SURVEY ON EXCESS FLOW VALVES: INSTALLATIONS, COST, OPERATING PERFORMANCE, AND GAS OPERATOR POLICY

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I. Introduction

This report provides information on excess flow valves (EFVs) based on the survey responses of gas operators (i.e., local distribution companies or gas utilities) during late 2006 and early 2007. EFVs restrict the flow of natural gas in a customer's service line when a severe break in the line occurs. By restricting gas flows, an EFV can prevent deaths, injuries and property damage.

In 2005, the National Regulatory Research Institute (NRRI) conducted a survey of state public utility commissions to acquire information on EFVs.[1] Public utility commissions from forty-nine states and the District of Columbia responded to the survey. The survey focused on the policies of state commissions and gas operators regarding the installation of EFVs. The survey also included limited information on the operating performance of EFVs and the number of EFVs installed.

This report provides the responses to an updated survey conducted by NRRI. The U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety should find this information useful in determining trends in EFV installation-decision practices and EFV operating experiences. Both privately owned and municipal gas operators responded to the survey questions.

Unlike the 2005 survey, this survey focuses on the number of EFVs installed and the costs of purchasing and maintaining EFVs as well as the cost of EFV operation after a false closure. It also asked questions on EFV actuations, false closures and their causes, and failed closures. Overall, the updated survey intends to provide the U.S. Department of Transportation with a comprehensive database on EFVs.

This report presents summary statistics of the survey responses. It highlights the major findings and compares them with the information from the 2005 survey. [2]

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[1] See Ken Costello, *Survey: Treatment of Excess Flow Valves by State Public Utility Commissions* (NRRI 05-07), July 2005.

[2] An Excel spreadsheet helped to manage the survey responses. SPSS and Excel software provided the tools for the statistical analysis carried out for this report.

II. Survey Questions

Appendix A contains the survey questions sent by state pipeline-safety program managers to gas operators. The operators forwarded their responses to NRRI over the period of November 2006 through February 2007.

The survey questions fall into five categories: (1) the number of EFV installations, (2) EFV operating performance, (3) the cost for EFV installation and continued performance, (4) gas-operator policy on EFV installations, and (5) third party damages.

A listing of the specific survey questions follows:

1. Total number of service lines
2. Total number of EFVs installed
3. Total new or replacement service lines (2005)
4. Total new or replacement service lines for which EFVs are feasible (2005)
5. Total number of feasible service lines on which EFVs were actually installed (2005)
6. Gas operator policy on installing EFVs when feasible
7. Cost recovery of EFV installations (customer or system wide)
8. Unit purchase cost for an EFV
9. Maintenance cost for installed EFVs
10. Total number of third party damage leaks and meter-set damages (2005)
11. Total number of EFV actuations (2005)
12. Total number of instances where excavation damage caused an EFV to close and resulted in adverse consequences not reported by the damaging party (2005)
13. Total number of false closures and reasons for closures (2005)
14. Restoration costs for a false-closure event
15. Total number of failed closures following line failure or downstream leak

III. Survey Responses

Four hundred ninety seven gas operators in 39 states and the District of Columbia, with a combined 34.6 million service lines, responded to the survey.[3]

[3] According to a 2005 report conducted for the Office of Pipeline Safety, natural gas distributors in the United States operate over 56 million "services," or connections to consumers' meters. (See Allegro Energy Consulting, *Safety Incidents on Natural Gas Distribution Systems: Understanding the Hazards*, April 2005, 2.) The gas operators responding to this survey thus represent close to 62

The largest number of respondents were from Tennessee (63), followed by Louisiana (49) and Oklahoma (41). Several gas operators did not answer all the questions. In contrast to the overall response rate, for example, 483 gas operators provided statistics on the total number of service lines while fourteen gas operators did not. For the other statistics, a high percentage of gas operators provided information, although in most instances some operators did not.

Appendix B contains tables and figures on the most information presented in this section and section IV.

