PUGET SOUND ENERGY

2011 Continuing Surveillance Annual Report

Gas System Integrity Department
May 2012

Table of Contents

Table of Figures

Table of Abbreviations

The following lists the abbreviations that are commonly used throughout this report.

AGA	American Gas Association
CFR	Code of Federal Regulations
CP	Cathodic Protection
CSAR	Continuing Surveillance Annual Report
DIMP	Distribution Integrity Management Program
GFP	Gas Field Procedure
GFR	Gas First Response
GIS	Geographic Information System
GOS	Gas Operating Standard
GSI	Gas System Integrity
GWR	Gas Work Request
HOS	High Occupancy Structure
HP	High Pressure
IP	Intermediate Pressure
KAI	Kiefner and Associates, Inc.
LMS	Leak Management System
LNG	Liquefied Natural Gas
O&M	Operations and Maintenance
PE	Polyethylene
PHMSA	Pipeline and Hazardous Materials Safety Administration
PSE	Puget Sound Energy
RCW	Revised Code of Washington
SME	Subject Matter Expert
SSFT	Single Service Farm Tap
STW	Wrapped Steel
TIMP	Transmission Integrity Management Program
WUTC	Washington Utilities and Transportation Commission

Definitions

The following lists the definitions of the terminology used in this Continuing Surveillance Annual Report. These are the same definitions as provided in the Distribution Integrity Management Plan. Any terms and definitions not listed below are defined in Gas Operating Standard 2400.1000 Definitions.

Term	**Definition**
Additional and Accelerated Actions	Measures to reduce risks that exceed minimum code requirements.
Distribution Integrity Management (DIM) Plan	A written explanation of the mechanisms or procedures used to implement the DIM program and to ensure compliance with 49 CFR Part 192, Subpart P, Distribution Integrity Management Program.
Distribution Integrity Management (DIM) Program	An overall approach to ensure the integrity of the gas distribution system.
Excavation Damage	Any impact that results in the need to repair or replace an underground facility due to a weakening, or the partial or complete destruction, of the facility, including, but not limited to, the protective coating, lateral support, cathodic protection or the housing for the line device or facility.
Hazardous Leak	A leak that represents an existing or probable hazard to persons or property and requires immediate repair or continuous action until the conditions are no longer hazardous.
Mitigative Measures	All measures that reduce risks including those required by the regulations as well as Additional and Accelerated Actions.

Foreword

The following report provides the results of PSE's review of system performance and operational measures of the gas distribution system in 2011. This is the third Continuing Surveillance Annual Report on PSE's system. This report expands on the previous reports incorporating additional analysis and detail to provide insight into PSE's system performance. The additional detail incorporates new and expanded ways of analyzing the data based on insight gained from PSE's development of its Distribution Integrity Management Program (DIMP), PHMSA reporting and data quality initiatives, and discussions with consultants involved with the third party audit of PSE's gas safety activities.

This report in conjunction with the Distribution Integrity Management Plan (DIM Plan) comprises PSE's Distribution Integrity Management Program (DIM Program) in accordance with the requirements of 49 CFR Part 192, Subpart P, Distribution Integrity Management Program. The DIM Plan specifies the procedures for developing and implementing the Distribution Integrity Management Program as required by 49 CFR Part 192, Subpart P, Distribution Integrity Management Program. The DIM Plan documents the relatively static elements of PSE's DIM Program.

The Continuing Surveillance Annual Report documents the more dynamic elements of PSE's DIM Program. It also documents that PSE has performed the procedures and processes required by the DIM Plan. This includes reporting on system performance measures, conducting a broad review of system performance data, and providing a detailed discussion of what this data indicates. This includes validation and confirmation of previously identified trends and the identification of emerging trends; a description of plans to initiate new proactive measures; any plans to continue, modify or add Additional and Accelerated Actions; and provides a format for tracking and reporting on subsequent progress. If additional or enhanced measures are needed, these plans will be developed and integrated into the DIM Plan as appropriate.

Timely identification and remediation of individual issues that require immediate action is accomplished through existing processes such as those established in GOS 2575.2700 Continuing Surveillance, GOS 2575.3100 Patrolling Program, GOS 2575.2800 Examining Buried Pipelines, and GOS 2625.1300 Leakage Action Program.

Additionally, identification of trends that may emerge during the year is important and is being addressed through monitoring gas system metrics. These metrics are monitored on an ongoing basis and action will be taken as a result of any emerging trends or concerns.

This report is divided into six main parts:

- Part 1: Executive Summary
- Part 2: System Knowledge and Threat Identification
- Part 3: Risk Evaluation and Prioritization
- Part 4: Mitigative Measures and Additional and Accelerated Actions
- Part 5: Measure Performance, Monitor Results, and Evaluate Effectiveness
- Part 6: Periodic Evaluation and Improvement

Part 1: Executive Summary
The Executive Summary provides a high level overview of the most significant trends identified and the measures that have been implemented or are proposed to address these trends and maintain system integrity.

Part 2: System Knowledge and Threat Identification
The second part is a summary of PSE's knowledge of its distribution system and identification of threats. This includes a description of the various materials used in PSE's system as well as information on the relative amounts of pipe by material, vintage, and facility type. Also included in this section is the review of the system trends related to leaks, material failure analysis, system condition, federally reportable incidents, third party damage prevention program, and potential threats. A summary of data initiatives is also included in this section.

Part 3: Risk Evaluation and Prioritization
This next part describes the risk evaluation and prioritization and the results. The results are presented in both the Risk Evaluation and Prioritization Matrix and a high level summary of the risks by facility type and threats.

Part 4: Mitigative Measures and Additional and Accelerated Actions
Part 4 describes the mitigative measures and Additional and Accelerated Actions that resulted from the risk evaluation and prioritization. This presents the different mitigative measures already implemented to reduce risks, Additional and Accelerated Actions that have been implemented since the last DIM Plan, and those that are in development.

Part 5: Measure Performance, Monitor Results, and Evaluate Effectiveness
This part details the key system performance measures and trends. This section presents data that has been analyzed to determine if existing programs are adequately addressing system risks or whether there are any emerging trends that indicate additional or revised measures are appropriate to consider implementing to address the potential trend. This analysis includes a discussion of whether the performance metrics validate the current direction PSE has taken or identify areas that warrant increased activities.

Part 6: Periodic Evaluation and Improvement
The final part discusses the improvements to DIMP since the last review. This includes discussing updates to system knowledge, revisions to the risk evaluation and prioritization, new

or revised mitigative measures, new or revised performance measures, and other pertinent information that adds to the continuous effort of improving DIMP.

Part 1: Executive Summary

This report in conjunction with the Distribution Integrity Management Plan (DIM Plan) comprises PSE's Distribution Integrity Management Program (DIM Program). The DIM Plan specifies the procedures for developing and implementing the DIM Program and documents the relatively static elements of PSE's DIM Program.

The Continuing Surveillance Annual Report (CSAR) documents the more dynamic elements of PSE's DIM Program. It also documents that PSE has performed the procedures and processes required by the DIM Plan. This includes reporting on system performance measures, conducting a broad review of system performance data, and providing a detailed discussion of what this data indicates. It also includes validation and confirmation of previously identified trends and the identification of emerging trends; a description of plans to initiate new proactive measures; any plans to continue, modify or add Additional and Accelerated Actions; and provides a format for tracking and reporting on subsequent progress.

System Summary

PSE's gas distribution system consists of over 12,000 miles of main and provides gas service to more than 800,000 customers. As shown in Table 1, more than two-thirds of the system is plastic, almost a third of the system is wrapped steel pipe, and less than 1% of the system is bare steel.

Table 1. Percent of Mains and Services by Material Type

Material Type	Mains	Services
Plastic	67%	79%
Wrapped Steel (Protected)	32%	19%
Bare Steel and Wrought Iron (Unprotected and Protected)	1%	2%

Materials and vintage are both important predictors of system performance. More than 75% of the system was installed after the initial federal pipeline safety regulations were adopted and more than 50% was installed after 1990 when plastic pipe materials and construction practices had significantly improved.

System Trends

The review of new and active leak data indicates leak trends that warrant additional investigation. This includes an increase in recent years in the number of new leaks found on all leak survey types, excluding bare steel, as well as an increase in the number of active leaks. PSE has investigated these trends and determined that bare steel is not a significant contributor to the increase in new and active leaks. Since 2008, the number of new leaks found per year on bare steel has decreased by more than 30%. This positive trend is largely a result of replacing the bare steel mains and services through the Bare Steel Replacement Program.

Additional analysis of these trends is currently limited by the data available for new and active leaks. Current leak data does not provide information on the facility or material type or vintage until the leak is repaired. To gain more insight into recent leak trends, PSE began an initiative focused on performing a detailed and comprehensive analysis of leak processes to gain insight into broad leak issues, including the increase in new and active leaks. This initiative will include identifying the data required to better understand the leak trends and the method for obtaining the additional data. If appropriate, the initiative will also include developing and implementing a plan to address this trend. Initial conclusions from the leak initiative are targeted to be available by the end of 2012.

Based on the information that is currently available, additional research of historic leak trends was performed. The results of this research are shown in Figure 1.

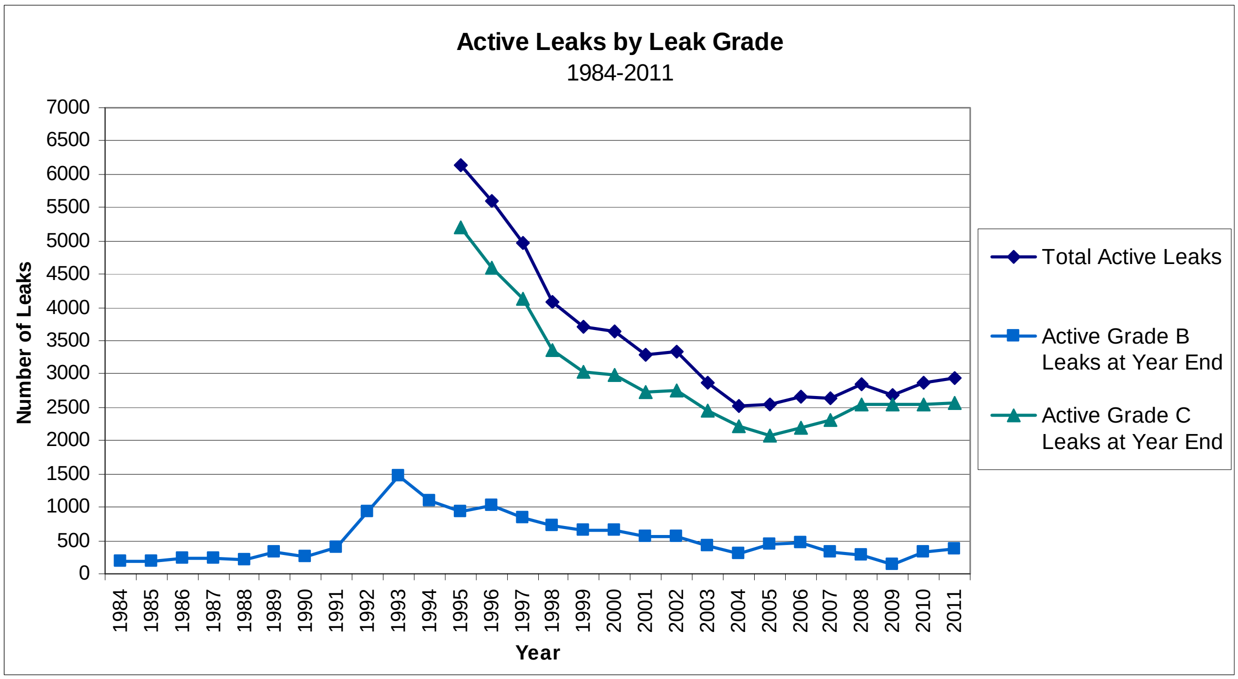


Figure 1. Number of Active Leaks by Leak Grade

Figure 1 shows that even with the recent increase, the total number of active leaks in 2011 is less than 50% of the historical peak in 1995 and grade "B" leaks remain approximately 30% lower than the peak seen in 1993.

In 2008, PSE performed a study in to gain information on the distribution of active leaks by material and age of facility. The results of this study are shown in Figure 2. The 2012 leak initiative will identify the best method of updating this information going forward to provide insight into active leak trends in addition to this one-time snapshot.

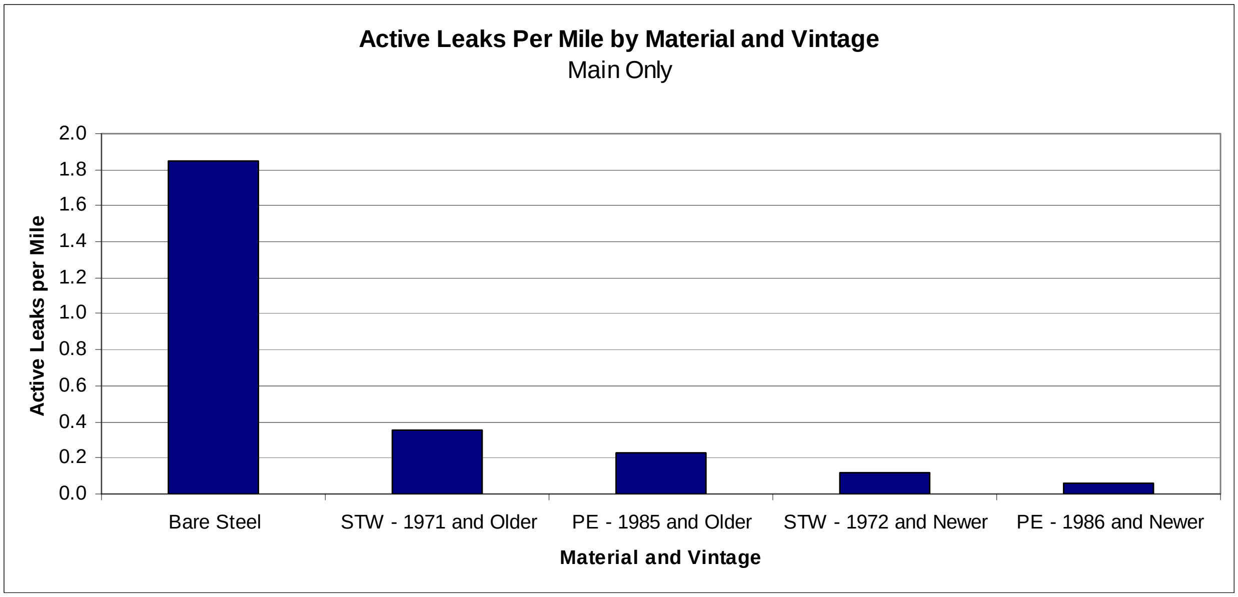
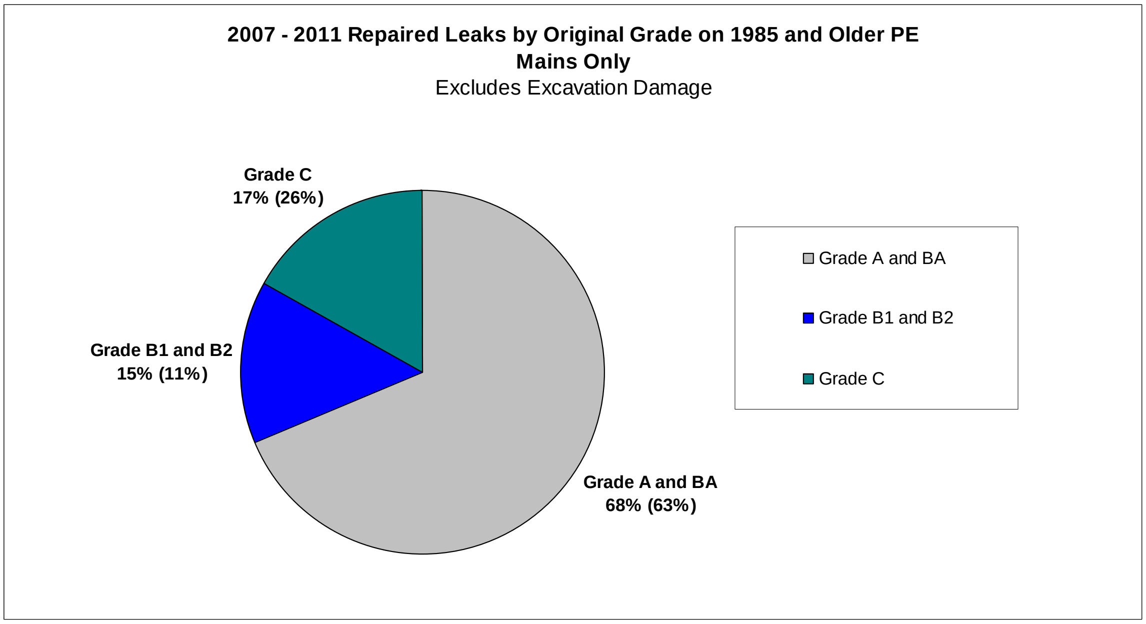


Figure 2. Number of Active Leaks Per Mile by Material and Vintage

This figure shows that in 2008, bare steel had the highest number of active leaks per mile. In addition, bare steel has the highest number of new leaks found per mile. This data supports completing the replacement of bare steel by the end of 2014 as an appropriate risk reduction measure.

