatively low rates of customer-initiated installations in places where this has been an option.[24] Although the option for customer-initiated EFV installation is a useful adjunct to mandatory

[24] K. Costello and P. Laurent, National Regulatory Research Institute (NRRI), Survey On Excess Flow Valves: Installations, Cost, Operating Performance, And Gas Operator Policy, March 2007.

installation on new and replaced services, PHSMA does not believe it would be adequate to address the relevant safety concerns or NTSB recommendations.

5.3 Full implementation of NTSB's recommendation to require that excess EFVs be installed in all new and renewed gas service lines, regardless of a customer's classification, when the operating conditions are compatible with readily available valves

This alternative was determined by PHMSA to be infeasible.

While EFVs provide safety benefits by snapping shut automatically and rapidly due to changes in gas pressure, they have also been known to shut in response to sudden increases in gas use such as the turning on of an industrial oven. This is known as a "false closure." False closures can cause considerable damage. One docket comment noted that false closures can lead to harmful chemical releases if the gas used to burn chemical waste in factories is suddenly shut off.[25] False closures would also have consequences in medical establishments, where a sudden loss of heat or hot water could cause serious harm. While EFVs can be sized to prevent most false closures, there is still a chance for false closures to occur, particularly for customers whose gas loads are more variable. Thus, the potential for false closures render an EFV requirement impractical in many settings, such as those with high and variable gas loads (over 1000 SCFH), low-pressure lines, lines with contaminants, or where EFVs would interfere with maintenance or lead to loss of service.

5.4 Development of a hybrid approach requiring EFVs where loads are smaller and more stable and requiring that any line not protected by an EFV be protected by a manual shut-off valve.

This alternative was determined by PHMSA as the preferred regulatory option and is compared in the document with the baseline "no action" alternative. While the quantified benefits associated with this alternative do not always outweigh the costs, the potential unquantifiable benefits and relatively low cost make this alternative preferable, especially from a safety point of view, as an EFV can prevent or mitigate the consequences of rare, but severe and costly, incidents.

[25] PHMSA-2011-0009-0015, Comment by Southwest Gas, submitted 03/21/2012

This alternative proposes operators place EFVs or curb valves where they are most operationally effective and where they most maximize the overall safety benefit. Excess flow valves, which provide greater safety benefits than manual shut-off valves, would be required on smaller, more stable loads that are similar to loads on single-family residences. The properties affected by this proposal would have few negative operational impacts and would be protected with automatic shut-off capabilities in the event of a pipeline rupture, saving life and property. Other lines, including those serving public establishments and large commercial or industrial customers would receive some safety benefits from manual shut-off valves without incurring the potential costs of a false closure.

6 Industry Information

The gas distribution industry is complex, composed of some very small operators, including master meter operators that serve only a few customers; medium-sized operators, many of which are municipal agencies, serving between 1,000 and 50,000 customers; and some larger companies operating sizable systems often in multiple States. The industry is also fluid, as companies may merge or municipalities sometimes decide to jointly provide services or offer a contract to a third party to operate a system. The table below breaks down operator size by type. It is based on operator data from the PHMSA annual report, combined with Dun and Bradstreet data on sector and size[26].

	Under 1,000 service lines	1,001-50,000 lines	Over 50,000 lines	Lines Unknown
Natural Gas Distributor	23%	53%	24%	1%
Public Sector Entity	55%	44%	0%	1%
Other Company	49%	39%	10%	2%
Unknown Type	32%	40%	28%	0%
Overall	**44%**	**45%**	**10%**	**1%**

[26] Estimate based on PHMSA's active operators submitting 2011 gas distribution annual reports, validated and identified by Dun and Bradstreet under contract to PHMSA, as of December 2012.

6.1 Impacted Operators

The regulatory changes will apply to all operators of gas distribution systems, including master meter and LPG systems regulated under 49 CFR Part 192. The 2011 annual report database contains 1,398 reports from gas distribution operators, with an estimated 1,289 unique operators (i.e., those with a unique OPID) with 66 million service lines. Master meters and small LPG systems comprise another group of 6,184 operators, with an unknown number of lines. Previous benefit-cost analyses have assumed 100 lines per operator in this category, which leads to roughly an additional 620,000 service lines impacted.[27]

6.2 Industry Size and Growth Over Time

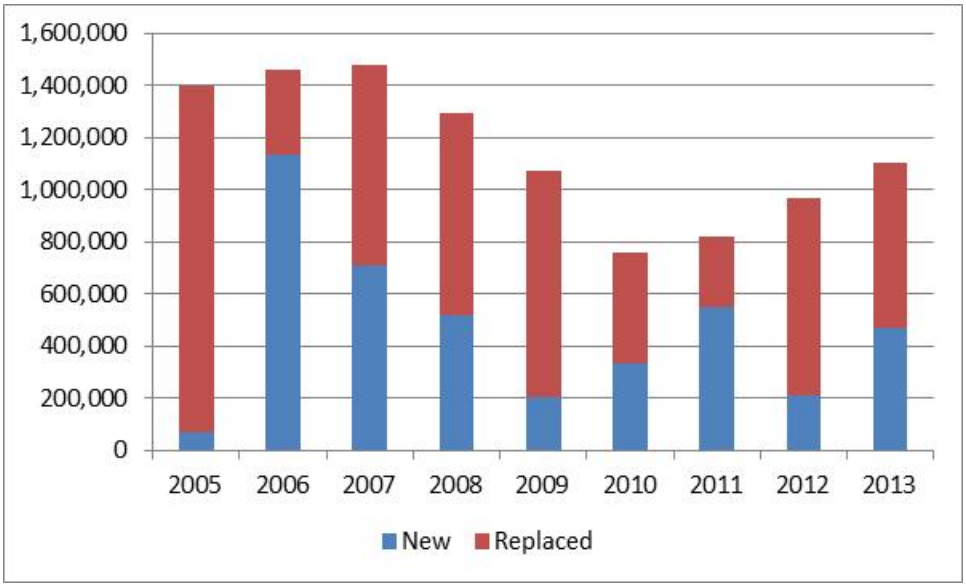
The proposed rule affects new and replaced service lines. PHMSA's annual report[28] has collected information on decade of installation since 2004, providing a limited amount of data with which to analyze trends in growth and replacement over time. Figure 1 below charts the new and replaced lines from 2005-20132013.[29]

Figure 1 New and Replaced Service Lines 2005-2013

[27] The rest of this analysis is limited to those operators that submitted an annual report and does not cover master meter and small LPGs. According to PHMSA's Operator Management System, there are 5,295 master meter and 889 small LPG operators, for a total of 6,184 additional operators as of 9/20/2013. Some operators that are affected by this proposed rule may be omitted from the analysis due to this lack of data, but no comments were received in either the ANPRM docket or the information collection docket critiquing this omission, or even mentioning these categories of operators at all.