A. Size of gas operators

The total number of service lines reported by gas operators was 34.6 million. Responses from individual operators ranged from one service line to over 4.2 million. The mean, or average, size of gas operators providing data is 71,636 service lines. Out of the 483 gas operators reporting the number of service lines, almost three quarters of them have less than 10,000 service lines. (See Table B1) This skewed distribution results in a median value of 1,903 that is much lower than the mean value.[4] The lower quartile of gas operators reporting the number of service lines is 539 (i.e., one quarter of the gas operators reporting had less than 539 service lines). The second quartile (or median) is 1,903 service lines; the third quartile is 11,205 service lines; and the fourth quartile (or maximum) is 4.2 million service lines.

For this report, gas operators with 1-539 service lines (the first quartile) fall in the "small" category. Those with 540-11,205 service lines (the second and third quartiles) fall in the "medium" category. Gas operators with more than 11,205 service lines (the fourth quartile) fall in the "large" category. In some instances, statistics presented in this report includes a special category "very large," which encompasses gas operators with 500,000 or more service lines (twenty-two gas operators fall in this category).[5] (See Table B2)

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percent of the total service lines in the country. The total number of local gas distributors in the Unites States is around 1,200, of which over 70 percent are municipal utilities and the remainder privately owned utilities. The survey respondents thus constitute over 40 percent of the gas distributors in the country.

[4] The median represents the middle value in a series of values arranged in order of magnitude. Many analysts prefer the use of medians to means when the distribution of the data is heavily skewed. Medians also have the advantage of being insensitive to outliers or extreme values.

[5] Large operators encompass operators with more than 500,000 service lines, but in some of the later analyses, we distinguish between the two groups.

By classifying gas-operator size on the basis of quartiles, the "small" and "large " categories contain about 120 gas operators each, with the "medium" category encompassing about 240 gas operators. With such a large number of gas operators in each category, statistical analysis becomes more robust.

B. Number of EFVs installed

Gas operators reported the installation of 2,495,263 EFVs. This number represents about 7.2 percent of the total service lines reported.[6] The ten states with the most EFV installations constitute over 86 percent of the total installations reported by all gas operators. The smallest and largest gas operators have the highest percentages of service lines with EFVs. (See Table B3)

Gas operators voluntarily installing EFVs account for 96 percent of the total installations.[7] Gas operators with no voluntary policy thus represent only 4 percent of the EFVs installed. This finding coincides with the responses from the 2005 survey showing that operators voluntarily installed 98 percent of the total EFVs in the seven states reporting this information. One major conclusion of the 2005 survey was that customers rarely purchase EFVs. The updated survey results concur with the 2005 finding of a relatively small percentage of EFVs installations by operators without a voluntary installation policy.

C. EFV installations on new or replacement services (2005)

Gas operators reported over 1,101,315 million new or replacement service lines for 2005. Gas operators reported that EFV installation was feasible for 544,914, or about 49 percent, of these service lines. Gas operators installed EFVs on about 56 percent of the feasible service lines, or 302,165 EFV installations. The 2005 EFV installations thus represent over twelve percent of the total EFVs in place reported by all gas operators.

The ten states installing the most EFVs in 2005 constituted about 87 percent of the total installations reported by all gas operators for that year. (This is almost identical to the share of the top ten states for the total number of EFVs

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[6] This percentage used only the information from gas operators that provided both the total number of service lines and the total number of EFVs installed.

[7] Under Federal law in effect as of 2005, gas operators either had to voluntarily install EFVs on all new and renewed service line or notify new or renewal customers about the benefits and availability of EFVs.

in place.) Overall, EFV installations occurred on about 27 percent of new or replacement service lines for 2005.

In grouping the responses by size of gas operators, the ratio of new or replacement lines to feasible lines are uniform across size categories and, thus, close to the ratio for all gas operators as a whole. One striking finding was that medium-sized gas operators in 2005 installed a much lower percentage of EFVs on feasible lines than other sized gas operators do.[8] (See Table B4) One explanation lies with the operators' policy on installing EFVs voluntarily.