The next highest concentration of active leaks is on the older wrapped steel system. While the wrapped steel system is generally performing very well, review of the system indicates there are some segments and some geographic areas that have a higher concentration of leak history and reports of corrosion. These segments are risk ranked and mitigated through the Older Wrapped Steel Pipe Mitigation Program and the Wrapped Steel Service Assessment Program (WSSAP).

The data on leak repairs by grade and material type show leaks repaired on older vintage PE main are more than twice as likely to be hazardous than leaks repaired on older STW main or bare steel main. As shown in Figure 3, the original grade of repaired leaks on older PE main are hazardous approximately 65% of the time compared to 30% and 20% on older STW main and bare steel main, respectively. This highlights the important role that the Older Vintage PE Pipe Mitigation Program has in reducing the risks associated with these facilities.



Note: 2011 percentages are provided in the parenthesis for comparison.

Figure 3. Number of Repaired Leaks by Original Grade on 1985 and Older PE Mains

While facility replacement plays an important role in maintaining and improving system integrity, of equal importance is the proactive identification and repair of leaks through leak survey and the leakage action program. The leak survey trends illustrate that PSE's leak frequencies are appropriately assigned for the different types of facilities. The highest concentration of new leaks are found on facilities that are leak surveyed the most frequently and the lowest concentration of new leaks are found on those facilities that are surveyed the least frequently. The data relative to leaks discovered by source and grade indicate that over 70% of all Grade "B1" and lower grade leaks are found by leak survey and that Grade "A" and "BA" leaks are found predominantly by the public. This data illustrates that the combination of PSE's leak survey program, odorization program, and Public Awareness Program all play an important role in detecting and proactively mitigating leaks.

Leak repair data indicates that Excavation Damage or third party damage remains the leading cause of leaks on the system. As shown in Figure 4, third party damage was the cause of more than half of the leaks repaired during the last 5 years. In addition, third party damage is the leading cause of federally reportable incidents. These trends related to third party damage are consistent with those experienced throughout the industry.

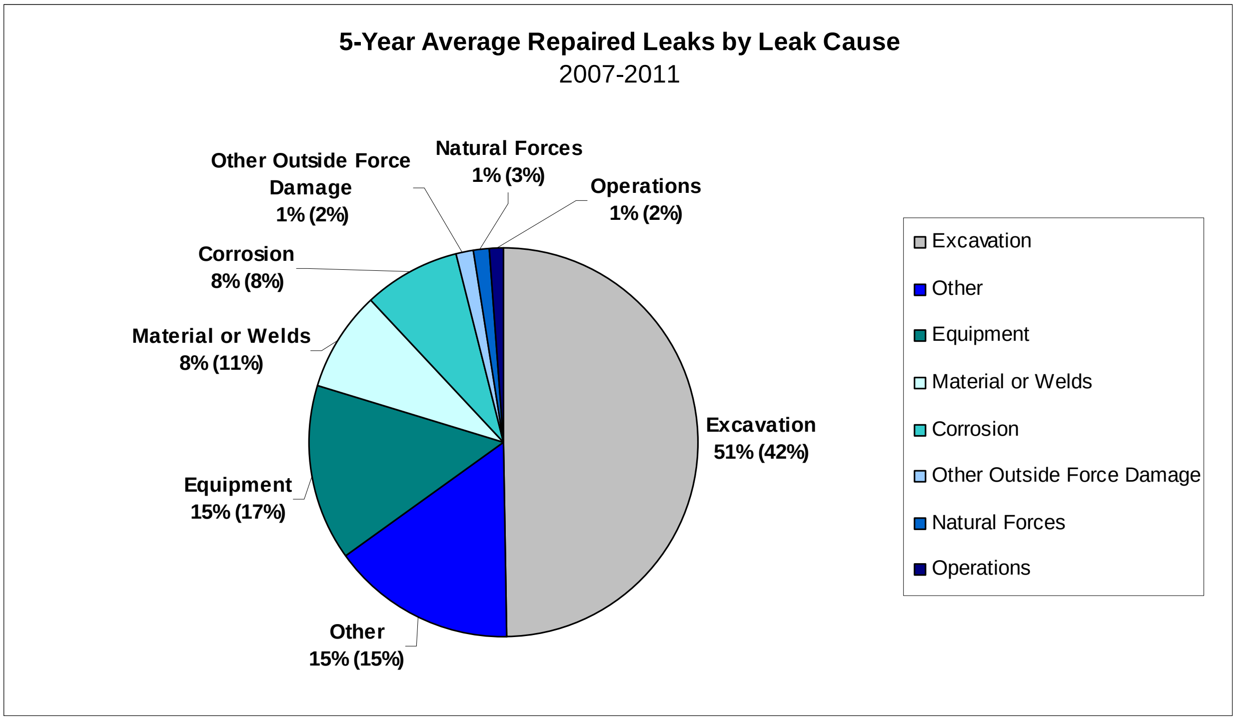


Figure 4. 5-Year Average Repaired Leaks by Leak Cause

Even though third party damage remains the leading cause of leaks on the system, PSE has achieved a significant reduction in third party damage since 2003. The Common Ground Alliance and industry in general has accepted representing the ratio of damages per 1,000 locates to better normalize the impact of increasing and decreasing excavation activity. As shown in Figure 5, PSE has been very successful in reducing damages per 1,000 locate requests. This positive trend has been achieved through a combination of efforts. The most significant reductions have been achieved by excavators using more careful excavation practices and increased public awareness of and adherence to the regulations that require excavators to call for locates prior to excavating.

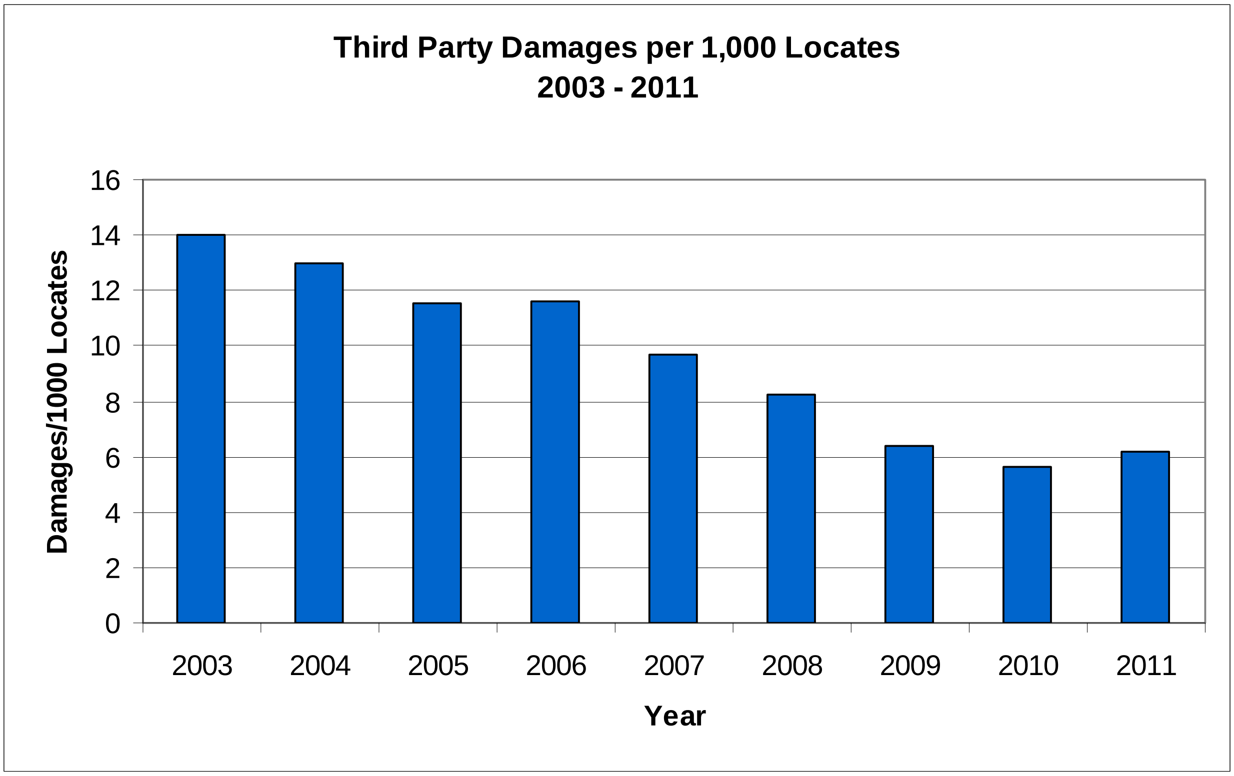


Figure 5. Third Party Damages per 1,000 Locates

New Washington State damage prevention legislation was passed in 2011 and will become effective on January 1, 2013. The goal of the legislation is to continue to reduce damages to underground and above ground facilities. The legislation will facilitate enforcement of the damage prevention regulations and provide more detailed requirements for both utilities and excavators related to locate marking requirements and locate requests.

PSE continues to monitor system data to validate previously identified trends and to recognize changes or newly emerging trends. At this time, the data confirms PSE is focusing on the highest priority areas including reducing third party damage and mitigating integrity concerns through the programs as outlined in the *Mitigative Measures and Additional and Accelerated Action section*.

PSE's review of system knowledge and system performance data and trends has identified opportunities to capture additional data and/or improve data accuracy to improve system risk understanding. These opportunities include implementing a Geographic Information System (GIS), capturing additional data on third party damage and leak root causes, and capturing additional data on PE pipe backfill and squeeze locations. PSE's implementation of a GIS will significantly improve risk knowledge, provide additional integrity management tools, and provide additional opportunities to improve data accuracy.

Risk Evaluation and Prioritization

Based on the current risk knowledge and system trends, the risk evaluation matrix (*Part 3. Risk Evaluation and Prioritization*) has been updated. This update includes risk ranking additional facilities and documenting where existing mitigative measures are adequately addressing risk and where Additional and Accelerated Actions need to be developed and/or implemented to reduce risk.

Mitigative Measures and Additional and Accelerated Actions

Mitigative measures implemented by PSE are documented in *Appendix D of the DIM Plan*. Additional and accelerated actions that have been implemented since the DIM Plan was last updated will be incorporated in the next update to the DIM Plan.

Additional and accelerated actions that have been implemented with documented program plans as well as those in development are documented in *Part 4. Mitigative Measures and Additional and Accelerated Actions* of this report. For Additional and Accelerated Actions that have been implemented, a summary of the program is provided as well as the mitigation plans, the performance measures, the effectiveness of the mitigative measures, and any improvements needed. For Additional and Accelerated Actions that are in development, a summary of the integrity risks is provided as well as the plan to develop and implement mitigative measures.

The following are Additional and Accelerated Actions that have been implemented with documented program plans:

- Bare Steel Replacement Program
- Older Vintage PE Pipe Mitigation Program
- Wrapped Steel Service Assessment Program (WSSAP)
- Older Wrapped Steel Pipe Mitigation Program
- Isolated Facilities Extension Programs
    - Sidewalk Regulators
    - Above Ground Regulators
    - Steel Services in Casing
    - Extended Service Lines in Mobile Home Communities
- Regulator Station Remediation
- Converted Single Service Farm Tap Program

The following are Additional and Accelerated Actions that are in development:

- Sewer Cross Bores
- Buried MSA Remediation
- Traffic Protection Enhancements
- Industrial Meter Set Remediation

- Shallow Main and Service Remediation
- Mobile Home Community (MHC) Encroachment Surveys
- Bridge and Slide Remediation
- Atmospheric Corrosion Inspections
    - Hard-to-Reach Bridges
    - Docks and Wharves Assessment
    - Pipe on Pipe Supports
- Aging Valve Mitigation
    - High Pressure (HP) Valves
    - Intermediate Pressure (IP) Valves
- Double Insulated Flange (IF) Valve Mitigation
- High Voltage Alternating Current (HVAC) Mitigation Program
- High Pressure Main Evaluation and Assessment
- Extended Utility Facility (EUF) Program
- Modified Farm Tap on a Riser
- Main and Services in Wall-to-Wall Paving and Near High Occupancy Structures (HOS)
- Sumner Propane Distribution System
- Wrapped Steel Main in Casing
- Encroachments

Programs that have been completed are also discussed for historical system knowledge and include:

- Isolated Facilities Program
- Cast Iron Replacement Program
- Critical Bond Program

Measure Performance, Monitor Results, and Evaluate Effectiveness

The performance measures as well as the data presented in the *Part 2. System Knowledge and Threat Identification, System Threats and Trends* section show leak trends that indicate the Additional and Accelerated Actions with documented program plans as well as those that are in development are appropriately focused to continue to reduce risks and improve performance measures. The performance measures that are program-specific are discussed in *Appendix B* of this report.

Hazardous Leak Repairs by Material

As shown in the table below, there has been an increase in the number of hazardous leak repairs on bare steel and wrapped steel and a decrease in the number on PE in 2011 compared to the 5 year average. The leaks on bare steel are primarily being addressed through the Bare Steel Replacement Program. Since 2005, PSE has replaced almost 70% of the bare steel main and the remaining bare steel will be replaced by the end of 2014.

The increase in the hazardous leaks on wrapped steel supports the direction PSE has taken in implementing the WSSAP Program as well as the Wrapped Steel Pipe Mitigation Program. Both of these programs are expected to reduce the number of hazardous and total leaks on wrapped steel facilities.

Table 1. Performance Measure – Hazardous Leaks Repaired, Categorized by Material (Excluding Excavation Damage)

Material	Number of Repaired Hazardous Leaks			
	5-Year Average	2011	5-Year Average / Facility Mile	2011
Bare Steel and Wrought Iron	35	46	0.0802	0.1281
Wrapped Steel	176	188	0.0273	0.0295
PE	216	206	0.0120	0.0112

Note: Beginning in 2010, PHMSA required operators to report aboveground hazardous leaks. The data presented in the table above does not include aboveground hazardous leaks as a full 5 years of data is not available by material type.

The decrease in hazardous leaks on PE is a positive trend. However, the additional data analysis on older vintage PE presented in the *System Threats and Trends* indicates the Older Vintage PE Pipe Mitigation Program is an important part of reducing the risks associated with brittle-like cracking and fusion failures experienced on pipe of this vintage.

Excavation Damage

The excavation damage performance measures show positive trends in reducing damages due to excavation damage. While these are positive trends, excavation damage still remains the leading cause of hazardous leaks on PSE's system emphasizing the importance of PSE's continuing efforts on reducing excavation damages through the Damage Prevention Program.

Response Time to Emergency Calls

In 2011, both the percentage of emergencies that were responded to within 60 minutes and the average emergency response time improved compared to the 4-year average as shown in the table below. Emergencies include both odor and leak calls.

Table 2. Performance Measure – Gas Emergency Responses and Response Times

Gas Emergency Response Time Performance Measure	Gas Emergency Response Time	
	4-Year Average	2011
Number of Emergency Calls	22,852	22,806
Percentage of Emergencies Responded to Within 60 Minutes	93.59%	96.73%
Average Response Time	32 minutes	29 minutes

Note: The baseline for this performance measure is 4-year averages at this time due to data accuracy improvements that make the 4-year average a more appropriate baseline. In 2011, both the percentage of emergencies that are responded to within 60 minutes and the average emergency response time improved compared to the 4-year average.

All the performance measures and overall trends will continue to be monitored to confirm that existing programs are effectively mitigating risks and to identify where new programs or revisions to existing programs are necessary.

Periodic Evaluation and Improvement

The evaluation of PSE's DIM Program indicates the DIM Plan in conjunction with this report are effectively mitigating system risks and identifying where Additional and Accelerated Actions need to be developed and implemented to further mitigate risks.

Conclusion

The overall system performance has improved over the years due to a number of factors including replacing bare steel, older wrapped steel, and older PE mains and services, and mitigating risk through other Additional and Accelerated Actions. These Additional and Accelerated Actions, both those with documented program plans and those that are in development, are supported by the system trends and performance measures as the appropriate areas to focus on risk reduction. The recent increase in new and active leaks has prompted further investigation into this trend and has resulted in the 2012 Leak Initiative. PSE will continue to monitor system trends and performance measures and evaluate where improvements are needed to existing Additional and Accelerated Actions or whether additional mitigative measures need to be developed and implemented.