[28] Per 191.11, each operator of distribution pipeline system submits an annual report for that system on PHMSA Form F7100.1-1. PHMSA's Annual Report collects information on pipeline mileage, commodities transported, and state of operations Data are available via http://www.phmsa.dot.gov/pipeline/library/data-stats .

[29] 2004 was the first year that companies recorded the decade of installation for pipes. It is likely the high proportion of replaced in 2005 is an artifact of this data as companies adjusted to the new data reporting requirements.



Factors that influence the rate of service line installation include broader economic conditions, labor availability, and weather incidents. As the chart above shows, the rate is variable, with new installations following a generally downward trend in the earlier years of the period and then rebounding somewhat after the period of slow economic growth in 2008-2009. Overall industry growth is roughly 1% a year, and the replacement rate varies between 1 and 2%.

Data on EFV installation has been available since the 2010 annual report. In 2010, 504,854 EFVs were installed in roughly two-thirds of the pipes installed that year. In 2011, the percentage of newly installed lines with EFVs went up to 72%. The overall network coverage was 9.6% in 2010 and 10.4% in 2011, with 6.3 million EFVs in the system in 2010 and 6.9 million in 2011. These data reveal two important network characteristics. The first is that there was a significant amount of voluntary EFV installation before the DIMP rulemaking (as evidenced by the 6 million EFVs installed prior to 2010). The second is that the industry has little experience installing EFVs beyond SFRs, as nearly three quarters of new lines installed in both 2010 and 2011 had EFVs placed in them, and the majority of EFVs installed each year are installed on lines serving SFRs.

7 Definition and Evaluation of the Benefits and Costs

7.1 Data Sources and Limitations

7.1.1 Data

Cost data for the price of valves was taken from past benefit-cost analyses, docket comments, and discussions with industry. The table below shows the cost data and the source.

Estimate	Source
$20-30 per EFV	DIMP Rulemaking, variation based on company size
$50 per EFV	Mid-American Energy Docket Submission
$15-50 per EFV, $10-$100 per curb valve	Ranges provided by a representative from a gas operator in the Pacific Northwest with installation experience, by telephone 8/15/2012

Quantifiable benefits were estimated using data from the PHMSA Incident Reports database. The researchers utilized the incident database developed for the Interim Evaluation because that version included a customer classification for each incident type, which is otherwise unavailable for periods prior to 2004, and then extended the analysis through 2012. For both EFVs and curb valves, incidents were filtered based on customer type and incident cause to isolate those incidents that would actually be prevented by the selected valve under the proposed rule. This regulatory evaluation uses Departmental guideline on valuing reduction of fatalities and injuries by regulations as published by the Office of the Secretary of Transportation, U.S. Department of Transportation.[30]

To determine the incident rate, rough estimates of the size of each customer category for the years in the incident database were developed based on Table 8-1 of AGA's GasFacts, "Gas Industry Sales Customers by Class of Service." While the ratio of customer to service line is not exactly one, the ratio is close enough to approximate the size of the population. Table 8-1 only goes through 2010. Because the share of residential lines has been steadily rising relative to commercial and especially industrial lines over time, the 2010 shares were extended through 2012 rather than using the 2004-2010 average. The shares in 2010 were 92.7% residential, 7.1% commercial, and 0.2% industrial.

Benefits and costs are all presented in real (i.e., inflation-adjusted) terms. Future costs and benefits accrued over the 50-year lifespan of the valves are discounted to the present value using a real 7% discount rate. A 3% rate is also included to show how sensitive the estimates are to the selection of a discount rate. At the end of the 50-year analysis period, valves installed in years 2 through 50 will still be providing benefits into the future. The remaining protection at the end of the 50-year time frame is summed to reflect the remaining benefits of those valves.

[30] Trottenberg, Polly and Robert Rivkin. "Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in U.S. Department of Transportation Analyses." February 28, 2013. The injury number is equivalent to a "serious" injury on the Abbreviated Injury Scale and is 10.5% of the VSL.

For simplicity, this analysis presents the benefits and the costs of a single valve first and then expands the analysis nationwide. Valves are not assumed to have network effects; in other words, each EFV operates independently, and the costs and benefits of EFV installation simply scale linearly. Because nationwide estimates include valves installed over a 50-year period, and USDOT now recommends that the monetary value of an injury or fatality increase over time with the wage rate, benefits rise slightly over time as the equivalent injury values rise. Benefits and costs are determined separately for multi-family EFVs, commercial EFVs, and the industrial/other curb valves as each category has different incident rates and severities, as well as different valve costs.

7.1.2 Assumptions and limitations

In order to perform the analysis with the limited data available, a number of assumptions were made. First, for the benefits that are quantified here, the research team assumed that incident rates and costs developed from past data would not change during the 50-year analysis period. This assumption may not hold, since other safety improvements, such as 811 "Call Before You Dig," could reduce the number of EFV-preventable incidents in the future. However, 811 is a longstanding initiative, and its effects should largely already be reflected in the relatively recent (2004-2012) incident data used in this analysis. Additionally, there is the chance that incident costs could be somewhat higher in the future due to higher population densities, aging infrastructure, or other factors.