D. Gas operator policy on EFV installations

Out of the 484 gas operators reporting, 335 (or 69.2 percent) do not install EFVs voluntarily[9] and 149 gas operators (or 30.8 percent) do.[10] The 2005 survey, in comparison, reported that 23 percent of gas operators installed EFVs voluntarily. Some of the responses to the updated survey indicate that several gas operators changed their policies during 2005 and 2006.[11]

The survey responses also show that within individual states gas operators have dissimilar installation policies. In Ohio, for example, sixteen reporting operators voluntarily install EFVs while fourteen do not. As another example, in Tennessee thirteen out of sixty-three gas operators reported voluntary installations

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[8] Our calculations show that medium-sized gas operators installed EFVs on about one-third of feasible lines. In comparison, EFV installations occurred on over one-half of the feasible lines of small-sized and large-sized gas operators and over 60 percent of the feasible lines of very large-sized gas operators.

[9] In those instances, a gas operator has to notify customers about the availability of an EFV, which the customer can purchase.

[10] The responses to the question on the operator recovery of EFV costs show that nearly all gas operators who voluntarily install EFVs do not charge individual customers. A couple of exceptions exist where individual customers were charged.

[11] For example, one large operator in Arkansas reported a policy change to voluntary installations effective June 2006; a large operator in Idaho reported the same policy change effective October 2006, and a large operator in Louisiana reported the same change starting in 2006. Other example exists where gas operators, for whatever reason, decided since the 2005 survey to install EFVs on a voluntary basis.

of EFVs. (See Table B5 for the distribution of operator policy in seven other states with the highest number of survey respondents.)[12]

The responses indicate that a much higher percentage of large gas operators install EFVs voluntarily than smaller-sized operators do. About one-half of large operators install EFVs voluntarily, while only about a quarter of small- and medium-sized operators have such a policy. (See Table B6)

For 2005, gas operators voluntarily installing EFVs accounted for over 98 percent of the total EFVs installed. During the same year, gas operators without a voluntary policy installed EFVs on less than 3 percent of the total feasible lines reported by all gas operators. In contrast, gas operators with a voluntary policy installed EFVs on over 80 percent of feasible lines.[13]

E. EFV purchase cost

Four hundred twenty one gas operators provided information on unit EFV purchase cost. The cost ranged from $6.50 to $500.[14] This wide disparity suggests that the respondents may have interpreted the survey question differently. Gas operators reporting costs on the high side probably included labor cost in addition to the FEV unit purchase cost. The mean value across reporting operators is $49.39 and the median value is $30, reflecting a heavily skewed distribution of costs around the mean value. (See Figure B1)

The responses illustrate an inverse relationship between the EFV purchase cost and the size of the gas operator. For example, the mean unit cost for small, medium, large and very large gas operators, for example, was $72.87, $52.14, $24.80 and $19.23, respectively. These numbers suggest possible economies in purchasing power for larger-sized gas operators. The numbers, however, might also show that smaller operators more frequently include labor costs in their calculation.

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[12] The finding of mixed policies within individual states coincides with the results of the 2005 survey. In that survey, gas operators in thirty-four states had mixed policies, while in fifteen states either all gas operators voluntarily installed EFVs or done did.

[13] The reason for the percentage being less than a 100 was that some of these operators did not have a voluntary policy throughout, or any part of, 2005.

[14] One gas operator reported that the cost of an EFV could range from $10.50 to $33.10, depending upon the size of the EFV and whether the material for the components is plastic or steel.

F. Maintenance costs

Similar to EFV purchase cost, maintenance cost on a per line basis exhibited wide disparity across gas operators. (See Figure B2) Most gas operators did not report any maintenance costs for installed EFVs. It is unclear whether these operators incurred no maintenance cost or just were unable to measure it.[15] Of the 54 operators reporting a cost greater than zero, the mean level was $268.[16] The median value was $180.