Part 2: System Knowledge and Threat Identification

This section describes the characteristics of PSE's gas distribution system and provides an in-depth analysis of system trends. Through this trend analysis of leaks, failure analysis, system condition, federally reportable incidents, and third-party damage, the threats to the distribution system as well as any potential threats are identified and further analyzed to add to PSE's system risk knowledge. This information is the basis for evaluating and prioritizing the risks in the distribution system.

System Summary

PSE's gas distribution system spans 6 counties in Washington State. The majority of the system is located in western Washington and a small portion is located in Kittitas County in eastern Washington. The system includes over 12,000 miles of main and more than 800,000 services. PSE serves residential, commercial and industrial customers throughout the service territory. PSE also operates two peak-shaving plants. One is a propane-air plant in Renton and the other is an LNG plant in Gig Harbor.

While the majority of PSE's natural gas system is distribution, PSE also operates approximately 30 miles of transmission pipe. PSE has implemented a Transmission Integrity Management Program (TIMP) in accordance with the regulations. Through this program, baseline assessments of transmission pipe in high consequence areas have been performed. Through these assessments, PSE has gained and will continue to gain information about our transmission system that provides knowledge that may be beneficial for the high pressure distribution system.

PSE's distribution system includes mains and services of the following materials:

- bare steel
- wrought iron
- wrapped steel (STW)
- plastic or polyethylene (PE)
- copper (this includes a limited number of services only)

Additional information on PSE's Gas System Description can be found in *Section 5. Knowledge of Distribution System* in the DIM Plan as well as Gas Operating Standard (GOS) 2400.0500 Gas System Description. The following table and graph, Table 3 and Figure 1, summarizes the mains and services in PSE's system by material type as of the beginning of 2012.

Table 3. Percent of Mains and Services by Material Type

Material Type	Mains	Services
Plastic	67%	79%
Wrapped Steel (Protected)	32%	19%
Bare Steel and Wrought Iron (Unprotected and Protected)	1%	2%

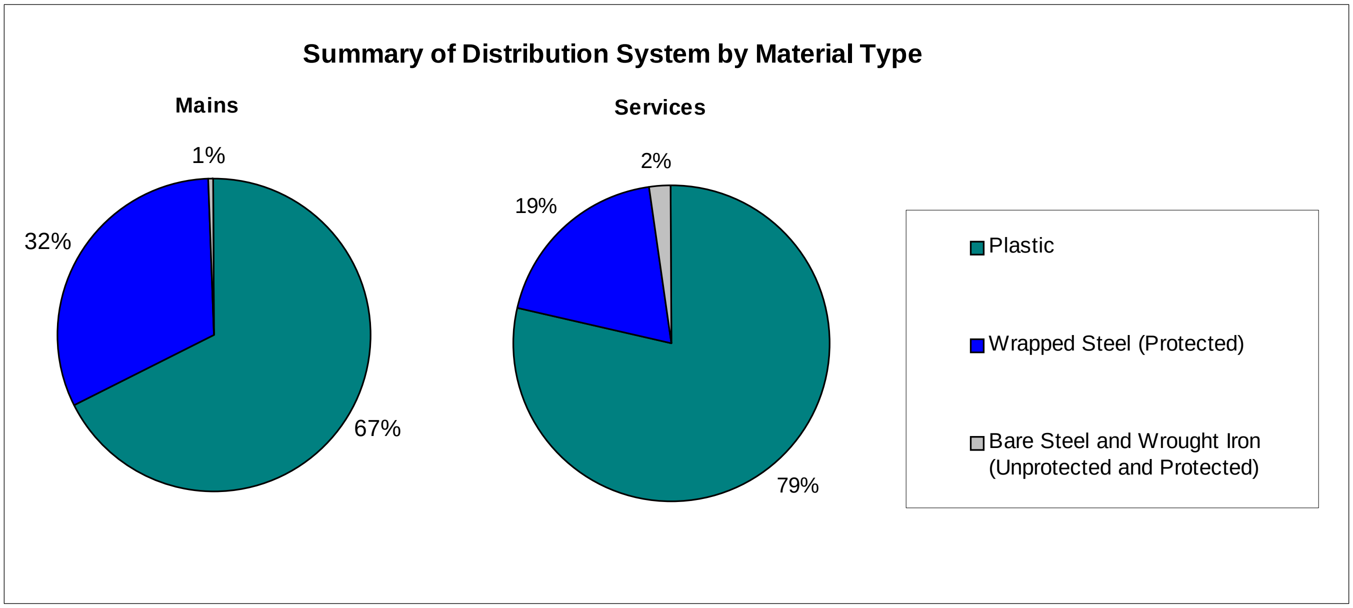


Figure 1. Summary of Distribution System by Material Type

Table 4 summarizes the miles of main categorized by maximum operating pressure of both the transmission and distribution systems as of the beginning of 2011.

Table 4. Maximum Operating Pressure of Mains[1]

Maximum Operating Pressure	Miles of Main	% of Miles of Main
Low Pressure (1 PSIG or less)	8	0.1%
Intermediate Pressure (60 PSIG or less)	11,121	94.7%
High Pressure (greater than 60 PSIG)	584	5.0%
Transmission	27	0.2%
Total	11,741	100.0%

[1] Total miles of main in the Low Pressure, Intermediate Pressure, and High Pressure categories are approximations and are based on system modeling data. The difference between the total miles reported on the annual DOT report in 2011 and as provided from the system model is less than 10%.

More than 99% of PSE's gas main is distribution piping with approximately 95% being operated at or below 60 psig (intermediate pressure). Less than 5% of the system operates at pressures above 60 psig (high pressure) and less than 1% of the system operates below 1 psig (low pressure).

The year the facilities were installed is also significant due to varying material types, construction practices, and operation and maintenance practices. The different material and vintages include bare steel pipe, wrapped steel pipe installed prior to 1972, wrapped steel pipe installed in 1972 and later, PE pipe installed prior to 1986, and PE installed since 1986. For steel pipe, 1972 is an important year as the federal regulations governing pipeline safety were adopted in 1971. Pipelines installed prior to the adoption of the federal regulations did not require cathodic protection and were not installed to the same stringent standards as subsequent installations. PE pipe installed prior to 1986 included early generations of plastic pipe resins that have demonstrated less resistance to installation techniques followed at the time, namely backfill and pipe joining. Material properties and construction practices have improved over time and by 1986, these materials and construction practices had matured and significantly improved.

Table 5 and Figure 2 summarize the distribution of mains and services by installation period in PSE's system as of the beginning of 2011.

Table 5. Percent of Mains and Services by Installation Period

Installation Period	Mains	Services
Pre-1970	16%	12%
1970-1989	28%	23%
Since 1990	55%	58%
Unknown	1%	6%

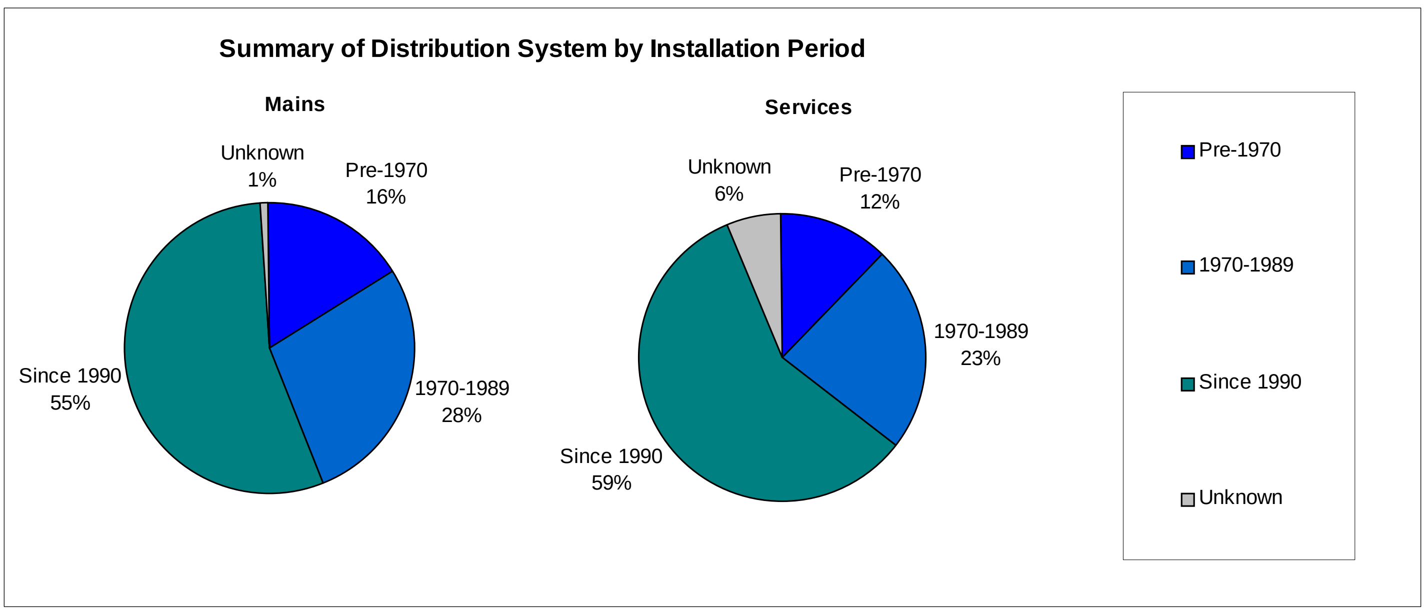


Figure 2. Summary of Distribution System by Installation Period

As this information indicates, over half of PSE's system has been installed since 1990 using newer high performance materials that are more resistant to slow crack growth and brittle-like cracking and modern construction practices including improved fusion and backfill procedures. Additionally, more than 70% of the system has been installed since 1972 when the federal regulations that govern pipeline safety were adopted.

Many programs have already been implemented and some completed to address the risk associated with the older vintage materials and construction practices. These programs are described in *Part 4. Mitigative Measures and Additional and Accelerated Actions*. Programs that have already been completed that address older vintage material and construction practices include the Cast Iron Replacement Program, Critical Bond Program, and Isolated Facilities Program. Programs that are currently implemented with a documented program plan include the Bare Steel Replacement Program, the Wrapped Steel Service Assessment Program (WSSAP), Older Wrapped Steel Pipe Mitigation Program, and Older Vintage PE Pipe Mitigation Program.

System Threats and Trends

This section of the report presents data that has been analyzed to gain insight into system performance and understand system threats as required by Section 6 of the DIM Plan. PSE has evaluated a wide variety of data to determine if existing programs are adequately addressing system risks and if there are any emerging trends for which implementation of additional or revised additional and accelerated action should be considered. The data presented in the following sections focuses on communicating where this review identified a meaningful trend or where the information was so significant in understanding system performance that it merited discussion even if no trend is evident.

In some instances, changes to how the data is categorized have been implemented to enhance the usefulness of the data. In other instances, additional training has been conducted to improve data accuracy. For example, a reference sheet of leak cause code definitions and examples was created and distributed to field personnel to help clarify the different leak cause codes and promote more consistent and accurate reporting. These changes are at times so substantial that they impact the ability to perform meaningful trend analysis but provide extremely valuable insight into the system knowledge and system risks. With additional years of data, the trending of this data will be more valuable.

System Trends section includes information on the following:

- Leak Trends
- Failure Analysis Trends
- System Condition Trends
- Federally Reportable Incident Trends
- Third Party Damage Prevention Program Trends

Leak Trends

A number of leak trends are reviewed in the following section. These include trends relative to:

- New and Active Leak Trends
    - New Leaks Found per Mile Surveyed by Leak Survey Type
    - New Leaks by Original Leak Grade
    - Leaks Discovered by Source and Grade
    - Active Leaks by Leak Grade
    - Active Leaks per Mile by Material and Vintage
    - Leak Initiative

- Leak Repair Trends
    - Repaired and Active Leak Trends
    - Leak Repairs by Leak Cause
    - Equipment Leak Trends
    - Corrosion Leak Trends
    - Material or Weld Leak Trends
    - Leak Repairs by Material, Vintage, Facility, and Grade
    - Leak Repair Methods

New and Active Leak Trends

New and active leaks can be impacted by many factors, but are evaluated as an indicator of how a system is performing as it ages, i.e. whether more new leaks are being discovered on a particular facility type or whether the severity (leak grade) is increasing over time, in combination with reflecting the effect of maintenance versus replacement strategies. PSE has evaluated new leak trends from a variety of perspectives. The following sections discuss why these data analyses are important, what the trends are, and what PSE is doing as a result of these trends.

New Leaks Found per Mile Surveyed by Leak Survey Type

PSE has an extensive leak survey program which is documented in GOS 2625.1100 Leakage Survey Program. This standard specifies the frequency of leak survey for each type of facility. Unprotected steel pipe and copper pipe is leak surveyed twice annually and the results of these surveys are depicted in Figure 3 as “Unprotected Survey 1” and “Unprotected Survey 2”, representing the first and second survey each year, respectively. Pipe within areas that are designated as business districts, high occupancy structure (HOS) or area, and supply mains operating above 250 psig are leak surveyed annually. The results of these surveys are depicted in the same graph as “Annual (Business District)”. With the exception of a few specialized leak surveys, all other surveys are required by pipeline safety regulations to be performed at least once every 5 years. In 2006, PSE began performing these surveys every 3 years and has continued to maintain this schedule due to efficiencies of combining leak survey activities with atmospheric corrosion monitoring. These surveys are depicted as “5-year (3-year)” on the graph.

As shown in this graph, the highest concentration of new leaks is found on the facilities that are leak surveyed the most frequently and the lowest concentration of new leaks is found on those facilities that are surveyed the least frequently. This chart demonstrates that the different survey frequencies are appropriately distributed for the different types of facilities.

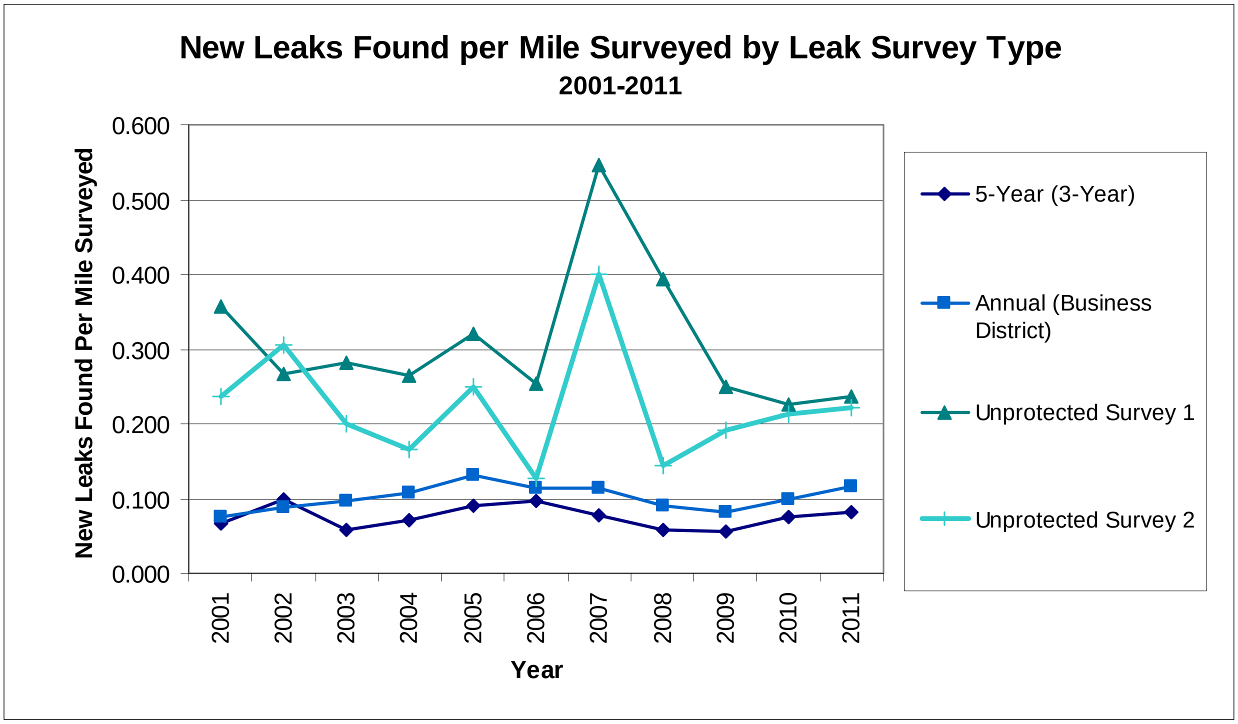


Figure 3. New Leaks Found Per Mile Surveyed by Leak Survey Type

In addition to demonstrating that the different survey frequencies are appropriately assigned to the different types of facilities, this graph shows a significant increase in new leaks found in 2007 on the unprotected pipe leak surveys. PSE noticed this increase in new leaks being found and took steps to ensure personnel were trained to properly identify and grade leaks as well as trained in PSE's phantom leak procedure. Subsequently, the number of new leaks found returned to more typical values.