Second, two costs were excluded due to lack of data. There are no valve failure costs and no curb valve maintenance costs included in the analysis. Valve failure costs would include the replacement costs for EFVs that close and fail to reopen as designed, close falsely, or fail to close in the event of an incident. They also would include replacement costs for curb valves that fail to close when operated. Curb valve maintenance costs would include the cost of visits to keep curb valve locations accessible and free from plants or debris. This omission acts to make the cost figures lower than they otherwise would be, but without the operator survey data (see Section 2) this effect cannot be quantified. However, the difference appears to be very small. A previous study of EFVs found that false closures and failed closures are very rare when EFVs are installed in settings where they are currently used (mostly SFRs), occurring in about 1/100th of 1 percent of installed EFVs among companies surveyed. [31] Required maintenance for curb valves is also believed to be minimal.

Third, some benefits are left un-monetized, particularly the value of avoided evacuations and lost business revenue for residents and customers, and the value of avoided emergency response.

[31] Costello, K. and P. Laurent, Survey on Excess Flow Valves: Installations, Cost, Operating Performance, and Gas Operator Policy, National Regulatory Research Institute, March 2007. The study identified 223 false closures and 26 failures to close out of approximately 2.5 million EFVs.

EFVs can prevent the need for evacuations by quickly stopping the flow of gas, reducing the likelihood of an explosion or fire and therefore allowing residents and businesses to continue operating normally or at the least shortening the disruption caused by the incident. Further, a reduced likelihood of explosions or fire following a pipeline incident will cause fewer emergency response teams to be mobilized and be unnecessarily subjected to fire and danger. Additionally, there is often valuable time lost, once incidents occur, in waiting for the gas company to shut off the supply of gas. In previous incidents (including St. Cloud, MN, 1998; Bridgeport, AL, 1999), emergency responders, gas employees, and public citizens have been killed or injured because gas continued to flow from a broken pipe to a place where it collected and ignited. Ensuring that the supply of gas is quickly shut off will prevent these types of incidents and would allow emergency responders, should they need to respond, to attend to people more quickly and safely.

In its investigation of a pipeline incident at a multi-family residence in Allentown, PA, in June of 1994,[32] the NTSB noted that the Department of Housing and Urban Development (HUD) did not require the installation of EFVs on multi-family residences where residents receiving Federal rent subsidies lived. HUD deferred to the Research and Special Programs Administration (RSPA; later PHMSA) on this recommendation, arguing that the issue was under RSPA's purview. This proposed rule would provide equal safety benefits to those members of society who are receiving Federal housing subsidies, who earn lower incomes and cannot afford to live in SFRs, or who simply choose to not live in SFRs. The NTSB found that, in the case of the Allentown incident, it would have cost from $8-10 per apartment to have installed appropriate EFVs and gas detectors. While "peace of mind," "confidence in the safety of the gas distribution system," and, as a MFR resident, "knowing that they would be receiving the same technological protection and safety benefits as someone living in a SFR" aren't quantifiable benefits, they are certainly unquantifiable benefits that need to be accounted for.

The environmental and climate-change benefits of reductions in lost gas are also not monetized in the base case; Appendix B includes estimates of the climate change benefits of reductions in lost gas. Therefore, the quantifiable benefits presented here somewhat understate the total societal benefits.

Fourth, while EFVs operate automatically, curb valves require manual intervention and therefore will not be effective for all otherwise-eligible incidents. Based on PHMSA's knowledge of curb valves, this analysis uses an assumed 90% effectiveness rate to reflect the fact that there will be cases in which not all incident consequences will be averted because of human and operational factors (including ability to reach the valve and potential damage to the valve from third-parties). Appendix A provides sensitivity analysis of other rates. PHMSA seeks comment as to whether this assumption is reasonable.

[32] http://www.ntsb.gov/investigations/AccidentReports/Reports/PAR9601.pdf

Fifth, the analysis does not include otherwise eligible and preventable incidents that are not reportable to PHMSA, either because they are outside PHMSA's jurisdiction or because they do not meet the 30-day written reporting criteria as defined in §191.3. The PHMSA incident database used in this analysis only includes data from incidents where there was a fatality, injury requiring hospitalization, loss of property greater than $50,000, the unintentional release of more than three million cubic feet of gas (for incidents since 2011), or where the operator felt the need to report it. As a result, benefit numbers are lower than they would be if non-reported incidents were included, particularly for EFVs, which are likely to be more effective than curb valves in mitigating smaller incidents that could escape manual detection.

Sixth, PHMSA incident and annual reports do not collect information on customer classification; the analysis uses incident data for which location and classification can be identified by the research team. As a result, to be conservative, the analysis omits 53 incidents from the database that are in other respects likely to be candidates due to an inability to determine incident location and/or classification. For instance, the NTSB noted several instances in which an EFV could have mitigated or outright prevented incidents where there were one or more fatalities, injuries, or significant property damage[33], including the ones occurring in 1968 at Hapeville, GA; 1972 in Lake City, MN; 1974 in New York, NY; and 1979 in Stanardsville, VA.

Seventh, all calculations related to service lines, incident rates, and installation costs are based on the assumption that one customer equals one service line, and will receive one EFV or curb valve. PHMSA assumes that one EFV or curb valve would be installed on any service line[34] and estimated the costs accordingly. PHMSA seeks comments as to whether this assumption is reasonable or whether better information is available. For a small portion of branched service lines where a single EFV could serve the multiple branches, this assumption may slightly overestimate costs and underestimate benefits, as this analysis assumes an EFV would have to be installed both close to the main and on each service line itself.

A summary table of the data limitations' effect on estimates is included below. PHMSA invites comment on the reasonableness of the assumptions used here and other sources of information that may be relevant to the analysis.