G. Restoration costs

Similarly, most gas operators also did not report any restoration costs following a false closure. They responded either by reporting a zero value or by leaving the question blank. For the sixty-three operators reporting a cost greater than zero, the mean value was $370 per closure and the medium value was $325. The costs ranged from $50 to $1,000. (See Figure B3)

H. Number of actuations (2005)

Gas operators collectively reported 1,108 EFV actuations (i.e., successful terminations of gas flow in response to a severe service-line break). One operator alone reported 302 actuations. For the 271 gas operators with at least one EFV, forty-eight (or 17.7 percent) experienced one or more actuations.[17] Total actuations as a percentage of the total number of installed EFVs (2,495,277) were a minuscule 0.044 percent. This small number of actuations indicates that EFVs act as an insurance against line ruptures and they rarely activate.

I. False closures (2005)

The vast majority of gas operators (365) reported no false closures (i.e., closing of an EFV when no severe service-line break occurs). Thirty-two

[15] Two hundred forty one operators reported zero cost, while a large number left the question blank.

[16] One gas operator reported a maintenance cost of $1,000.

[17] Of the 48 operators, 34 reported more than one actuation.

operators reported at least one false closure. These operators in total reported 223 false closures in total.[18]

The ratio of actuations to false closures reported by gas operators, collectively, was about 5:1. False closures as a percentage of the total number of installed EFVs were 0.0089 percent, indicating that EFVs seldom close inadvertently.

Out of the reported 213 false closures, EFV failure, line contaminants and added load each accounted for more than thirty percent of them. (See Table B 7)

J. Failed closures (2005)

Only three gas operators reported EFVs that did not function properly in response to a line failure or downstream leak. These operators in total reported twenty-six instances of failed EFV closures.

K. Third-party damage leaks and meter-set assembly damages (2005)

Gas operators reported 45,579 incidents of third-party and meter-set assembly damages. Out of 451 operators responding to the survey question, 282 (or 63 percent) reported at least one incident. The mean number of damages for operators reporting at least one incident was 162. Thirteen operators reported over 1,000 incidents. Incidents as a percentage of total service lines were 0.131 percent.

Thirty-three gas operators reported instances of EFV closure from unreported excavation damage. This number represents 7.3 percent of the 451 operators who responded to the survey question. Of those operators who indicated that closure occurred, twenty-six reported 200 EFV closures.

Only fourteen gas operators reported adverse consequences from unreported third-party damage. They mostly involved service cutoffs for which the operator incurred service restoration costs.[19]

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[18] One operator alone had 55 false closures, which represented about one-quarter of the total false closures reported.

[19] One gas operator, however, indicated a single instance of unreported third-party damage that resulted in an undetected leak from a ruptured service line.

IV. Highlights and Further Review of Survey Responses

The discussion below highlights the findings of the survey responses. It also includes some analyses to provide additional interpretation of the survey responses.

The survey responses show that about 58 percent of gas operators, as of 2005, had at least one EFV installed on their system.[20] Gas operators voluntarily installing EFVs accounted for 96 percent of these installations. The low percentage of EFVs installations by other operators is compatible with the premise that relatively few gas customers purchase EFVs when given the option. The 2005 survey suggested this same phenomenon.

The updated survey indicates that during 2005 several gas operators changed their policy to voluntarily installing EFVs on new or replacement service lines. The responses show that large gas operators undertook most of these policy changes. The responses also suggest that in 2005 gas operators were more aggressive than in past years in installing EFVs, as operators taken together installed over 12 percent of their total EFVs in just that year.

The survey results also show that small gas operators (defined in this report as having less than 539 service lines) do not lag behind medium-sized operators (defined as having more than 539 service lines but less than 11,205) in installing EFVs. To the contrary, statistically speaking, small operators install EFVs at a significantly higher rate (i.e., EFV installations per service line) than medium operators do.[21] Even when compared with large operators, small operators have installed EFVs at a higher rate.[22] The survey results show that very large operators (defined as having more than 500,000 service lines) have the highest rate of installation. This result stems from their greater willingness to install EFVs voluntarily.[23]

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[20] Out of 471 gas operators reporting on the number of EFVs, 271 had at least one EFV while 200 had none.