The graph also shows that historically, the first unprotected pipe survey of the year typically found more leaks than the second survey. PSE has explored this trend and found that the difference between the two surveys has become less significant over the past two years. This trend is likely impacted by the significant reduction in bare steel mains and services over the past several years and the significant reduction in the total number of new leaks found. For example, since 2008 the new leaks found on bare steel have decreased by more than 30%. This shows a very positive trend related to reducing leakage through the Bare Steel Replacement Program.

Since 2009, there has been a slow but steady increase in the number of new leaks found per mile of main surveyed for both the "Annual (Business District)" and "5-year (3-year)" leak surveys. This is a trend that PSE is analyzing further to better understand the factors behind this increase and what if any mitigative measures should be implemented to reverse this trend. Additional information on this analysis is provided in the *Leak Initiative* section in this report.

New Leaks Found by Original Leak Grade

Another trend that is important to analyze is the initial leak grade for new leaks. The leak grade indicates the severity of the leak and the timeframe required to repair or monitor the leak. PSE's leak grading scale is documented in Gas Operating Standard 2625.1300, Leakage Action Program. The leak grade determines what action shall be taken to monitor and repair the leak. Leak grades include Grades "A", "BA", "B1", "B2", and "C" in order of highest to lowest risk priority. Grade "A" leaks are leaks that represent an existing or probable hazard and require prompt action, immediate repair, or continuous action until conditions are no longer hazardous. Grade "B" leaks are leaks that are nonhazardous at the time of detection but justify scheduled repair based on potential future hazard. These leaks vary in how frequently they are monitored, but all Grade "B" leaks are required to be repaired within a specified timeframe. Grade "C" leaks are leaks that are considered nonhazardous at the time of detection and are expected to remain nonhazardous. These leaks are reevaluated each year until the leak grade changes or the leak is repaired.

Figure 4 shows trends over the past 6 years related to the grade of new leaks found each year. This includes leaks found by leak survey, as well as those found by company personnel or reported by the public. It excludes leaks that are due to excavation damage as these leaks are generally not indicative of system integrity and the mitigative measures for this threat are different than for other threats. As a result, third party damage trends are analyzed and discussed in the *Third Party Damage Prevention Trends* section of this report.

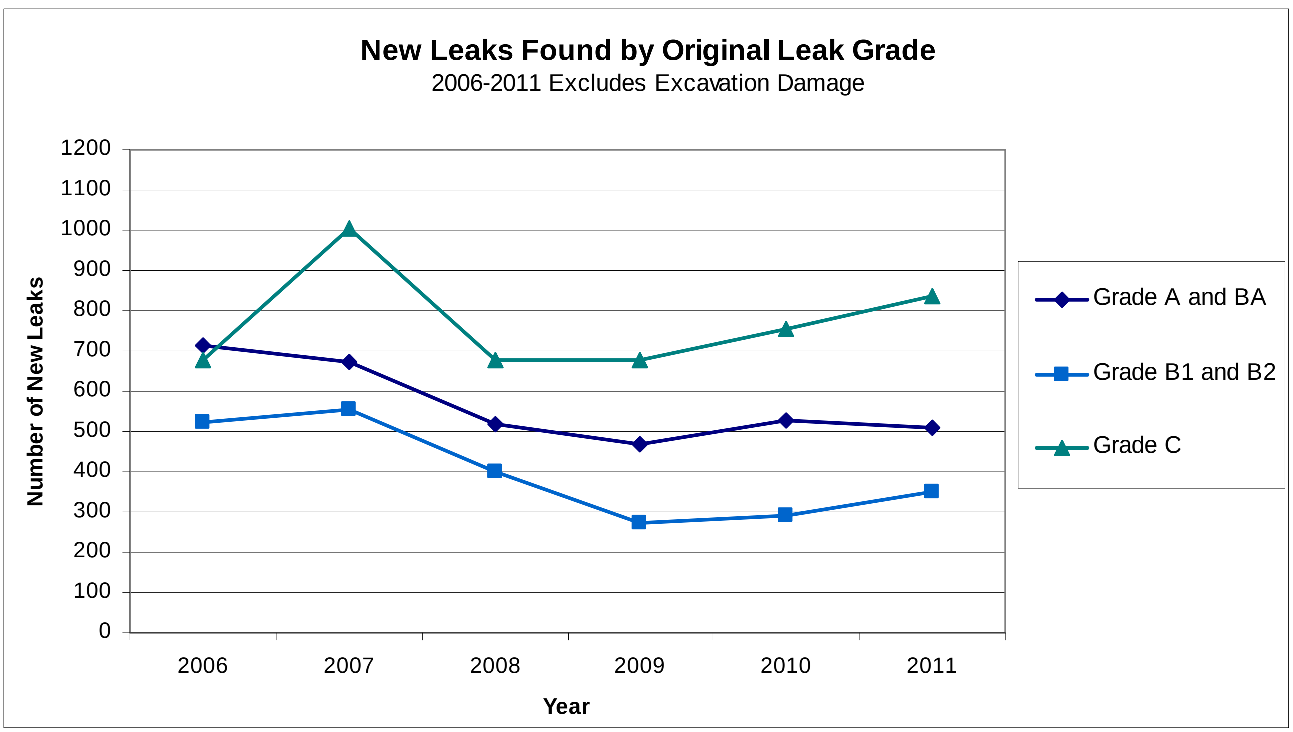
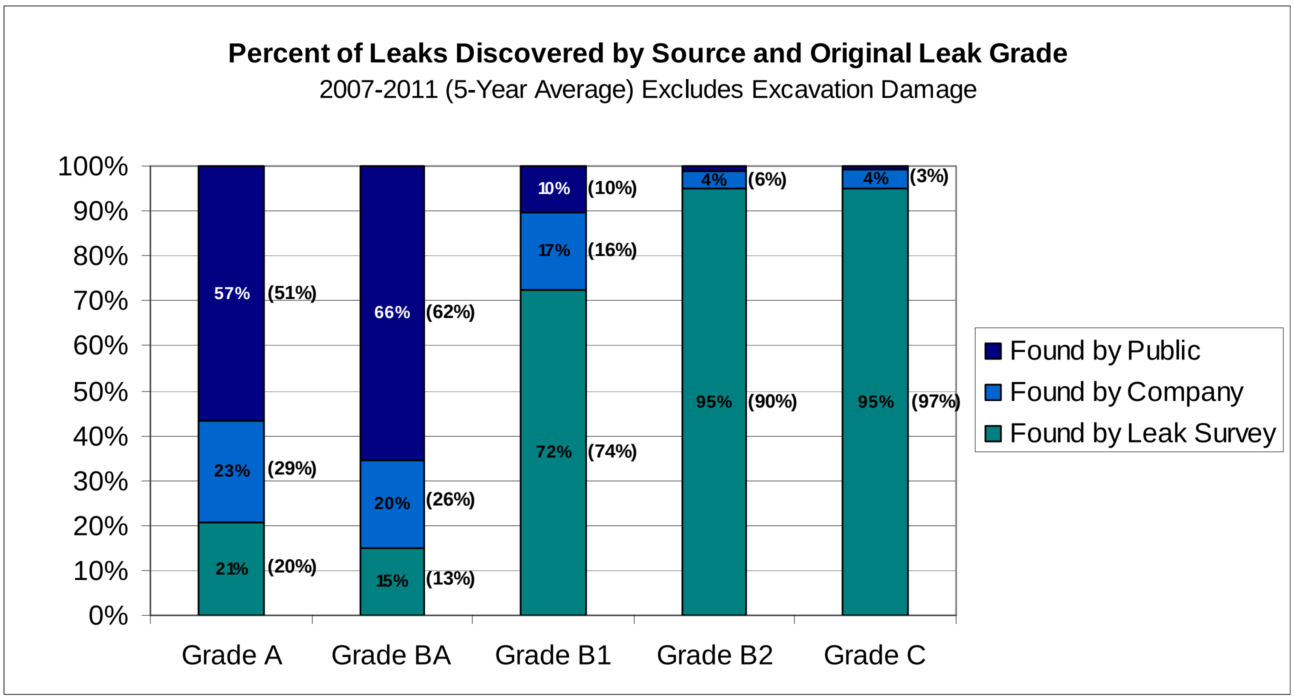


Figure 4. New Leaks Found by Leak Grade

This graph shows a similar trend in new leaks increasing since 2009 and will be included in the additional leak analysis that will be performed as described in the *Leak Initiative* section of this report.

Leaks Discovered by Source and Grade

Figure 5 shows additional data that provides insight into the effectiveness of PSE's leak survey program. As shown by this graph, over 70% of all Grade "B1" and lower grade leaks are found by leak survey. This graph also illustrates the effectiveness of PSE's odorization program and Public Awareness Program for the higher grade leaks (Grade "A" and "BA") that are found predominantly by the public.



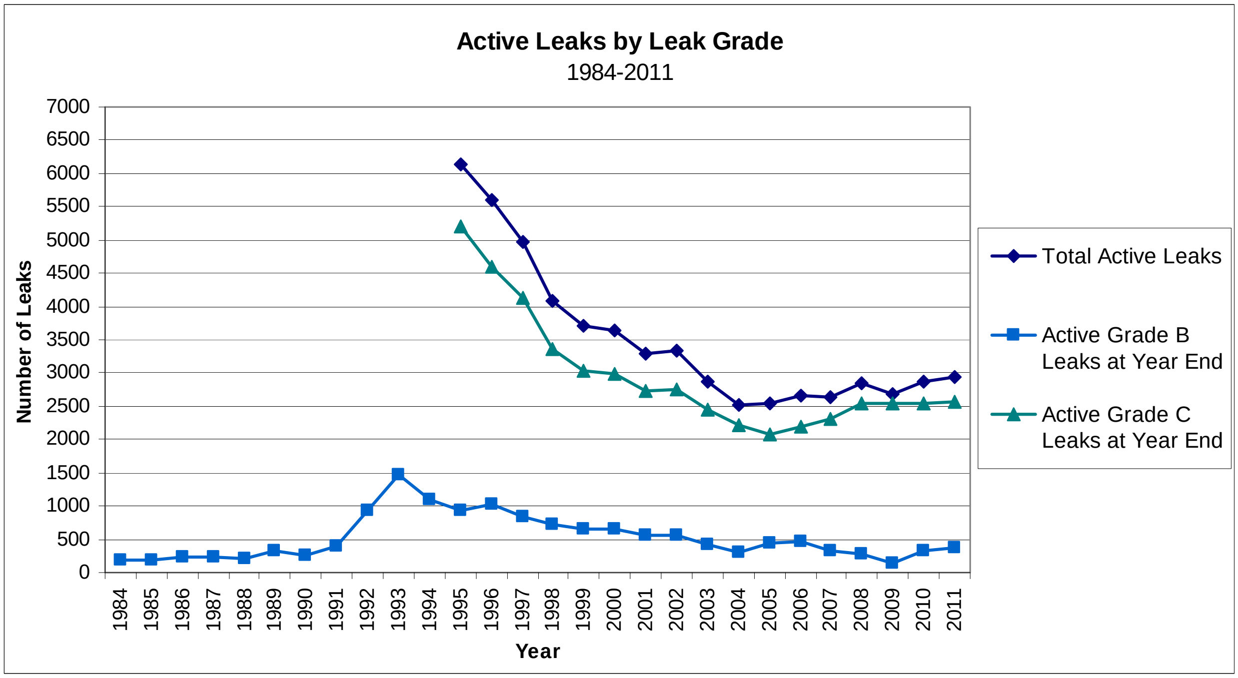
Note: 2011 percentages are provided in the parenthesis for comparison

Figure 5. Percent of Leaks Discovered by Source and Grade

PSE has reviewed the 2011 data and found it is consistent with the 5 year average confirming there are no new trends related to leaks reported by source and grade.

Active Leaks by Leak Grade

Figure 6 illustrates the historical active leak trends. Active leaks are leaks that are being monitored but have not yet been repaired. This graph shows the active Grade "B" leaks since 1984. It also shows the total active leaks and active Grade "C" leaks since 1995. Data on the total active leaks and active Grade "C" leaks is not available prior to 1995.



Note: Active Grade C leaks and total active leaks data prior to 1995 is not available.

Figure 6. Active Leaks per Year by Leak Grade

This graph shows a significant increase beginning in 1992 in the number of active Grade "B" leaks. The number of active Grade "B" leaks peaked in 1993 and began to decrease in 1994. Active Grade "B" leaks continued to decrease almost every year after that until 2004. Since 2004, active Grade "B" leaks have seen both increases and decreases over the years but remain significantly below the numbers experienced in the 1990's. For example, the active Grade "B" leaks in 2011 are more than 75 percent less than they were when they peaked in 1993.

The total active leaks and active Grade "C" leaks trend significantly downward from 1995 until 2005. Since 2005, total active leaks and active Grade "C" leaks have generally increased each year. Even with the recent increases in active leaks, both the increases from year to year as well as the cumulative increase remain relatively small compared to the decreases seen in prior years. The total number of active leaks at the end of 2011 remains less than 50 percent less of the historical peak in 1995.

Due to these trends, PSE performed additional research on historical leakage to obtain insight to assist in interpreting the current trends. This analysis revealed that there were two changes in 1992 to leak survey procedures that appear to have had a substantial impact on leakage trends. These changes include requiring all services to be leak surveyed using a combustible gas detection instrument rather than solely a vegetation survey and increasing the leak survey frequency of unprotected facilities from twice every 5 years to twice annually.

The following graph further demonstrates the impact the changes to the leak survey procedures had on leak repairs on unprotected facilities. As shown Figure 7, there was a significant increase in leak repairs on cast iron, bare steel mains, and bare steel services beginning in 1992 and continuing over the next several years. This graph also shows that leak repairs on the remaining bare steel pipe have shown a steady decline in recent years.

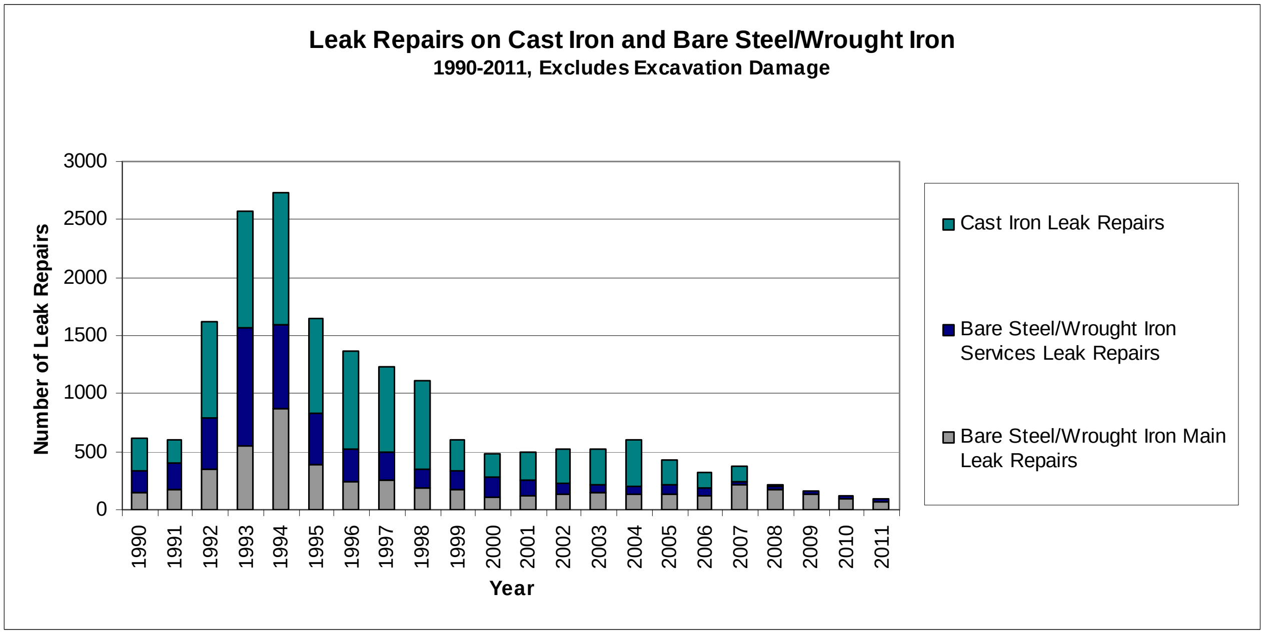


Figure 7. Leak Repairs on Cast Iron and Bare Steel/Wrought Iron

Active Leaks per Mile by Material and Vintage

In 2008 and 2009, PSE undertook an initiative to gain more information on the material and vintage of active leaks. This information has not historically been available on active leaks as it is typically not populated until the leak is repaired. The results of this review are presented in Figure 8 and confirm the direction PSE is headed in continuing the Bare Steel Replacement Program as well as developing and enhancing the Wrapped Steel Service Assessment Program (WSSAP), the Older Wrapped Steel Pipe Mitigation Program, and the Older Vintage PE Pipe Mitigation Program. These programs are all described in *Part 4. Mitigative Measures and Additional and Accelerated Actions* of this report.