Limitation	Effect
Omission of valve failure and maintenance	Reduces costs for both EFVs and curb valves

[33] http://www.ntsb.gov/investigations/AccidentReports/Reports/PAR9601.pdf; Appendix B

[34] A service line represents one gas service or "customer." In multi-family housing, there may be one service for the entire building, or separate services individually metered for each unit. For consistency, this analysis uses PHMSA definitions and estimates of services, and assumes that each relevant service will receive an EFV or curb valve. As noted above, there may be limited cases where a single EFV could serve multiple services, in which case total installation costs are slightly overstated.

costs	
Un-monetized benefits	Reduces benefits for both EFVs and curb valves
Omission of non-reported incidents	Reduces benefits, particularly for EFVs
Omission of non-located incidents	Reduces benefits
Assumption of 1 valve installed per line	May reduce benefits and increase costs for branched service lines

7.2 Costs

There are two types of costs considered in a benefit-cost analysis, fixed and variable. Fixed costs include program costs such as developing a compliance policy, choosing valves and assembling an inventory, and training current employees. For the proposed rule, these costs are believed to be minimal and assumed to be zero for estimation purposes, because operators have already conducted these activities for installing EFVs in single-family residential settings.[35] Similarly, because curb valves are already an industry-recognized solution for larger installations, there will be little additional training or materials assembly required. PHMSA seeks comment on these assumptions.

For this rule, variable costs are equal to the price of a valve, installation, and maintenance. For EFVs, PHMSA received estimates through informal discussions with an operator and via the docket that were in the range of $15 to $50 per EFV. Operators did not provide details on the reasons for the range in reported costs, though factors may include company size and customer characteristics. The DIMP rule used a cost range of $20 to $30 for EFVs. This analysis uses a midrange cost estimate of $30, with sensitivity testing of lower ($15) and higher ($50) costs. The $30 estimate includes additional labor costs resulting from EFV installation as reflected in conversations with industry. The additional labor cost for an EFV ranges from zero to thirty minutes with significant reductions as the crew's installation experience for EFVs increases.[36] These time requirements were included in operators' estimates of total installation costs.

[35] Docket Number: PHMSA-RSPA-2004-19854, "Pipeline Safety: Integrity Management Program for Gas Distribution Pipelines."
[36] Estimates taken from conversations with industry representatives.

The analysis does not include potential costs from having to re-install an EFV in response to a significant change in a customer's gas usage, which might occur when a small commercial building changes to a more gas-intensive tenant. The typical practice in the gas industry is for the service line to be sized according to the high end of potential usage, so a change in gas usage can ordinarily be accommodated without any change to the line or to its EFV. In an extreme case, the service line would need to be re-sized, and the costs for a new EFV would be captured in the estimates of "new or replaced" services as described in more detail below in Section 7.4.2.

In addition, there are potential costs from EFV failure. There are three types of potential EFV failures. First, EFVs can have false closures (discussed above). Second, most EFVs are designed to reset automatically, but the reset mechanism can fail. Third, a valve can fail to close when an incident does occur. In each of these failure scenarios, operators and their customers incur costs, ranging from a service visit and a brief loss of gas service to the need to dig up and replace the valve. The Interim Evaluation contained estimates of the rates of each of these failure types from a National Regulatory Research Institute (NRRI) survey, but the estimates were for single-family residences and may not reflect operators' concerns of increased load variability for the proposed new customers. Out of 2.5 million EFVs installed as of 2005 by respondents to the survey, the NRRI survey found 223 false closures and 26 failures to close. Failures to reset were not captured, nor were the costs of failure or the failure rate per line-year. PHMSA requests public comment on the number of false closures that might occur on the EFVs that would be required by this rule, and the costs of such failures. PHMSA encourages commenters to provide information to support their comments.

Ideally, the "Costs" section of this analysis would also include the costs of and updated rates for valve failures, including valve replacement and repair. However, as mentioned above, reliable data cannot be assembled for this by category, and companies have said that assembling it would cost more than complying with the proposed rule. It is also possible that failure costs would be negligible if the failure rates remain what they are with currently installed EFVs.

For curb valves, an assumed average cost of $55 is used, with sensitivity testing of lower ($10) and higher ($100). Again, costs appear to vary by operator but without clear patterns. As with EFVs, these cost estimates from operators include the estimated incremental labor costs for installation. In the case of curb valves, the additional labor required is for excavating the vault and assembling the above-ground portion of the valve. The proposed requirement applies only to new or replaced lines, so the excavation costs for the line are not applicable, as the trench would be open. Costs for manually operating the curb valve in the event of an incident are minimal and are assumed to be zero, given that some form of incident response is already required. Curb valves would have little hardware cost reduction over time as they are already standard industry practice.

Costs for EFVs and curb valves are assumed to remain constant (in inflation-adjusted terms) over the analysis period. Although there is the possibility that costs could fall with manufacturing

innovations or economies of scale, the analysis assumes conservatively that costs remain constant.

A small additional cost item is the proposed requirement that certain customers be notified of their ability to request an EFV installation. Operators have multiple options for fulfilling this requirement, including something as simple as adding a short statement to customers' monthly bills. PHMSA estimates that approximately half of the 6,184 operators categorized as either master meter operators or small LPG systems will be impacted, resulting in 3,092 operators. This estimate is based on the premise that only half of these operators have systems that can accommodate an EFV (based on operational characteristics). PHMSA also estimates that 1,289 gas distribution operators will be impacted. Therefore, PHMSA estimates a total impacted community of 4,381 (3,092 master meter/small LPG operators and 1,289 gas distribution operators). PHMSA estimates that each impacted operator will take approximately 30 minutes per year of staff time to complete this notification, and an additional 30 minutes per year to maintain the associated records, for a total of 1 hour per year. According to the Bureau of Labor Statistics, a compliance officer in the natural gas distribution industry has average wages of $41.52[37], with similar figures for other occupations that may handle this requirement. Overall, the notification and recordkeeping is estimated to entail annual costs of $181,899 per year (i.e., 4381 operators * 1 hour/operator * $41.52/hour).