[21] The results of a t-test showed that, at a 95-percent confidence level, the mean value for the percentage of service lines with EFVs was significantly higher for small operators than for medium operators.

[22] Although small-sized operators have a higher installation, the difference in means across the two groups is not statistically significant.

[23] The result that small-sized operators install EFVs at a higher rate than large operators is somewhat puzzling since the percentage of large operators voluntarily installing EFVs is almost double the percentage for small-sized operators.

The survey results show that smaller gas operators pay a higher unit price for EFVs. A t-test analysis concluded that the mean price is statistically significantly higher for small operators than for the other groups, and higher for medium-sized operators than for large operators. The linear (negative) correlation between the size of operators and unit purchase cost also was statistically significant, supporting the observation that smaller operator pay a higher unit price for EFVs.[24]

Although most gas operators reported no maintenance or restoration costs, those that did, on average, calculated much higher costs relative to the EFV unit purchase cost. (See Table B8)

For 2005, EFV actuations, false closures and failed closures all occurred infrequently. These rare events suggest that EFVs posed relatively few problems (for example, false closures) while at the same time they operate infrequently in restricting gas flow in the event of a line break. (See Table B9)

We next examined whether gas operators tend to install EFVs more in those regions of the country where residential customers use higher levels of natural gas. Grouping gas operators by a state's average heating-degree days (HDDs), EFV installations (as a percentage of total service lines) are much higher in cold weather states.[25] The mean percentage of service lines with EFVs was 8.68 percent for cold weather states, for example, and only 3.30 percent for the other states.[26] In cold weather states, over 41 percent of the operators voluntarily install EFVs, while only 20 percent of operators in other states do.

Finally, aggregating the survey responses to the state level reveals a wide disparity in the percentage of service lines with EFVs. Excluding states where operators have few service lines, we observe some states (for example, Indiana, Kansas, Minnesota New Jersey, New York, Ohio, Oregon and Washington) have over 10 percent of service lines installed with EFVs. Other states (for example, Alabama, Arkansas, Maryland, Missouri, Nebraska, North Carolina and Utah) have extremely low EFV penetration rates. (See Table B10) Looking at EFV installations for 2005, we also observe wide variations in EFV penetration rates for new or replacement services. (See Table B11) The survey responses also

[24] The correlation coefficient was statistically significant using the Fisher transformation to hypothesis testing.

[25] We define cold weather states as those states with a 30-year populated-weighted average heating-degree days exceeding 4,000. According to this definition, twenty-seven states fall within the category "cold weather states."

[26] Calculating a t-statistic, this difference in means was statistically significant at a 95-percent confidence level.

exhibited a high degree of disparity of EFV penetration rates across gas operators in a single state.

V. Conclusion

The survey responses provide an extensive database on EFVs allowing for statistical analysis. Unlike the 2005 survey, the responses came directly from the gas operators themselves (close to 500). The responses provide a broad range of information, from a large sample of gas operators, on the number of EFVs installed, the purchase, maintenance and restoration costs of EFVs, gas-operator policy on EFV installations, and EFV operating performance.

The survey responses show that over 40 percent of gas operators have zero EFV installations. They also show that close to 70 percent of gas operators install EFVs only at the request of their customers. For many of these operators, therefore, no customer has purchased an EFV, notwithstanding federal regulations that required operators to notify customers of the availability and benefits of EFVs. The years 2005 and 2006 saw a number of additional gas operators shifting their policy to voluntarily installing EFVs.

The updated survey confirms, or at least does not contradict, the major findings of the 2005 survey. (See Table B12) Especially for operating performance of EFVs, the different costs associated with EFVs, and the number of EFVs installed, the updated survey presents a more complete picture of EFVs.