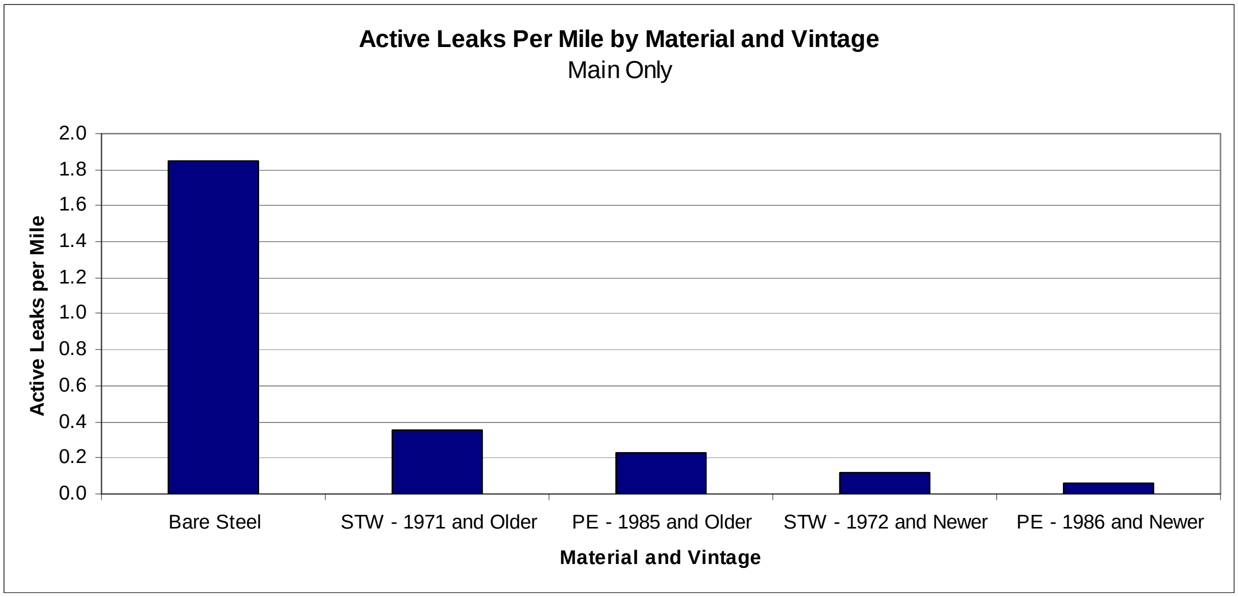


Figure 8. Active Leaks per Mile by Material and Vintage

PSE is exploring different options for making data on the material and vintage of active leaks available for ongoing analysis. These options include using the GIS system to obtain this data or capturing additional data when new leaks are found and not immediately repaired.

Leak Initiative

Based on recent leak trends including new, active, and repaired leaks, PSE is undertaking a comprehensive review of all aspects of the leak program. This review will include historical and current practices related to leak detection, grading, reporting, monitoring, and repairing leaks. It will also include reviewing the instruments and techniques used as well as the training provided to personnel involved in the leak management process.

The goal of this analysis is to gain insight into why leaks are increasing and develop a roadmap of steps that should be implemented if appropriate to address this trend. The roadmap will identify specific measures and/or additional areas that require data gathering for enhanced understanding of the leak trends as well as an implementation plan.

New and Active Leak Trends Conclusion

The review of new, active, and repaired leak data indicates several leak trends that warrant additional investigation. This includes an increase in recent years in the number of new leaks found on all leak survey types excluding bare steel as well as an increase in active leaks.

Additional research into historic leak trends was performed to provide more insight to assist in interpreting these recent trends. This research indicates there was a substantial change in 1992 to leak survey procedures that resulted in an increase in identifying leaks on services and leaks on unprotected bare steel and cast iron. As a result, active leaks and leak repairs increased significantly subsequent to this change. While current trends show an increase in active and new leaks, active leaks remain 50% below the number of active leaks in 1995 and Grade "B" leaks remain 75% below the peak seen in 1993.

While fewer new leaks are being found on bare steel piping, bare steel still has the highest number of new leaks found per mile and the highest number of active leaks per mile. The next highest leak densities are on older vintage wrapped steel and older vintage PE. These trends support PSE's focus on replacing the remaining bare steel and implementing the Wrapped Steel Service Assessment Program (WSSAP), the Older Wrapped Steel Pipe Mitigation Program, and the Older Vintage PE Pipe Mitigation Program.

While replacing facilities that have integrity issues is an important part of maintaining and improving system integrity, an important part of system safety includes leak surveys to proactively identify and repair leaks. The leak survey trends illustrate that PSE's leak survey frequencies are appropriately assigned for the different types of facilities. The highest concentration of new leaks are found on facilities that are leak surveyed the most frequently and the lowest concentration of new leaks are found on those facilities that are surveyed the least frequently. The trends relative to leaks discovered by source and grade continue to indicate PSE's leak survey program, odorization program, and Public Awareness Program are effective in detecting and proactively mitigating leaks.

While there are many positive leakage trends, the increase in recent years in new and active leaks warrants additional investigation. PSE's Leak Initiative is focused on performing additional analysis to gain insight into this increase and, if appropriate, developing and implementing a plan to address this trend.

Leak Repair Trends

In addition to evaluating new and active leak trends, PSE has looked at leak repair data from many different perspectives to gain insight into trends related to leak causes, leak severity, and material performance. The following sections discuss the results of this analysis and PSE's plans to incorporate this information into its system integrity plans.

Repaired and Active Leak Trends

The following graph shows repaired leak trends compared to total active leak and active Grade "B" leak trends.

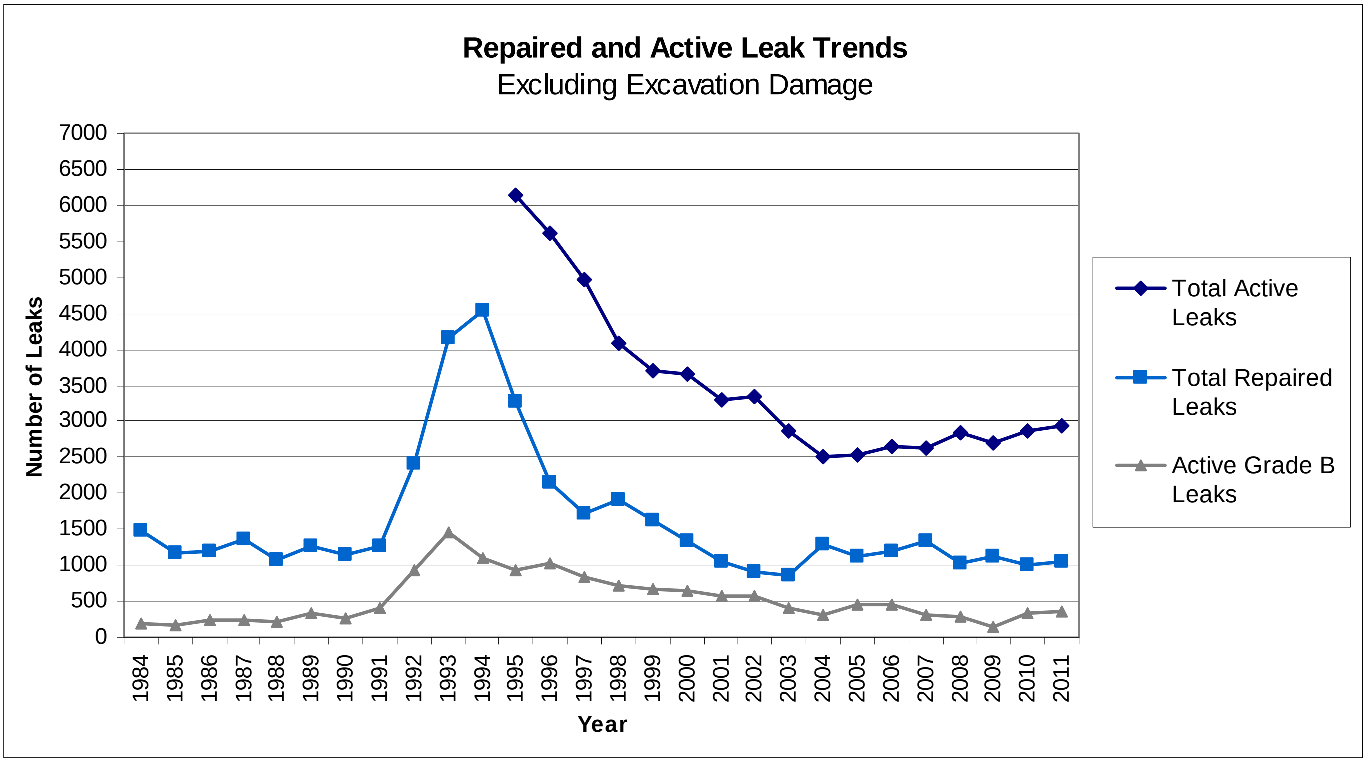


Figure 9. Repaired and Active Leak Trends

This graph shows that total repaired leaks generally follow a similar trend as active Grade "B" leaks and total active leaks. The trend is similar in that there is a significant increase in all categories for a few years beginning in 1992 and then all categories show a fairly steady decline over the next several years. As discussed in the New and Active Leak section, these historical leak trends were impacted by a change in 1992 to leak survey procedures. These changes resulted in an increase in identification of leaks on services and leaks on unprotected bare steel and cast iron. As a result, active leaks and leak repairs increased significantly subsequent to this change.

This graph also shows that in the past few years, total active leaks have been increasing while leak repairs have remained relatively steady. As discussed in the New and Active Leak section, PSE's Leak Initiative is focused on performing additional analysis to gain insight into the recent increases in new and active leaks and, if appropriate, developing and implementing a plan to address this trend.

While most leaks are eliminated by replacement, retirement or maintenance, leaks can also be eliminated when it is determined that there was not actually a leak present. These leaks are classified as phantom leaks. Leaks can also be eliminated by canceling the leak if the gas that was first detected was later confirmed to not be pipeline gas, the leak was confirmed to be on customer fuel line, or the leak is a duplicate. Phantom and Cancelled leak trends are shown in the following graph.

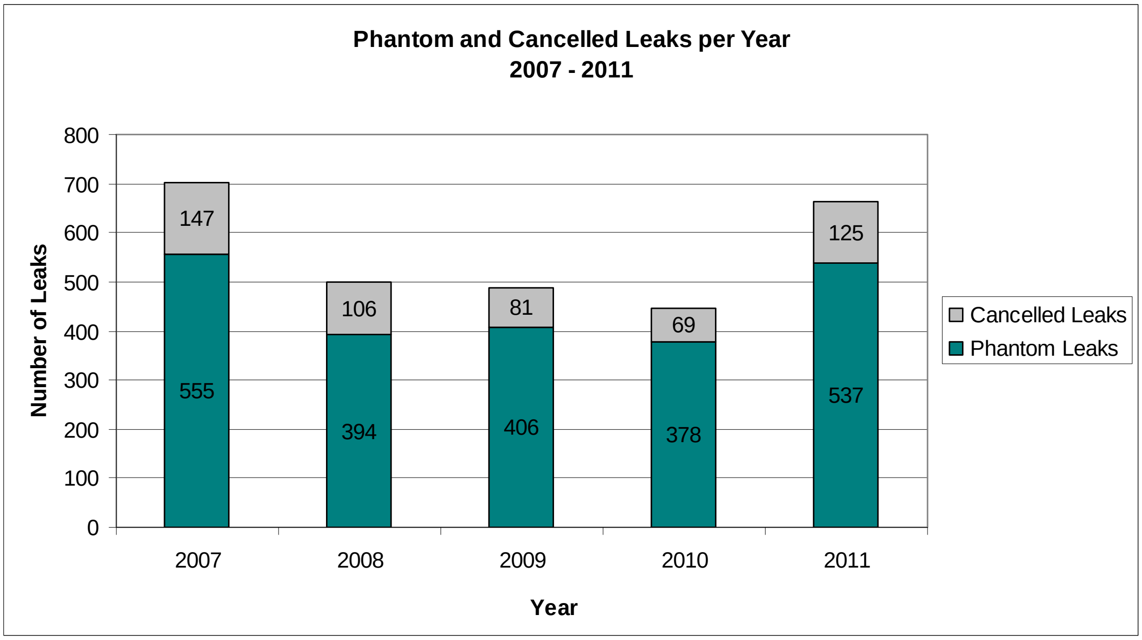


Figure 10. 2007-2010 Phantom and Cancelled Leaks per Year

Figure 10 shows that phantom and cancelled leaks had been decreasing until 2011. The decrease may have been due to improvements in the leak repair documentation process. The improvements focused on ensuring that leaks repaired by replacement were correctly identified as a leak repair rather than a phantom leak. Preliminary analysis of the phantom leaks in 2011 indicates the same issue may be driving the increase. As a result, the additional analysis of Phantom leaks will be performed as part of the Leak Initiative and if appropriate, additional process improvements may be implemented to reduce phantom leaks where a repair was performed through replacement.

In addition to the number of phantom leaks, the original leak grade of the phantom leaks was reviewed. This review indicated the majority of phantom leaks are found as a Grade "C" leak and rarely do Grade "A" or "BA" leaks becomes phantom leaks.

Leak Repairs by Leak Cause

Figure 11 shows the trends related to leak repairs by leak cause over the past 6 years. As shown in this graph, leaks repaired due to excavation damage and corrosion have decreased significantly over this timeframe.

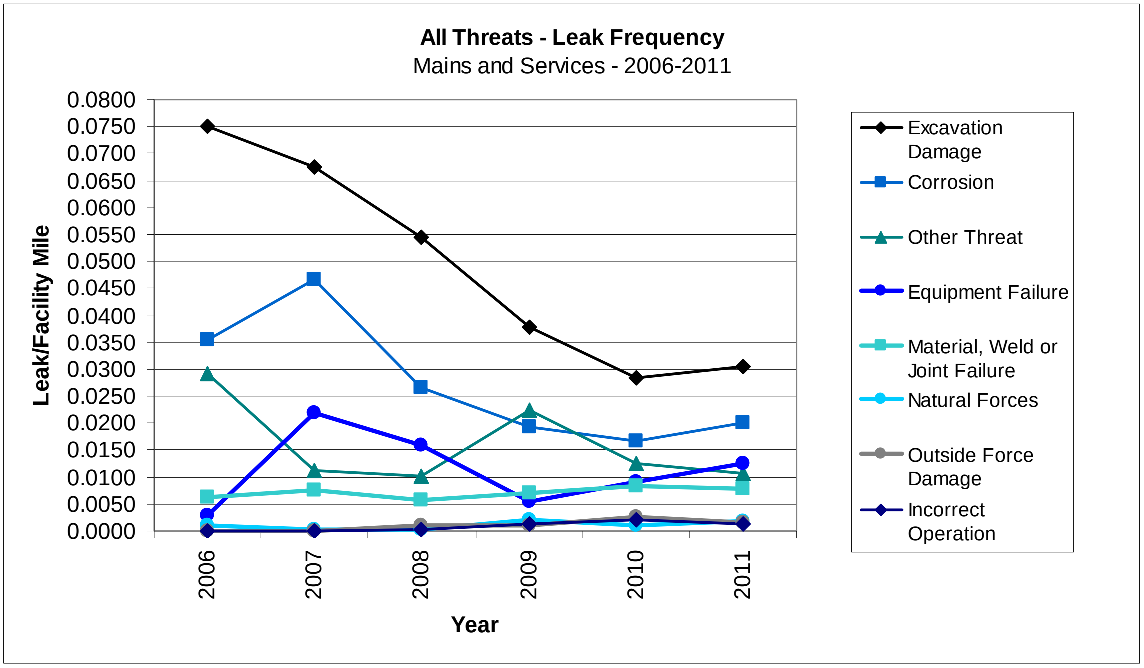


Figure 11. Leak Frequency of All Threats

During this timeframe significant efforts were made to improve the consistency in designating the leak cause in the remaining categories. These efforts have resulted in more accurate and useful data and will assist in trending these threats in future years. For now, a 5 year average is used to provide more insight into the leak causes to address the changes that resulted from more consistently identifying the leak cause.