PHMSA invites public comments on its estimates of the cost of installing and using EFVs and curb valves. Specifically, PHMSA seeks comment on the cost of the valves, the cost of installing them, the cost of maintaining them, the cost of reinstalling them or re-setting the tripping point if gas usage changes, and the cost of any unintended consequences such as false closures.

7.3 Benefits

The benefits provided by either type of valve are the avoidance of incident-related fatalities, injuries, and property damage over the course of the valve's lifetime, with future values discounted to present value. Because EFVs function automatically, they are assumed to prevent 100% of the relevant set of EFV-preventable incidents. This estimate is based in part on NRRI survey data showing very small numbers of failed closures among operators using EFVs and the absence of any PHMSA-reported incidents involving failed closures of EFVs. Curb valves are assumed to have 90% effectiveness because human intervention is required; this assumption is discussed in Section 7.1.2. PHMSA requests public comments regarding its assumptions about the effectiveness of EFVs and curb valves.

[37] Bureau of Labor Statistics, Occupational Employment Statistics, May 2012. Occupation code 13-041, industry code 221200. http://www.bls.gov/oes/current/oes131041.htm

Each valve provides benefits in the form of protection from certain kinds of incidents for the life span of the valve. Valves are assumed to last for 50 years, as stated in the manufacturer's specifications. In each year, the value provided by the valve is equal to the cost of the incidents that are prevented by the valve multiplied by the likelihood that the incident will occur. The best source available for the cost of an incident is the PHMSA incident database, though it is limited to reportable incidents as discussed above.

The benefits are calculated by multiplying the average cost of an incident by the likelihood of an incident occurring on a line within that customer class. The incident years used are March 2004 through December 2012. The cost of an incident is calculated using fatalities, injuries, and property damage. Property damage includes the market value of lost gas as reported on the incident form. Fatalities and injuries are converted to dollar terms using values from departmental guidance documents: $9.1 million per fatality and $955,500 for an injury requiring hospitalization.[38] Per departmental guidance, the injury and fatality figures rise 1.07% per year to account for wage increases over time.

The incident dataset does not include a known load size of the affected customer to use in determining customer size. The closest approximation available in the database is operating pressure and pipe size and material.[39] Note that while the low-pressure lines would now require a curb valve, there is no estimate available of the population of low-pressure lines and therefore no way to generate a rate and include them in the benefits calculation. Similarly, SFR incidents may include branched lines as well. As there are no defining characteristics separating single-family service lines from branched lines other than the configuration of the underground piping, this analysis does not separately analyze the case of branched lines serving SFRs; instead, based on the findings from the DIMP RIA, EFVs for branched lines serving SFRs are assumed to have net benefits just as EFVs do in the case of single-serve SFR lines. PHMSA requests public comments on whether the ratio of benefits and costs for branched lines may be different than the ratios for single-serve lines. Please provide information to support your comments.

To estimate an incident rate, the total number of service lines was taken from the annual report databases for 2004-2011. The 2004 total was adjusted to reflect that incidents in February and January were not included in the dataset, and the 2012 total was calculated assuming a 1%

[38] Trottenberg, Polly and Robert Rivkin. "Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in U.S. Department of Transportation Analyses." February 28, 2013. The injury number is equivalent to a "serious" injury on the Abbreviated Injury Scale (AIS-3) and is 10.5% of the VSL.

[39] The dataset contains eight incidents that occurred on steel or aluminum pipes ¾" NPS or larger with maximum operating pressures over 100 psi. One of the eight had been classified as a commercial candidate incident for EFV but was reclassified as industrial for this report based on further research that revealed that the incident occurred on a diatomaceous earth mine. Four incidents were confirmed as industrial or agricultural by aerial view, two were not findable, and one appeared to be a new single-family residence next to a field. For the last, there was no information as to what had been there the year of the incident, so it remained in the dataset. There were also three additional incidents classified as industrial EFV candidate incidents. Under the proposed rule, they would receive a curb valve, not an EFV, so they were used in the curb valve benefits.

growth rate. The sector totals were then calculated by applying the proportions from Table 8-1 of AGA's Gas Facts, "Gas Industry Sales Customers by Class of Service."[40] (These proportions are also used below to estimate the number of installed EFVs per customer class.) Further, it was assumed that 99.9% of residential customers had known loads not exceeding 1,000 SCFH, while 85% of commercial customers had known loads not exceeding 1,000 SCFH.[41] The adjusted totals were summed to provide a total number of line-years on which the incidents occurred. A line-year is one service line for one year. The line-years are calculated in the table below.

Year	MFR < 1,000 SCFH	Commercial <1,000 SCFH	Industrial/Other
2004	16,953,290	3,269,542	721,917
2005	20,383,567	3,891,653	851,908
2006	20,750,284	3,969,917	858,988
2007	20,995,915	3,978,199	858,556
2008	21,174,259	3,990,815	855,451
2009	21,240,908	3,987,022	869,822
2010	21,369,705	3,951,353	852,090
2011	21,540,204	3,982,879	858,888
2012	21,755,606	4,022,708	867,477
Total Line-Years	**186,163,737**	**35,044,087**	**7,595,098**

Additionally, there are several unquantified benefits from this proposal. Requiring the installation of EFVs on MFRs and branched lines serving SFRs will ensure that all members of

[40] American Gas Association, Gas Facts, https://www.aga.org/gas-facts. The shares in 2010, the last available year in the dataset, were 92.7% residential, 7.1% commercial, and 0.2% industrial. Because the share of residential lines has been steadily rising relative to commercial and especially industrial lines over time, the 2010 shares were extended through 2012 rather than using the 2004-2010 average.

[41] Data for assumptions gathered in discussion with industry representatives 8/15/2012.

society, regardless of their choice of accommodation, will receive the same level of protection against EFV-preventable incidents. Currently, only residents of SFRs served by single lines are afforded this extra safety measure. A person's dwelling can be dependent on many factors, including affordability and convenience, and no person should receive fewer pipeline safety benefits than others based on what type of structure they live in.