Appendix A

Survey Questions

I. EFV Installation Data

A. Total number of services? _____
B. Total number of services with EFVs? _____
C. Total new or replacement services in 2005? _____
D. Total services from [C] for which EFVs are feasible? _____
E. Total services from [C] for which EFVs are installed? _____
F. Does operator install EFVs in all new/replacement services when "feasible"? Yes _____ No ____

II. Survey Questions

1. Is any part of the cost for EFV installation charged to the customer? Yes No

2. What is your organization's average unit cost to purchase an EFV? _____

3. What is your organization's average maintenance unit cost related to an EFV following installation? _____

4. How many third-party damage leaks and meter set assembly damages have occurred on company-owned service lines during 2005? _____

5. How many EFV actuations occurred due to gas line leaks or failures in 2005? _____

6. Do you know of any specific instances in which excavation damage has occurred to a service with an EFV, causing the EFV to close and resulting in damage not reported by the damaging party? Yes No

7. If the answer to question six is yes, how many times did this occur during 2005 (please estimate if you have no data)? _____ Did it result in any adverse consequences? Yes No Please explain. _____
_____

8. How many inadvertent EFV actuations did you experience in 2005?

   a. Due to EFV failure _____
   b. Due to contaminants trapped in the EFV _____
   c. Due to added gas load _____
   d. Total _____

9. What is the average restoration unit cost your organization incurred (whether recovered from customers or paid by your organization) following inadvertent EFV actuations?

$_____

10. How many instances of EFV failure-to-close, in response to a line failure or downstream leak, has your organization experienced? _____

Appendix B

Tables and Figures

Table B1: Size Distribution of Gas Operators

Number of Service Lines	Portion of Total Gas Operators*
1-500	0.242
501-1,000	0.133
1,001-10,000	0.360
10,001-25,000	0.081
25,001-100,000	0.068
100,001-250,000	0.031
150,001-500,000	0.039
500,001-1,000,000	0.033
1,001,000 and more	0.012

* The total may not add to 1.0 due to rounding error.

Table B2: Grouping of gas operators by size (number of service lines)

Small	Medium	Large*	Very Large
≤ 539	> 539 and ≤ 11,205	> 11,205	≥ 500,000

* The "large" group includes gas operators with more than 500,000 services lines, with the "very large" group represents a sub-category of the "large" group.

Table B3: Percentage of Total Service Lines with EFVs, by Size of Gas Operator

Small	Medium	Large	Very Large
9.6%	3.7%	7.0%	10.0%

Table B4: Percentage of EFVs Installed on Feasible Service Lines, by Size of Gas Operator (2005)

Small	Medium	Large	Very Large
53.8%	33.6%	47.8%	63.0%

Table B5: Gas Operator Policy in States with the Most Respondents (Number of Operators for Each Policy)

State	Voluntary EFV Installations	Customer Purchase of EFVs
Alabama	1	29
Indiana	8	17
Iowa	6	29
Louisiana	6	38
Minnesota	24	4
Missouri	5	25
Ohio	16	14
Oklahoma	5	36
Tennessee	13	50
Total	**84 (25.8%*)**	**242 (74.2%)**

* The percentage represents the portion of total gas operators in the nine states with the specified policy.

Table B6: Percentage of Gas Operators Voluntarily Installing EFVs, by Size of Gas Operator

Small	Medium	Large	Very Large
27.6%	23.4%	50.0%	68.2%

Table B7: Causes of EFV False Closures

EFV Failure	Line Contaminants	Added Load	Total
67	65	81	213*

* Ten of the reported 223 false closures did not include a cause.

Table B8: Comparison of Costs (Mean Values*)

EFV Purchase Cost	Maintenance Cost	Restoration Cost
$49.39	$268.39	$370.20

* Mean values include only those observations greater than zero.