The data on the 5 year average is provided in Figure 12 as well as the 2011 numbers. This graph also shows that excavation damage is the leading cause of leaks on the system. PSE's third party damage data aligns with industry trends and highlights the importance of a robust Damage Prevention Program. PSE's Damage Prevention Program is working to reduce the damage caused by excavation. There is additional data presented on these efforts in the Third Party Damage Prevention Trends section.

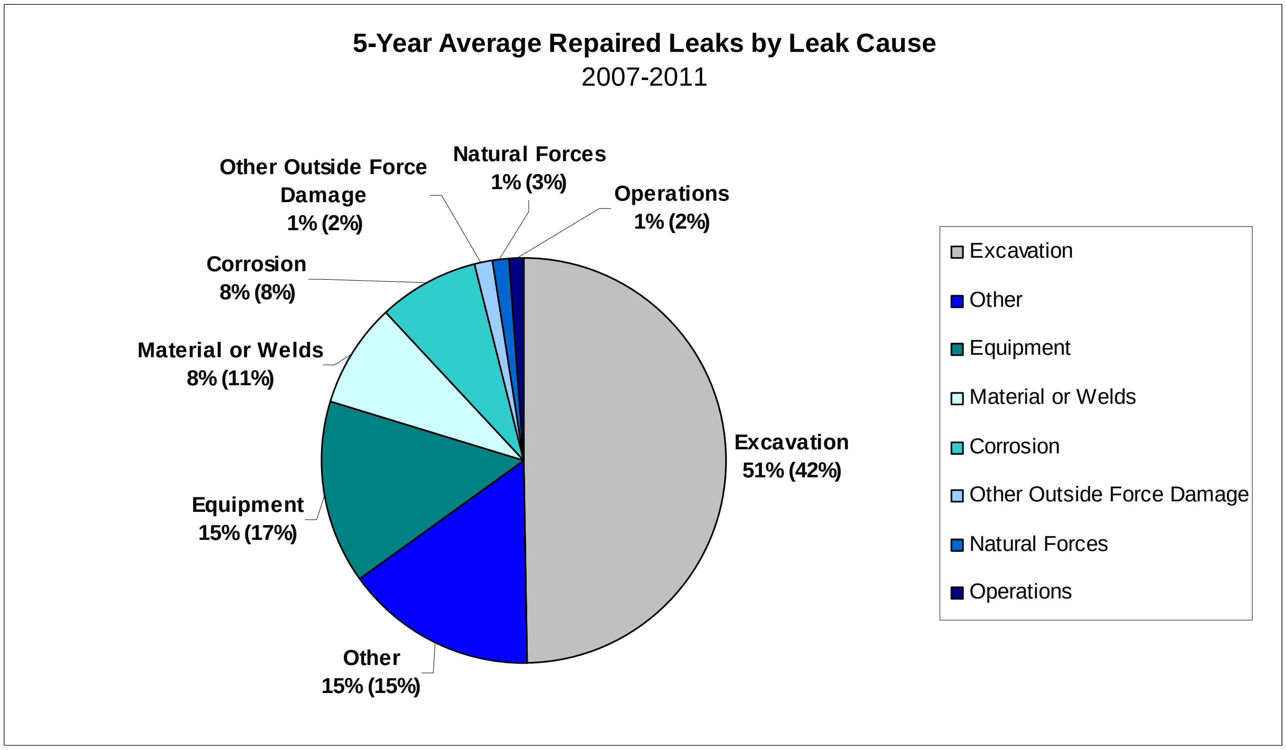


Figure 12. 5-Year Average Repaired Leaks by Leak Cause

The second leading cause of repaired leaks on PSE's system is from the leak cause category of "Other". Analysis of both the 5-year average leaks and 2011 leaks in this category indicates that more than half of these leaks were on pipe that was repaired by replacement or retirement without exposing the actual leak location and identifying the actual leak cause. For 2011, approximately 7% of the total leaks were repaired without exposing the pipe with 4% on older STW services, 1% on older STW mains, and 2% on bare steel mains.

Analysis of the remaining leaks in this category indicates additional training and/or job aides may reduce the number of "Other" leaks by more consistent determination of the leak cause. PSE will be undertaking additional efforts to improve the accuracy of this data as discussed in the *Data Initiatives* section of this report.

The next leading cause of repaired leaks on PSE's system includes "Equipment", "Material or Welds", and "Corrosion". The trend analysis for each of these leak repair causes are further discussed following this section. The remaining three leak cause categories include "Natural Forces", "Other Outside Force Damage", and "Operations" and each make up approximately 1% of the leaks. There are no trends identified at this time relative to these categories.

Equipment Leak Trends

The majority of leaks in the "Equipment" category are leaks at flanged joints, mechanical joints, and on plug valves. Most of these leaks are repaired by tightening bolts on flanges, tightening both PE and STW service tee caps, and greasing plug valves. The following graph shows the trends of leaks repaired by greasing and tightening over the past 5 years.

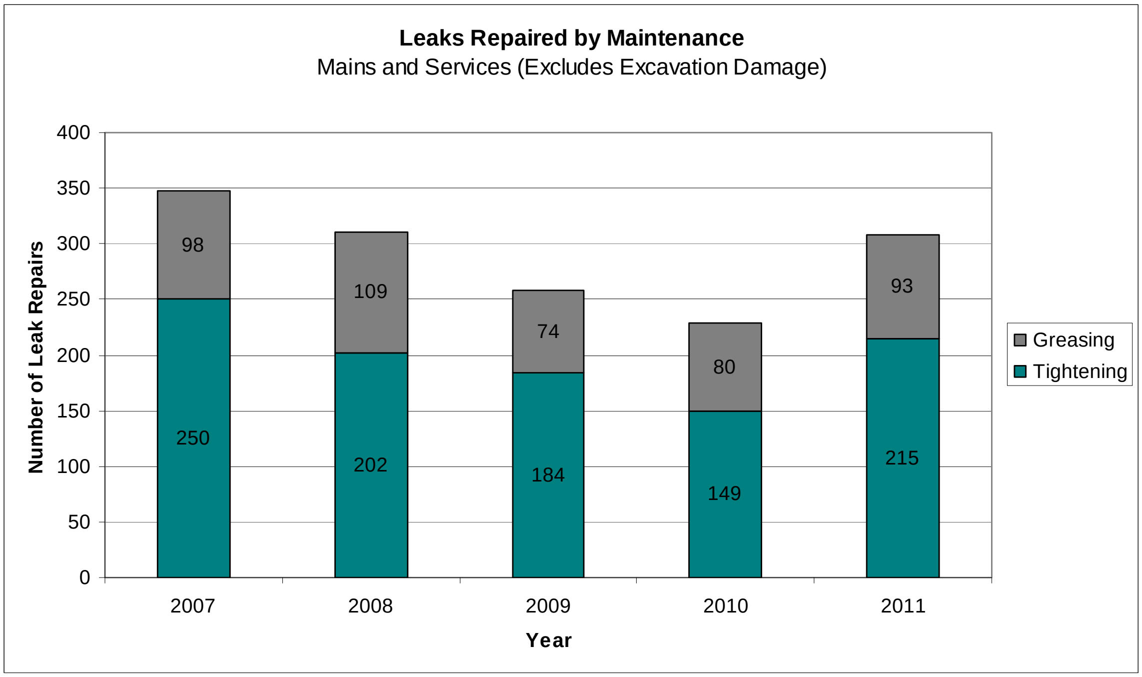


Figure 13. Number of Leaks Repaired by Greasing or Tightening

As shown in this graph, leaks repaired by greasing and tightening show a general decline from 2007-2010 and an increase in 2011. This data will continue to be monitored in future years to determine if there is a trend that warrants additional mitigative measures related to equipment failures.

Corrosion Leak Trends

PSE has approximately 69 miles of bare steel and wrought iron pipe remaining in the system with the majority of which is not cathodically protected. As a result, PSE has been replacing bare steel and will have all bare steel replaced by the end of 2014. The following graph shows the impact bare steel replacement has had on decreasing the number of leak repairs over the past 5 years.

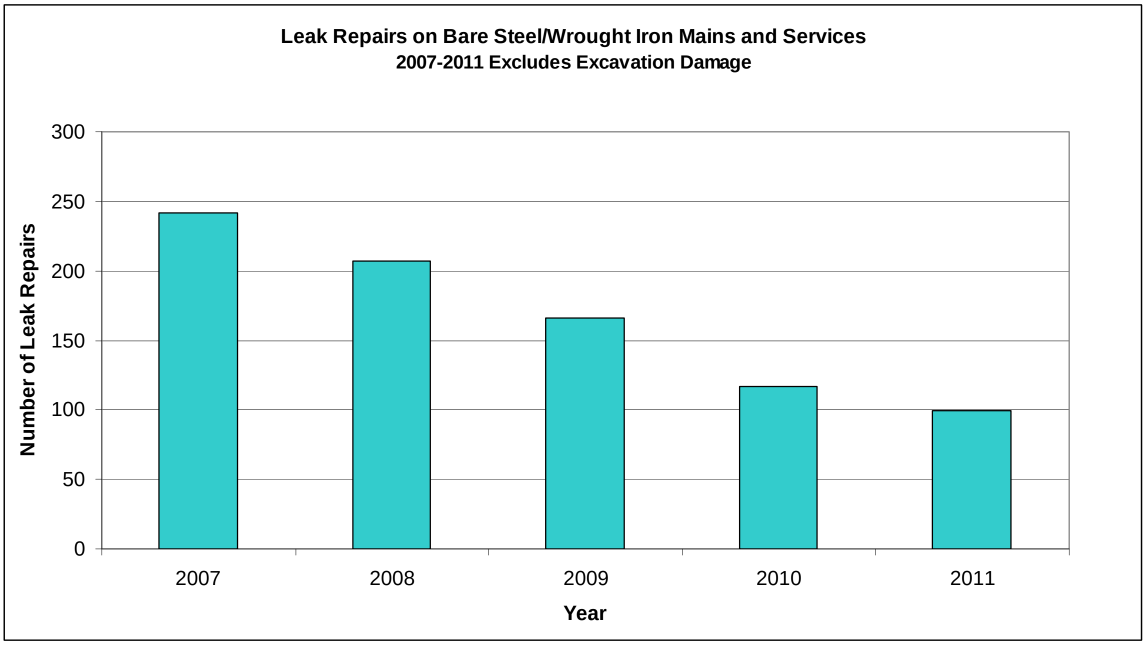


Figure 14. Number of Leak Repairs on Bare Steel Mains and Services

PSE also has over 3,800 miles of wrapped steel pipe which is cathodically protected. Additional information on the corrosion trends and data on the cathodically protected system is presented in the *System Condition Trends* section.

Material or Weld Leak Trends

As shown in Figure 15, of the majority of leaks repaired due to material or weld failures were on older vintage PE pipe and older vintage STW pipe.

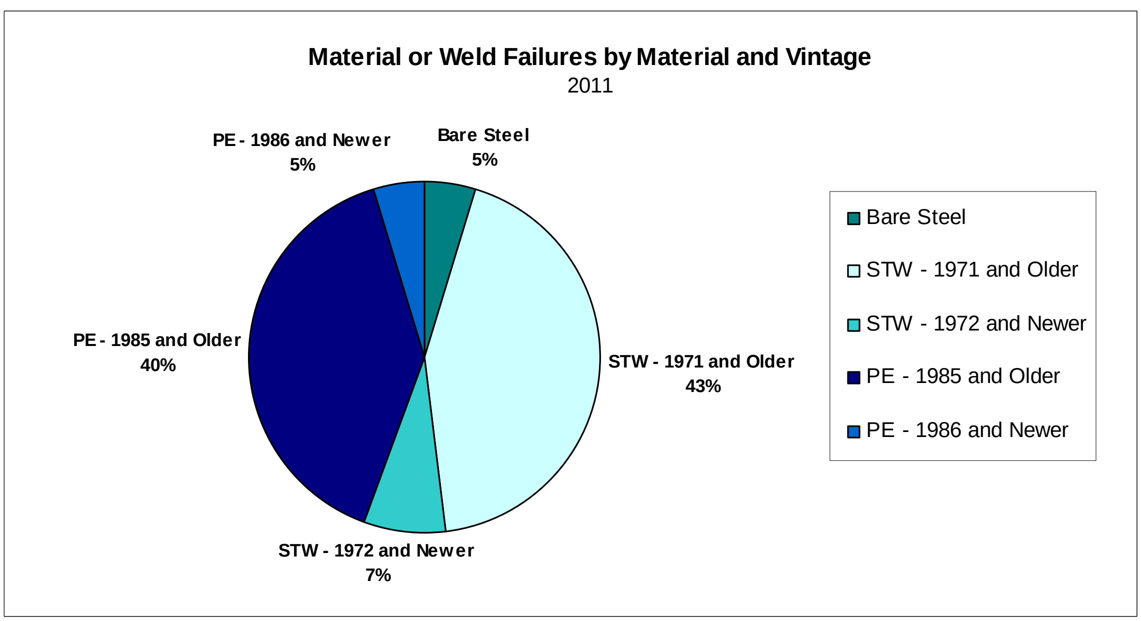


Figure 15. Material or Weld Failures by Material and Vintage

The analysis of this data shows that this trend is consistent with prior data. The Failure Analysis process provides additional information on these leaks which is discussed in the Failure Analysis Trend section.

Leak Repairs by Material, Vintage, Facility, and Grade

In addition to looking at trends related to leak causes, PSE has looked at trends related to leak repairs by material and vintage. As shown in the following chart below, the number of leaks repaired per mile of each type of pipe material and vintage is consistent with the trend observed for active leaks per mile by material and vintage and is consistent with prior years.

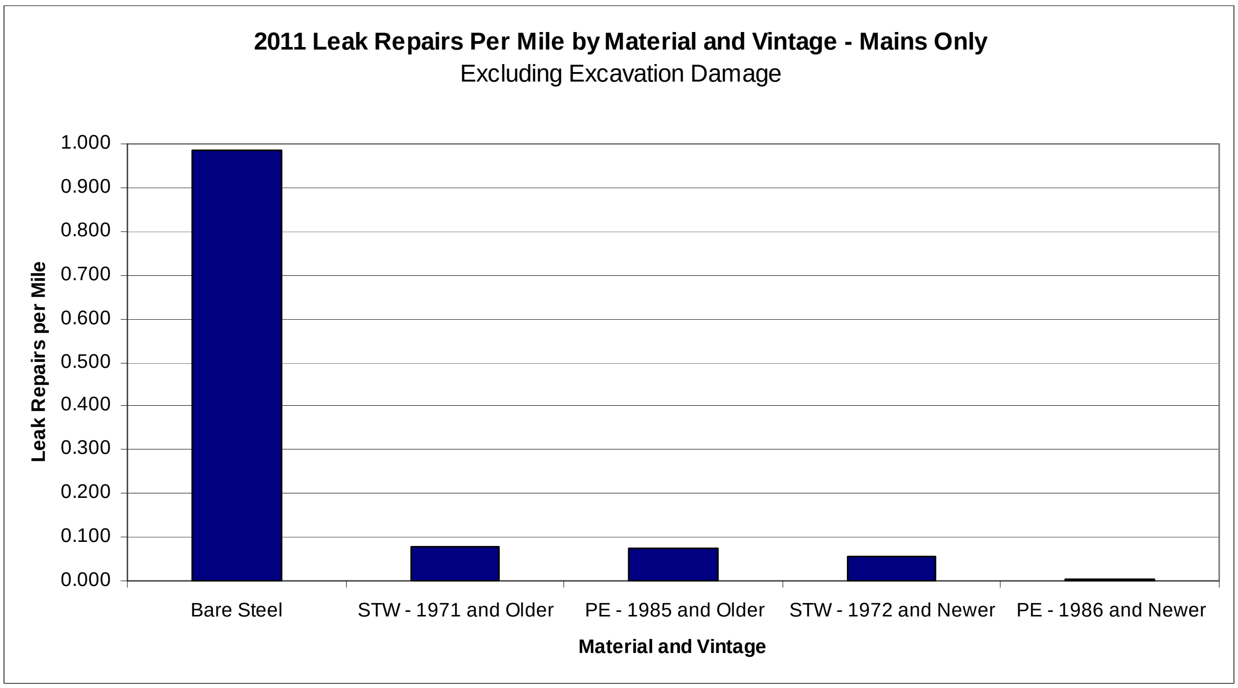


Figure 16. 2010 Repaired Leaks per Mile by Material and Vintage

PSE has also looked at trends related to the grade of leaks repaired by pipe material and vintage. As shown in Figure 17, bare steel has the highest concentration of grade all leak grades repaired per mile.