Further, more widespread EFV installation will help avoid more unnecessary, costly, and scary evacuations. Evacuations from leaking gas that otherwise might have been prevented by an EFV cause residents mental anguish and a loss of confidence in the natural gas distribution system. They cause businesses lost productivity and commerce.

EFVs also are beneficial where emergency response is concerned. Because EFVs can prevent incidents that emergency responders would otherwise have to respond to, expanded EFV installation can help prevent emergency responder mobilization costs and resource costs. Should emergency responders need to respond to an incident in an area where an EFV has activated, they can respond more quickly, not having to wait for the gas to be shut off to enter the area and not being subjected to further potential danger. This can help incident victims get the medical assistance they need that much more quickly when time is so critical, and it can also help prevent subsequent injuries or fatalities to emergency responders.

Further, these EFV provisions will help mitigate and prevent consequences of incidents that involve customer piping, which is non-DOT jurisdictional. PHMSA does not collect data for incidents that occur on customer piping, but EFVs could prevent or mitigate some portion of deaths, injuries, and property damage that occur from leaks or incidents on customer piping.

EFVs also protect against intentional pipeline tampering and can provide protection against seismic events, which has not been accounted for in this analysis. Certain operators, depending on their geographic region, install EFVs for seismic event protection, and many States encourage EFV installation for just this purpose.

7.4 Calculations

7.4.1 Per Valve

The table below lays out the numbers of incidents, fatalities, injuries, and property damage by category; the size of the category; and how the categories were determined. Multi-family residences had the lowest average incident cost, while industrial/other had the highest average incident cost, in part due to the high numbers of fatalities per industrial incident. Industrial/other also had the highest incident rate per line-year. Commercial incidents had the highest property damage values.

Category/Valve	Multi-Family Residential/EFV	Commercial/EFV	Industrial or Large Other/ Curb Valve	Source
Number of incidents 2004-2012	22	37	13	PHMSA incident database
Fatalities	5	3	4	PHMSA incident database
Injuries	6	24	3	PHMSA incident database
Property Damage (2012 $)	$6,780,021	$26,964,367	$1,073,147	PHMSA incident database
Average Incident Cost (2012 $)	$2,636,956	$2,086,388	$3,103,050	Calculated
Line-years used in calculating incident rate	186,163,737	35,044,087	7,595,098	PHMSA Annual Reports
Incident rate per line-year	1.2×10^{-7}	1.1×10^{-6}	1.7×10^{-6}	Calculated
Assumed Safety Effectiveness	100%	100%	90%	Assumption
Initial Annual Benefit Per Valve Installed	$0.31	$2.20	$4.78	Calculated
Category Determinants	Aerial photos of incident site to determine category, incident report, incident cause	Aerial photos of incident site to determine category, incident report incident cause	Pipe size and pressure, aerial photos and incident report where available	

As the table above shows, PHMSA identified 13 incidents between 2004 and 2012 involving facilities that PHMSA expects would receive a curb valve under the proposed rule. PHMSA was unable to determine the type of facility (e.g., industrial, commercial, multi-family residence, other) involved in each incident because this information is not collected by PHMSA. Although some information was available from aerial photos of the incident locations, PHMSA was unable to construct a definitive breakdown of estimated benefits for curb valves by customer type. PHMSA will continue attempting to identify the customer classification of the 13 incidents, which are listed in Appendix C, before publishing the final rule, and requests comments on this issue.

To find an estimate of the total benefit of a valve for each category, the annual benefit is carried out for 50 years, and the injury component is allowed to grow with the wage rate over time. Estimates were discounted using both a 7% and 3% rate. Annual benefit numbers and the total benefit over 50 years for each category are found in the table below.

Category	Initial Annual Benefit Per Valve Installed	Total Benefit Over 50 Year Valve Lifespan, NPV at 7%	Total Benefit Over 50 Year Valve Lifespan, NPV at 3%	Cost Per Valve
Multi-Family EFV	$0.31	$4.92	$9.75	$30
Commercial EFV	$2.20	$33.64	$65.71	$30
Industrial or Large Other Curb Valve	$4.78	$76.48	$152.30	$55

7.4.2 Nationwide Estimate

The nationwide estimate was created by establishing a baseline number of lines installed each year that would be covered by the proposed rule, forecasting the growth in installation over 50 years, and then estimating the costs and benefits of valve use on those lines.

One EFV or curb valve, as relevant, would be required on each eligible new or replaced service line. According to PHMSA's annual report for 2011, 819,894 lines had been installed or replaced that year. The industry estimates provided in comments to the ANPRM, such as those from Southwest Gas, noted that roughly 95% of all new or replaced lines (for an estimated total of 778,899 lines) would be required to have EFVs under both the current and proposed rules. There

were 597,740 EFVs installed in 2011. Assuming that all were required under the current rule[42], the proposed rule would cover an additional 181,159 lines. A conservative cost estimate would include all of these lines, though realistically some will be under 10 psi., have contaminants, etc. Valves serving multi-family residences are assumed to make up 85% of the proposed installed valves while valves serving commercial properties are assumed to comprise 15% of the proposed installed valves, based on their relative shares of the overall network as estimated in AGA Gas Facts Table 8-1, as noted above. Curb valves would be installed on the 5% of lines not covered by EFVs, or 40,955 lines. For the services to be covered by curb valves, it was not possible to create a breakdown by customer classification, because PHMSA does not collect data on customer classification, and the overall industry average as estimated by AGA Gas Facts would not be applicable to this small subset of high-capacity lines. (In other words, service lines that are large enough to require a curb valve would be much more likely to include industrial and other customer types.) PHMSA requests comment on the overall reasonableness of these assumptions and requests any additional data that could be used to make more precise estimates of the number of affected gas services by customer classification.

The estimate is based on the assumption that the number of installations rises 2% a year. As the Industry Information section showed, installation rates are quite variable, but 2% is a decent long-range estimate. Estimates at a 7% and 3% discount rate are shown here. Note that net benefits are greatest for commercial and industrial settings and are lower for MFR.