Table B9: Comparison of EFV Events (Total Number, for 2005)

Actuations	False Closures	Failed Closures
1,108	223	26

Table B10: State Statistics on the Number of Respondents, Total Service Lines, and Total EFVs Installed

State	Number of Respondents	Total Service Lines	Total EFVs Installed	Percentage of Service Lines with EFVs
Alabama	31	238,445	881	0.37%
Arkansas	8	681,361	576	0.08%
California	2	4,791,718	265	0.01%
Colorado	2	1,025,451	60	0.01%
Delaware	1	29,422	11,600	39.43%
District of Columbia	1	857,853	117,113	13.65%
Florida	17	593,075	40,021	6.75%
Georgia	1	8,558	0	0.00%
Idaho	2	291,836	410	0.14%
Illinois	5	1,491,682	124,052	8.32%
Indiana	26	1,535,728	171,378	11.16%
Iowa	36	390,863	11,379	2.91%
Kansas	17	810,910	95,446	11.77%
Louisiana	49	754,553	42,988	5.70%
Maine	2	1,824	1,027	56.30%
Maryland	5	566,804	10,890	1.92%
Massachusetts	5	755,566	61,639	8.16%
Michigan	1	1	0	
Minnesota	28	816,229	105,718	12.95%
Mississippi	11	48,384	63	0.13%
Missouri	30	712,550	11,753	1.65%
Montana	2	1,326	0	0.00%
Nebraska	20	431,932	359	0.08%
Nevada	1	96,445	67	0.07%
New Jersey	4	2,200,111	312,796	14.22%
New Mexico	4	18,040	429	2.38%
New York	6	1,995,606	224,161	11.23%
North Carolina	10	1,483,640	6,275	0.42%
North Dakota	2	301,356	731	0.24%
Ohio	32	3,490,274	623,849	17.87%
Oklahoma	41	164,176	112	0.07%
Oregon	2	616,403	143,116	23.22%
Pennsylvania	15	1,685,895	121,647	7.22%
Rhode Island	1	185,957	10,522	5.66%
South Dakota	2	10,210	3	0.03%
Tennessee	63	705,830	64,476	9.13%
Texas	2	5,080	0	0.00%
Utah	1	699,649	20	0.00%
Washington	4	1,318,937	45,457	3.45%
WY	1	25,567	0	0.00%
Multistate	4	2,761,124	133,998	4.85%

Table B11: State Statistics on Feasible New or Replacement Service Lines and EFV-Installed Service Lines (2005)

State	Number of Feasible N or R Service Lines	2005 EFV Installations	Percentage of Feasible Lines with EFVs
Alabama	1,244	111	8.92%
Arkansas	13,739	67	0.49%
California	54,826	15	0.03%
Colorado	2,500	0	0.00%
Delaware	2,700	2,700	100.00%
District of Columbia	11,501	11,501	100.00%
Florida	12,755	9,431	73.94%
Georgia	68	0	0.00%
Idaho	12,014	98	0.82%
Illinois	8,113	8,069	99.46%
Indiana	26,904	25,560	95.00%
Iowa	3,308	1,406	42.50%
Kansas	9,476	7,374	77.82%
Louisiana	8,066	3,153	39.09%
Maine	226	212	93.81%
Maryland	8,439	1,513	17.93%
Massachusetts	554	554	100.00%
Michigan	0	0	
Minnesota	36,317	35,289	97.17%
Mississippi	482	115	23.86%
Missouri	2,857	1,880	65.80%
Montana	17	0	0.00%
Nebraska	5,685	29	0.51%
Nevada	4,685	5	0.11%
New Jersey	34,802	34,802	100.00%
New Mexico	257	237	92.22%
New York	88,291	87,884	99.54%
North Carolina	36,391	1,195	3.28%
North Dakota	450	86	19.11%
Ohio	36,922	15,678	42.46%
Oklahoma	1,338	3	0.22%
Oregon	21,851	21,851	100.00%
Pennsylvania	17,388	11,818	67.97%
Rhode Island	1,069	1,069	100.00%
South Dakota	216	0	0.00%
Tennessee	11,922	7,832	65.69%
Texas	12	0	0.00%
Utah	20,743	6	0.03%
Washington	23,452	5,370	22.90%
WY	214	0	0.00%
Multistate	23,120	5,252	22.72%