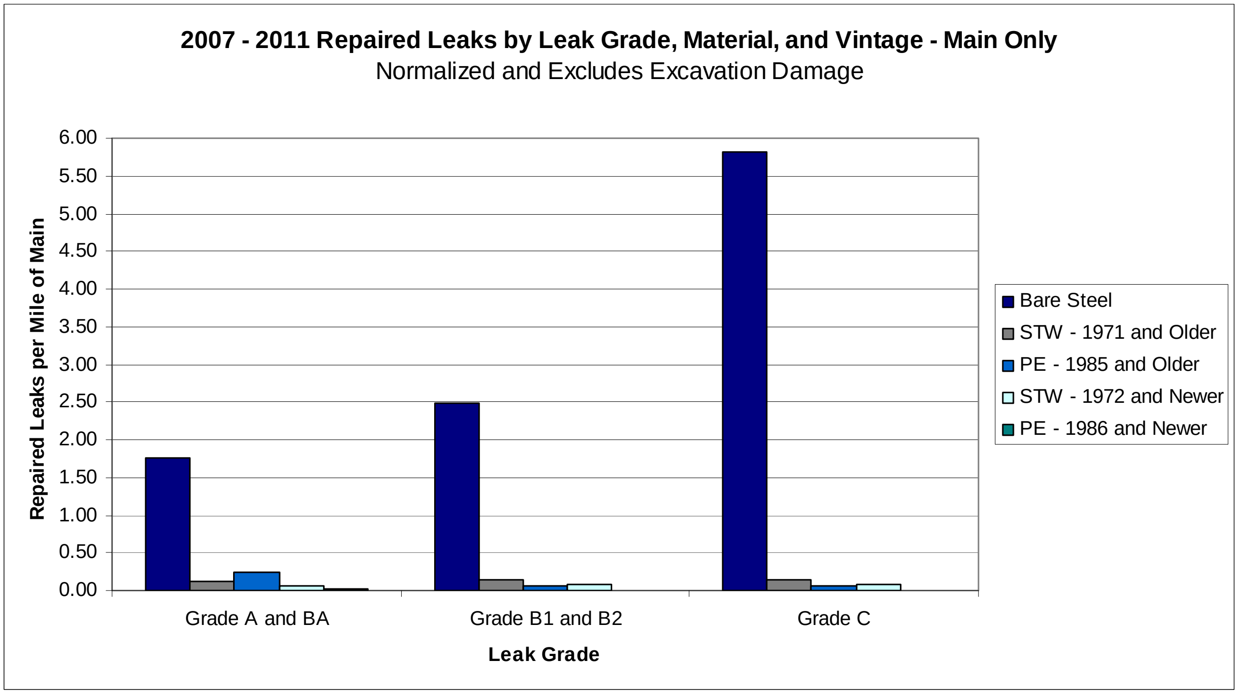


Figure 17. 2007-2011 Repaired Leaks by Leak Grade, Material, and Vintage – Mains Only

Additional analysis of leak repairs by grade and material type show leaks repaired on older vintage PE main are more than twice as likely to be hazardous than leaks repaired on older STW main or bare steel main. The following graph shows the original leak grade of leaks repaired on older PE main both as a 5 year average and for 2011.

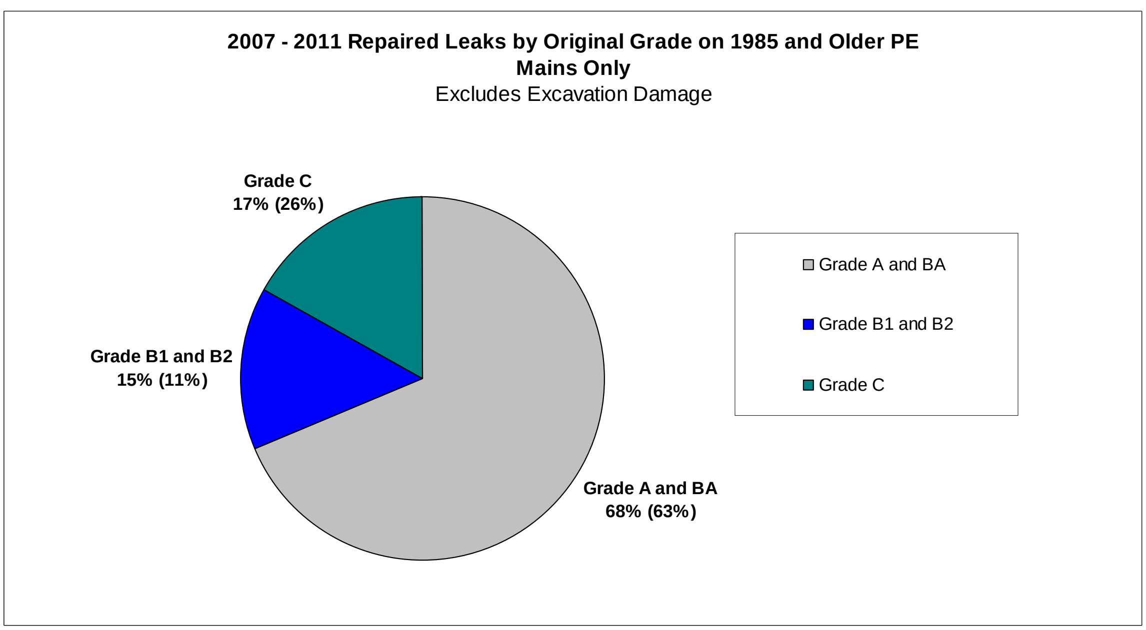


Figure 18. 2007-2011 Repaired leaks by Original Grade on 1985 and Older PE Mains

As shown in this graph, the original grade of repaired leaks on older PE main are hazardous approximately 65% of the time compared to 30% and 20% on older STW main and bare steel main respectively. This trend provides insight into the consequence of leaks especially on older vintage PE mains. Both the likelihood and consequence of a leak are part of PSE's risk analysis and are incorporated into risk ranking methodologies.

While the likelihood that a leak repaired on a main will be hazardous is significantly impacted by the material, leaks on services do not tend to be impacted as much by material. Over 50% of the time, leaks on services are hazardous regardless of the material. This is likely due to services being in closer proximity to buildings than mains are.

Leak Repair Methods

In addition to reviewing trends related to leak causes and leak repairs by material and vintage, PSE has analyzed trends related to how leaks are repaired. As discussed in the *Leak Trends* section of this report, approximately half of the leaks in the system that are repaired each year are due to excavation damage. Those leaks are repaired by a combination of maintenance and replacement.

For the remainder of the leaks, Figure 19 illustrates the mix of leak repairs performed by replacing or retiring facilities versus maintenance activities (i.e. installing leak clamps, greasing valves, tightening fittings, etc.).

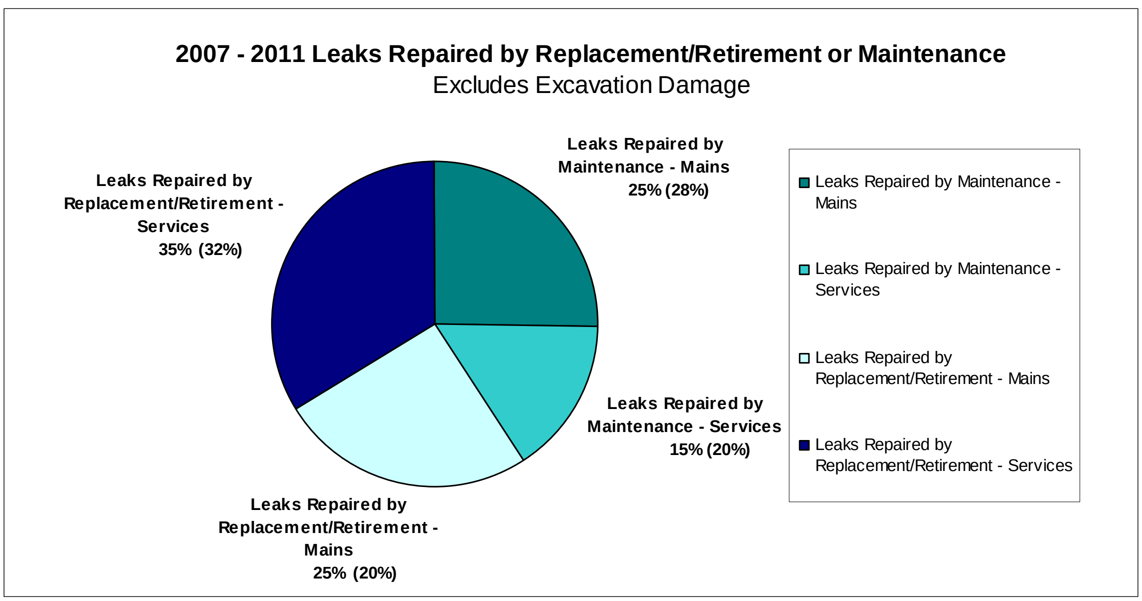


Figure 19. 2007-2011 Leaks Repaired by Replacement/Retirement or Maintenance

As shown in this graph, more than half of the leaks over the past 5 years have been repaired by replacement. The following graph shows the repair versus replacement trend for each of the past 5 years.

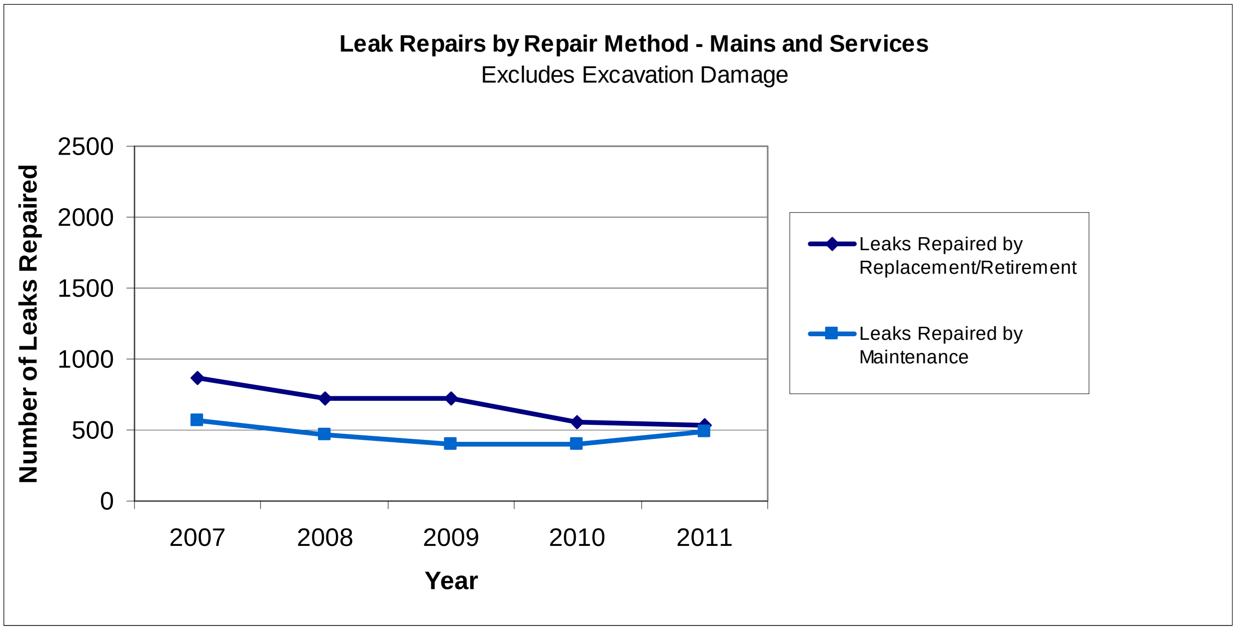


Figure 20. Leak Repairs by Repair Method – Mains and Services

This graph shows that repairs due to replacement are declining. This is likely due to the fact that replacements in prior years had a higher concentration of active leaks. As more facilities continue to be replaced, this trend is expected to continue as replacements will focus not only on active and historical leaks but also on more proactive replacement prior to leaks occurring that require repair.

The following graph shows the combination of repair methods for leaks repaired by maintenance.

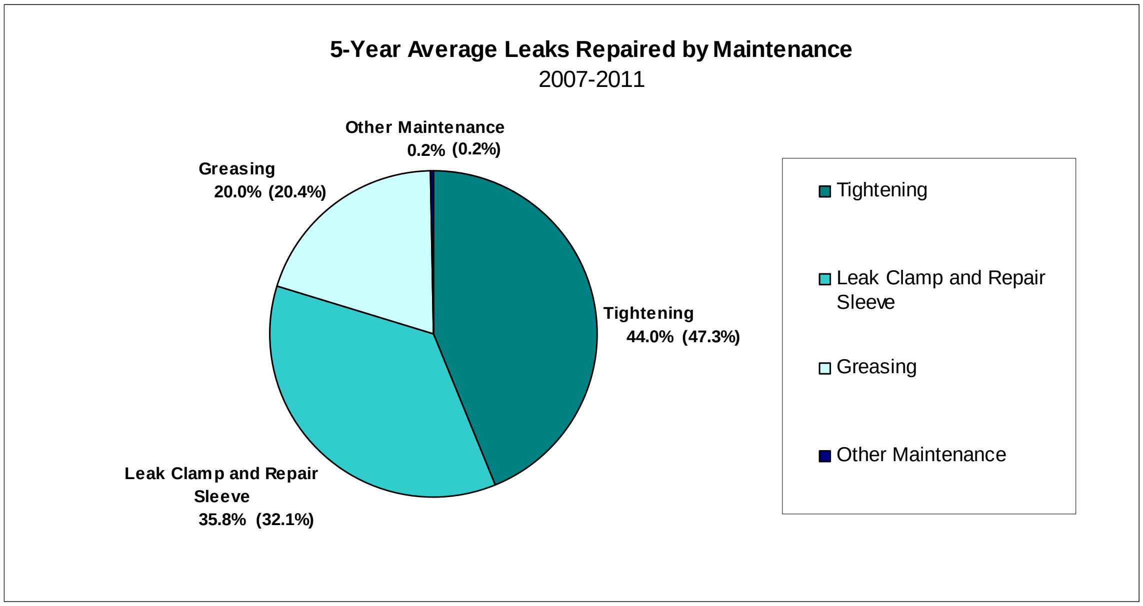


Figure 21. 5-Year Average Leaks Repaired by Maintenance

As shown in this graph, the majority of leaks repaired through maintenance are repaired by tightening or installing a leak clamp. The 2011 data shows a similar trend as the 5 year average data. These trends will continue to be evaluated to determine if there are any emerging threats that require additional mitigative measures.

Leak Repair Trends Conclusion

The review of leak repair data indicates that "Excavation Damage" has consistently remained the leading cause of leaks on the system which is consistent with industry trends. After "Excavation Damage", the next leading cause of leaks is attributed to "Other" and "Equipment". The leaks in this category are typical to find on a distribution system of PSE's age and are not indicative of any emerging trend.

"Corrosion" and "Material or Weld" are the next leading causes of leaks on the system each representing 8% of the total repaired leaks. The actual number of corrosion leak repairs is higher than represented in this data as most corrosion leaks on bare steel are repaired by replacing the pipe. As a result, the leak is not exposed and the leak cause is not able to be conclusively determined.

The leak repair trends support the direction PSE is headed in replacing all bare steel pipe as well as implementing programs to identify segments of older wrapped steel and older PE pipe that require additional mitigative measures to reduce risks. The data shows that while bare steel leak repairs continue to decrease each year, bare steel still has the highest density of leaks per mile. The data also shows that while leaks are not as dense on older PE mains, these leak repairs are significantly more likely to be a hazardous leak when found than on bare steel or wrapped steel mains. These trends provide insight into both the likelihood and consequence of failures and highlight the importance of the Older Vintage PE Pipe Mitigation Program.

Failure Analysis Trends

To provide additional understanding of leakage and failure trends, PSE has developed and implemented a failure analysis program as described in GOS 2575.1900 Investigating Failures of Pipeline Facilities. This program uses a combination of detailed failure analysis that is performed on physical specimens that are obtained from the field after a leak has been repaired and data that is obtained from the Leak Management System (LMS) when the repair does not involve removal of a failed specimen. Physical specimens may not be obtained for a variety of reasons including leaks that are not exposed when the leak is repaired by replacement or the facility is repaired in place through maintenance with a leak clamp or by greasing or tightening.

The detailed failure analysis provides additional data beyond the high level leak cause category. LMS information, such as material type, is confirmed and more detail on the failure such as failure category and failure type is obtained when there is adequate information to make a determination. The failure type classifies the failure as a weld failure, fusion failure, brittle-like cracking failure, mechanical joint failure or equipment failure. This information is the basis for the annual Construction Defect and Material Failure Report that PSE prepares for the WUTC. Beginning in 2011, this data is being used to report mechanical fitting failures that result in a hazardous leak to PHMSA as required under DIMP.