Category	Number of Valves Installed, Year 1[43]	Annualized Benefit (7%)	Annualized Cost (7%)
Multi-Family EFV	153,985	$1,144,372	$6,204,591
Commercial EFV	27,174	$1,434,683	$1,094,934
Industrial/ Large Other Curb Valve	40,955	$5,156,671	$3,025,399
Notification and Recordkeeping			$181,899

[42] It is possible that some of these installed EFVs represent non-mandatory installations on branched SFR services, or other customer types, in which case the estimates that follow can be viewed as somewhat conservative (i.e., they potentially overstate the number of services affected by the proposed rule).
[43] Year 1 valve installation is based on new and replaced service lines in 2011.

Category	Number of Valves Installed, Year 1[43]	Annualized Benefit (7%)	Annualized Cost (7%)
Total per Year, 7% Discount Rate	**222,114**	**$7,735,725**	**$10,506,823**

Category	Number of Valves Installed, Year 1	Annualized Benefit (3%)	Annualized Cost (3%)
Multi-Family EFV	153,985	$1,958,991	$7,069,443
Commercial EFV	27,174	$2,748,456	$1,247,556
Industrial/ Large Other Curb Valve	40,955	$10,240,363	$3,447,107
Notification and Recordkeeping			$181,899
Total per Year, 3% Discount Rate	**222,114**	**$14,974,810**	**$11,946,005**

8 Summary and Conclusion

This proposed rule would extend the required installation of EFVs, require installation of manual shut-off valves on larger industrial and multifamily residences, and require operators to notify customers of their ability to request installation of EFVs when service lines are not being newly installed or replaced. It is expected to generate safety benefits in the form of reduced fatalities,

injuries, lost product and other property damage from certain types of preventable incidents in gas distribution. In the base case analysis, overall benefits over a 50-year period were estimated at the annual equivalent of $7.7 million per year versus $10.5 million in compliance costs. In sensitivity testing, total benefits exceeded costs when using a 3% discount rate, and they fell within the expected low-to-high range of costs when using a range for installation costs.

Additionally, this regulation addresses Section 22 of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 and NTSB Recommendation P-01-2 and can be implemented at relatively minor cost. EFVs have been shown to be effective for SFRs based on findings from an NRRI survey showing over 1,100 activations in 2005, each of which represents a potential incident avoided, with only very small numbers of false and failed closures. Since 2010, PHMSA has required EFVs to be installed on SFRs and is not aware of any significant issues with false closures, failed closures, or other issues.

The requirements for installing EFVs on lines serving MFRs are among the most costly (in monetary terms) of the new provisions. Although the monetized costs of these requirements substantially exceed the monetized benefits, the benefits that have not been monetized (including peace of mind and protection against high-consequence events equal to residents of SFRs, avoided evacuations, and avoided emergency response) are expected to make this rule's cost reasonable. Further, PHMSA believes this regulation is appropriate due to its potential to prevent a high-consequence incident of the type identified just outside the analysis period (e.g., Santa Rosa, CA, Dec. 1991; Allentown, PA, June 1994; St. Cloud, MN, Dec. 1998—all of which affected MFRs and would have substantially impacted the monetized benefit figures).

We estimate the annualized net benefits of installing EFVs on lines serving MFRs are -$5.06 million per year (7% discount rate) or -$5.11 million per year (3% discount rate). We also estimate that 153,985 EFVs will be installed on MFR services in year 1 of the analysis period, rising to about 414,465 installations in year 50. Thus, for the proposed rule to break even in with respect to MFRs, PHMSA estimates that residents of MFRs would have to derive unquantified benefits (such as peace of mind) from this provision at somewhere between $12 and $33 per EFV per year ($5.06 to 5.11 million divided by 152,985 to 414,465 valves). Since that value would reflect the combined valuation from all of the residents of a given MFR protected by an EFV, it appears quite reasonable. Moreover, it is inequitable to allow residents of multi-family units to be exposed to more risk and receive fewer safety benefits than SFR residents because of a difference of accommodation, which may be dependent on many different factors including affordability and convenience.

Another way of looking at the breakeven calculation is to examine the consequences of major EFV-preventable incidents on MFR services. For example, the December 2005 incident in Bergenfield, N.J., led to 3 fatalities, 2 injuries (or 5 injuries according to news media reports), and $2.76 million in property damage and other quantified losses. Applying the DOT-standard injury values used elsewhere in this analysis, the incident had total costs in the range of $32

million. Thus, at an annualized cost of $6.2 million per year, the MFR provision of the proposed rule would to prevent an incident of this type roughly once every 5 years to reach breakeven.

Likewise, major industry stakeholders have expressed general support for the regulation, viewing the expansion of EFV installation as a common-sense safety measure with minimal cost impact.

Appendix A: Sensitivity Testing

Valve Costs: Low and High Scenarios, 7% Discount Rate

Category	Number of Valves Installed, Year 1	Annualized Benefit	Annualized Cost, Low Scenario ($15 EFV, $10 curb valve)	Annualized Cost, High Scenario ($50 EFV, $100 curb valve)
Multi-Family EFV	153,985	$1,144,372	$3,102,295	$10,340,985
Commercial EFV	27,174	$1,434,683	$547,467	$1,824,890
Industrial/ Large Other Curb Valve	40,955	$5,156,671	$550,073	$5,500,726
Notification and Recordkeeping			$181,899	$181,899
TOTAL	**222,114**	**$7,735,725**	**$4,381,734**	**$17,848,499**

Valve Costs: Low and High Scenarios, 3% Discount Rate

Category	Number of Valves Installed, Year 1	Annualized Benefit	Annualized Cost, Low Scenario ($15 EFV, $10 curb valve)	Annualized Cost, High Scenario ($50 EFV, $100 curb valve)
Multi-Family EFV	153,985	$1,958,991	$3,534,722	$11,782,405
Commercial EFV	27,174	$2,748,456	$623,778	$2,079,259
Industrial/ Large Other Curb	40,955	$10,240,363	$626,747	$6,267,467