Table B12: Comparison of Responses for 2005 Survey and Updated Survey

Responses	2005 Survey	Updated Survey
Total EFV Installations	-	2.50 million
Gas Operators with Voluntary Installation Policy (%)	23.0%	30.8%
EFV Voluntarily Installed by Gas Operators (%)	98.1% (for 7 states reporting)	96.0%*
EFV Operating Performance	Several actuations, and a smaller number of false closures (limited responses)	Relatively a small number of actuations, false closures and failed closures

* This number represents the percentage of total EFV installations by gas operators with a voluntary policy.

Figure B1: Distribution of Unit EFV Purchase Cost

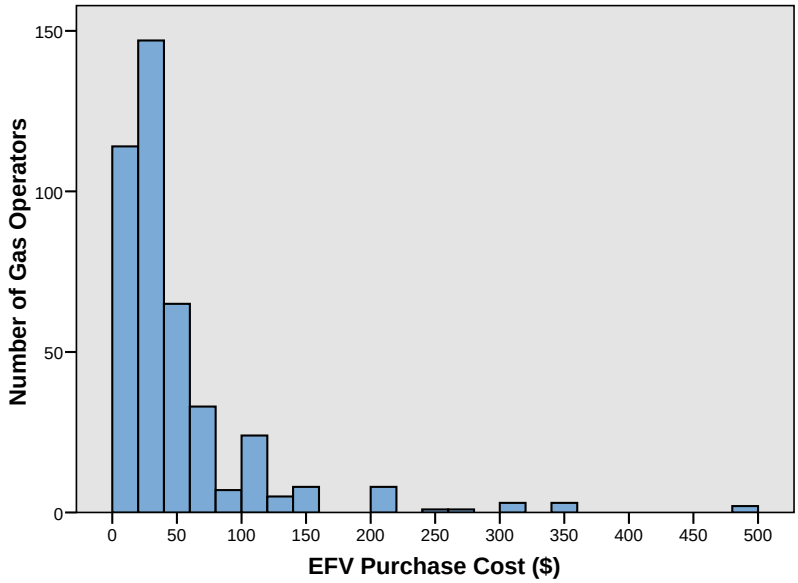

Figure B2: Distribution of Maintenance Cost

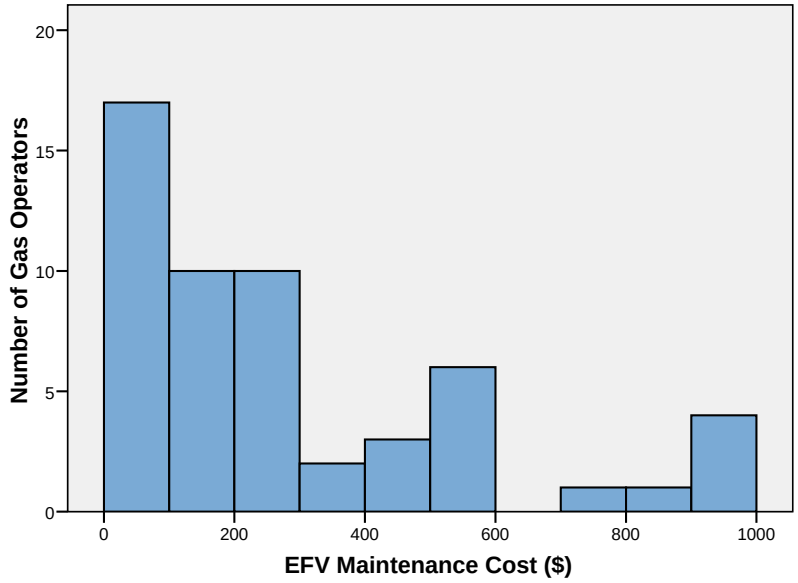

Figure B3: Distribution of Restoration Cost