Category	Number of Valves Installed, Year 1	Annualized Benefit	Annualized Cost, Low Scenario ($15 EFV, $10 curb valve)	Annualized Cost, High Scenario ($50 EFV, $100 curb valve)
Valve				
Notification and Recordkeeping			$181,899	$181,899
TOTAL	**222,114**	**$14,947,810**	**$4,967,145**	**$20,311,030**

Safety Effectiveness of Curb Valves: Low and High Scenarios, 7% Discount Rate

Category	Number of Valves Installed, Year 1[44]	Annualized Benefit, Low Scenario: Curb valves 80% Effective	Annualized Benefit, High Scenario: Curb valves 95% Effective	Annualized Cost – Base Case
Multi-Family EFV	153,985	$1,144,372	$1,144,372	$6,204,591
Commercial EFV	27,174	$1,434,683	$1,434,683	$1,094,934
Industrial/ Large Other Curb Valve	40,955	$4,583,707	$5,443,152	$3,025,399
				$181,899
TOTAL	**222,114**	**$7,162,762**	**$8,022,207**	**$10,506,823**

[44] Year 1 valve installation is based on new and replaced service lines in 2011.

Safety Effectiveness of Curb Valves: Low and High Scenarios, 3% Discount Rate

Category	Number of Valves Installed, Year 1[45]	Annualized Benefit, Low Scenario: Curb valves 80% Effective	Annualized Benefit, High Scenario: Curb valves 95% Effective	Annualized Cost – Base Case
Multi-Family EFV	153,985	$1,958,991	$1,958,991	$7,069,443
Commercial EFV	27,174	$2,748,456	$2,748,456	$1,247,556
Industrial/ Large Other Curb Valve	40,955	$9,102,545	$10,809,272	$3,447,107
				$181,899
TOTAL	**222,114**	**$13,809,992**	**$15,516,719**	**$11,946,005**

[45] Year 1 valve installation is based on new and replaced service lines in 2011.

Appendix B:

Including Benefits from Avoided Methane and Carbon Dioxide Emissions -- Reduced Global Warming Potential (GWP)

Natural gas contains methane and carbon dioxide, heat-trapping gases that contribute to global climate change and its attendant societal costs. To the extent that EFVs and curb valves reduce the quantity of natural gas that would otherwise be lost to the atmosphere during pipeline incidents, this will reduce the external costs associated with these gases' global warming potential (GWP). This sensitivity case examines the additional benefits that could be achieved by including these impacts.

The Interagency Working Group on Social Cost of Carbon (SCC) has estimated the societal harm of GWP from carbon dioxide emissions at $37 per metric ton in 2007 dollars.[46] The $37 estimate was converted to 2012 dollars for comparability with other values used in this analysis using the CPI-U; this yields an estimated $40.97 per ton of carbon dioxide emitted. (The Interagency Working Group's $37 value is based on a 3% discount rate and 2015 base year. Note that there is no value currently available for the 7% discount rate that is also used in this analysis, so the tables below use the SCC value associated with the 3% rate for *both* cases. Also, the SCC listed is for the timeframe to 2050, slightly shorter than the 50-year timeframe used here.)

Methane is generally understood to be a more potent greenhouse gas than carbon dioxide, although with diminishing effects over time. While an official value for methane has not yet been established, other rulemaking efforts[47] have used a multiple of 25 times the social cost of carbon dioxide emissions as an approximation (in the case, 25* $40.97, or $1024 per metric ton.)

The above estimates of GWP avoided are based on the average volume of lost gas by customer category as reported for EFV-preventable incidents in 2010 to 2012. (Incident data for prior years do not include information on the physical quantity of gas released.) Gas was assumed to

[46] See November 2013 update, using 2015 base year and 3% discount rate. http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf

[47] See, e.g., the Corporate Average Fuel Economy (CAFE) rulemaking, http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FRIA_2017-2025.pdf

comprise 96% methane and 1% carbon dioxide based on industry averages. Volumes were converted to mass using physical conversion factors at typical tariff pressure and temperature (1 atmosphere, 60 degrees Fahrenheit).

Sensitivity Case with Social Cost of Carbon: Benefits and Costs, 3% Discount Rate

Category	Number of Valves Installed, Year 1	Annualized Benefit *without* Estimated GWP Avoided	Annualized Benefit *with* Estimated GWP Avoided	Annualized Cost
Multi-Family EFV	153,985	$1,958,991	$1,959,393	$7,069,443
Commercial EFV	27,174	$2,748,456	$2,829,334	$1,247,556
Industrial/ Large Other Curb Valve	40,955	$10,240,363	$10,309,312	$3,447,107
Notification and Recordkeeping				$181,899
TOTAL	**222,114**	**$14,974,810**	**$15,098,039**	**$11,946,005**

Sensitivity Case with Social Cost of Carbon: Benefits and Costs, 3% Discount Rate for SCC and 7% Discount Rate for All Other Future Values

Category	Number of Valves Installed, Year 1	Annualized Benefit *without* Estimated GWP Avoided	Annualized Benefit *with* Estimated GWP Avoided	Annualized Cost
Multi-Family EFV	153,985	$1,144,372	$1,144,605	$6,204,591
Commercial EFV	27,174	$1,434,683	$1,481,662	$1,094,934
Industrial/ Large Other Curb Valve	40,955	$5,156,671	$5,196,721	$3,025,399
Notification and Recordkeeping				$181,899
TOTAL	**222,114**	**$7,735,725**	**$7,822,988**	**$10,506,823**

Appendix C: Curb Valve Incidents

Incident Report No.	Location City	Location State
20050102	Evansville	IN
20070118	Milan	NM
20040117	Mapleton	UT
20050012	Johnstown	PA
20050049	South Lake Tahoe	CA
20050076	Rochelle	IL
20060081	Dickson	TN
20060095	Pensacola	FL
20070032	San Jose	CA
20070148	Ada Township	MI
20080143	Monument	CO
20090144	Riverside	CA
20110040	Chicago	IL