Failure Analysis on Wrapped Steel

Since joining procedures and mechanical fitting designs are dramatically different for steel and plastic systems, each material type will be reviewed separately, beginning with steel pipe. Figure 22 illustrates the construction defect and material failure data from the failure analysis findings for wrapped steel pipe and fittings.

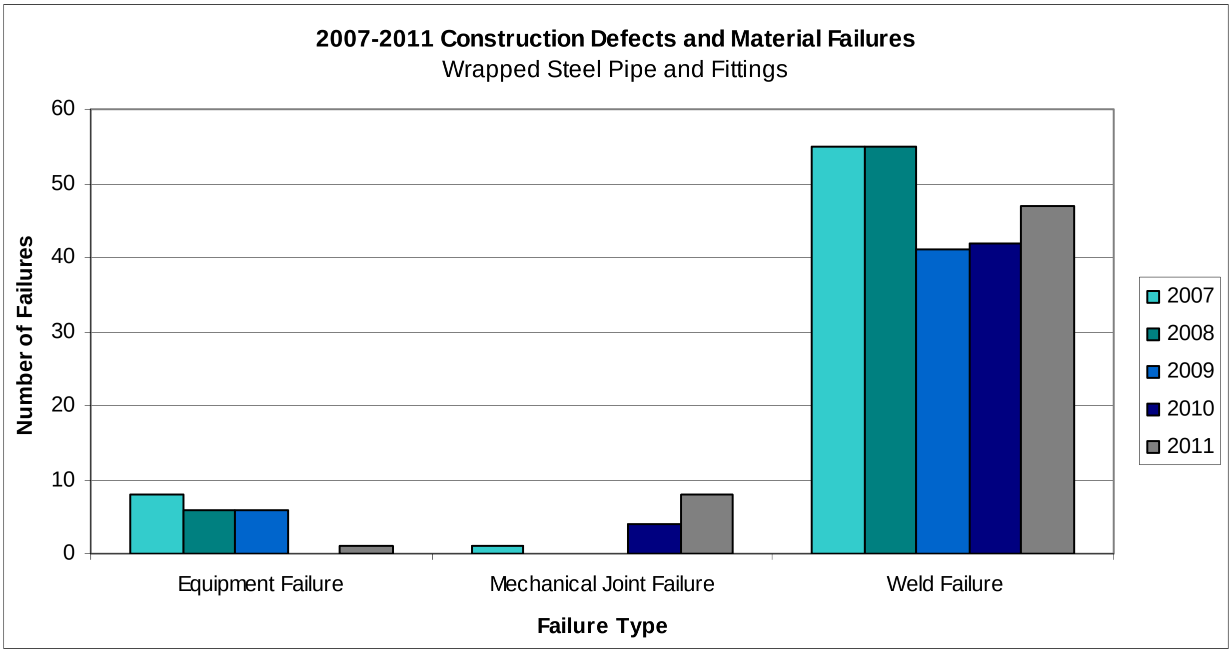


Figure 22. 2007-2011 Construction Defects and Material Failures – Wrapped Steel Pipe and Fittings

This graph shows weld failure as the leading cause of construction defect and material failure on wrapped steel pipe. The majority of these failures occur on older vintage STW pipe where the service tee is welded to the main. This graph also shows an increase in mechanical joint failures in recent years. Most of these failures were due to leaking service tee caps or leaking flanges on valves. The Wrapped Steel Pipe Mitigation Program discussed in *Part 4. Mitigative Measures and Additional and Accelerated Actions* assigns risk weightings to these failures, and segments are prioritized for mitigation based on the risk score. These trends will continue to be monitored and analyzed to determine if new or revised mitigative measures are necessary beyond the Wrapped Steel Pipe Mitigation Program.

Figure 23 shows the construction defect and material failure data on steel pipe by year the pipe was installed. As shown in this graph, steel pipe installed prior to 1972 has experienced the majority of failures within these two failure categories.

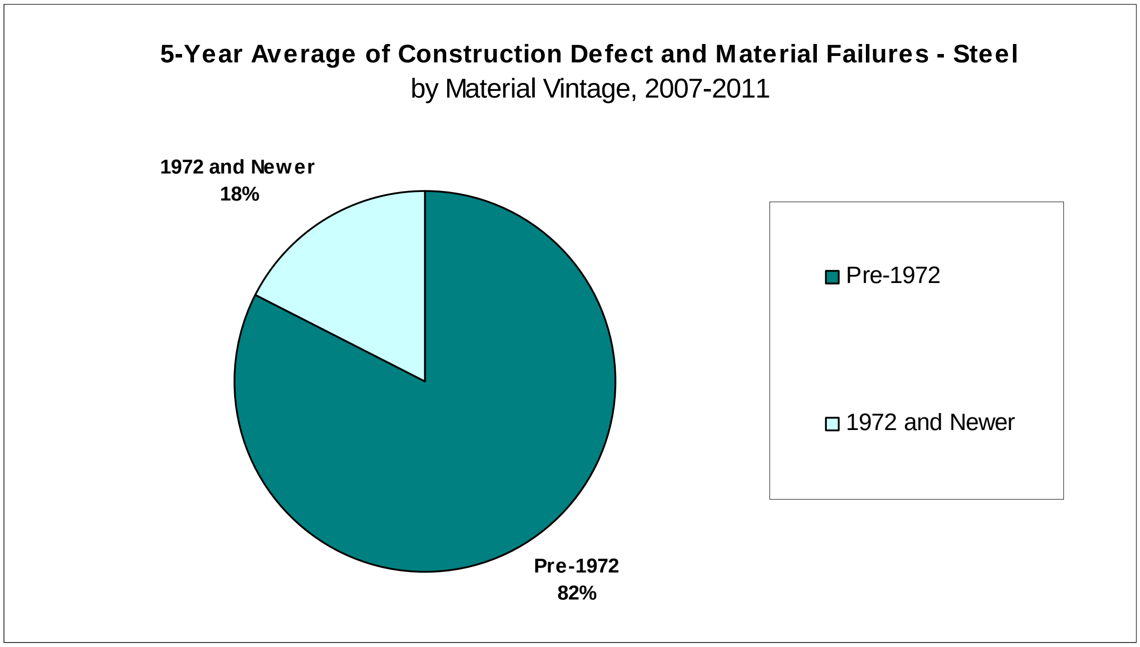
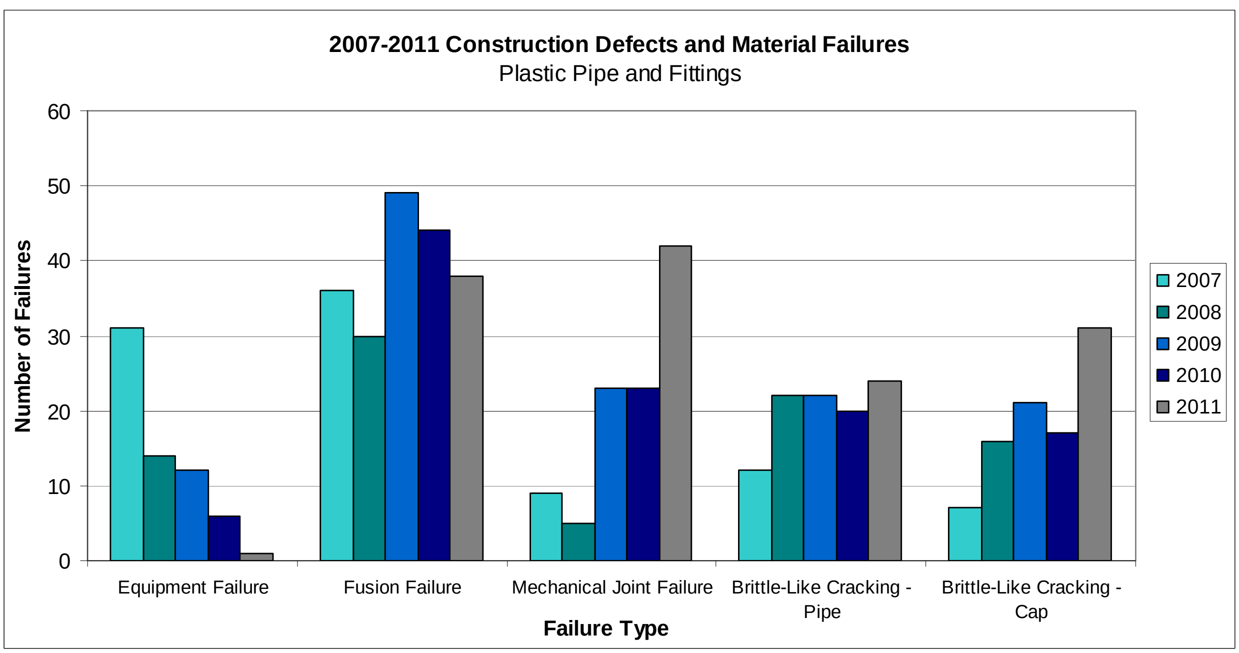


Figure 23. 5-Year Average of Construction Defect and Material Failures - Steel

Failure Analysis on Plastic

A similar review of construction defect and material failures was also analyzed for plastic pipe. This data is presented in Figure 24.



Note: In previous years, this graph had brittle-like cracking on PE service tee caps categorized as Equipment Failure or Brittle-like Cracking (general). To more accurately analyze these failures, additional analysis was performed on all years of data to categorize these failures more accurately.

Figure 24. 2007-2011 Construction Defects and Material Failures - Plastic

As shown in this graph, there has been a notable increase in the number of leaks due to brittle-like cracking of service tee caps as well as mechanical joint failures. This may be indicative of a trend or it may be due to continuous improvement in the Failure Analysis process that has resulted in more failures being categorized as Construction Defect or Material Failure and fewer failures categorized as Undetermined, Other, and Unknown.

Most of these PE service tee caps that failed due to cracking occurred on Plexco Celcon caps installed between 1990 and 1997. This is consistent with industry trends as Celcon has been identified as a material known to be susceptible to brittle-like cracking. Service tees installed after 1997 are unlikely to experience this failure as Plexco began using PE for their service tee caps in 1996.

Analysis of mechanical joint failures indicates there are no trends related to the type of mechanical joints that have failed. These failures include leaks on bolt-on tees, compression couplings, stab fittings, and service tee caps. Most of the leaks on service bolt-on tees occurred at the location where the O-ring in the saddle makes contact with the main. A more in depth failure analysis performed in January 2010 concluded that the root cause of failure was due to surface defects in the pipe surface that weakened the integrity and seal of the O-ring over time. As a result of the analysis, the importance of proper surface preparation was communicated through a company newsletter.

PSE began reporting all hazardous mechanical fitting failures to PHMSA in 2011 as required by the DIMP regulation. The majority of these failures occurred on older vintage plastic pipe. Analysis of these failures does not indicate a new trend that warrants additional mitigative measures. All these trends will continue to be monitored and analyzed to determine if new or revised mitigative measures are necessary.

Figure 25 shows the 5-year average of plastic construction defects and material failures by when the facility was installed. As shown in the graph, majority of failures occur on plastic pipe installed prior to 1986.

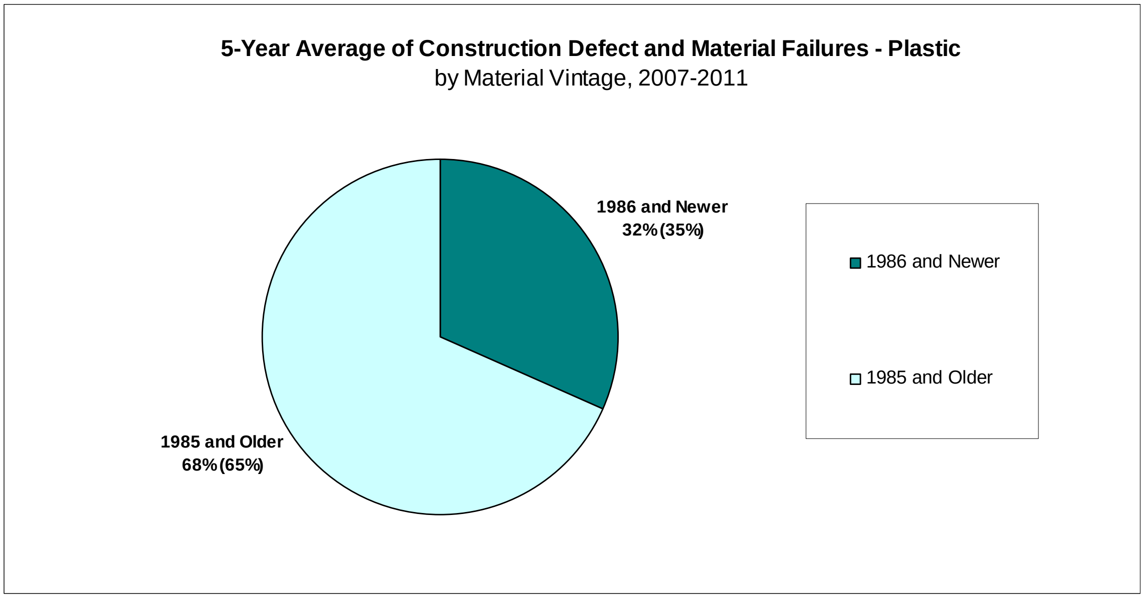


Figure 25. 5-Year Average of Construction Defect and Material Failures – Plastic

Additional analysis of construction defect and material failures on plastic pipe installed prior 1986 indicates that 70% of these failures are due to fusion failures or brittle-like cracking. This data is shown in Figure 26 and shows the trends in 2011 are consistent with the 5-year average.

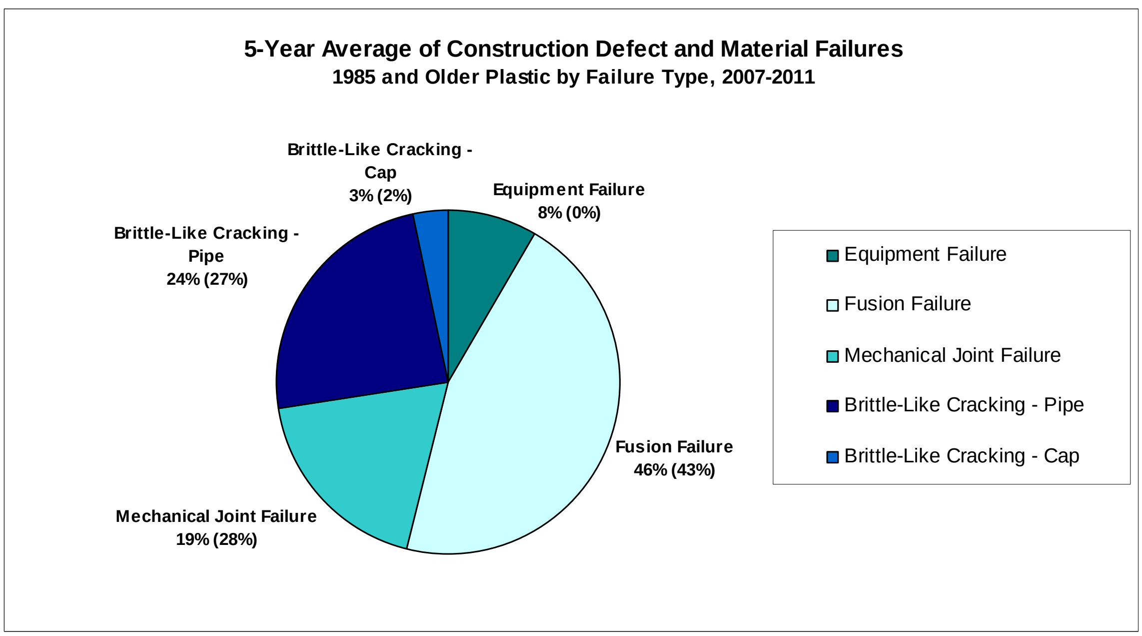


Figure 26. 5-Year Average of Construction Defect and Material Failures – 1985 and Older PE

Brittle-like cracking is primarily due to rock impingement but also occurs where the pipe has been squeezed or experienced point loading due to external forces. The Older Vintage PE Pipe Mitigation Program assigns risk weightings to fusion failures, brittle-like cracking, and reports of rock in the vicinity of PE pipe. Segments are prioritized for mitigation based on this risk score.

Analysis of construction defect and material failures on plastic pipe installed after 1986 indicates the majority of these failures are due to brittle-like cracking on PE service tee caps. As previously discussed, the brittle-like cracking cap failures occur mostly on the Celcon caps installed between 1990 and 1997. Figure 27 shows the root cause of these failures for both the 5-year average and for 2011.

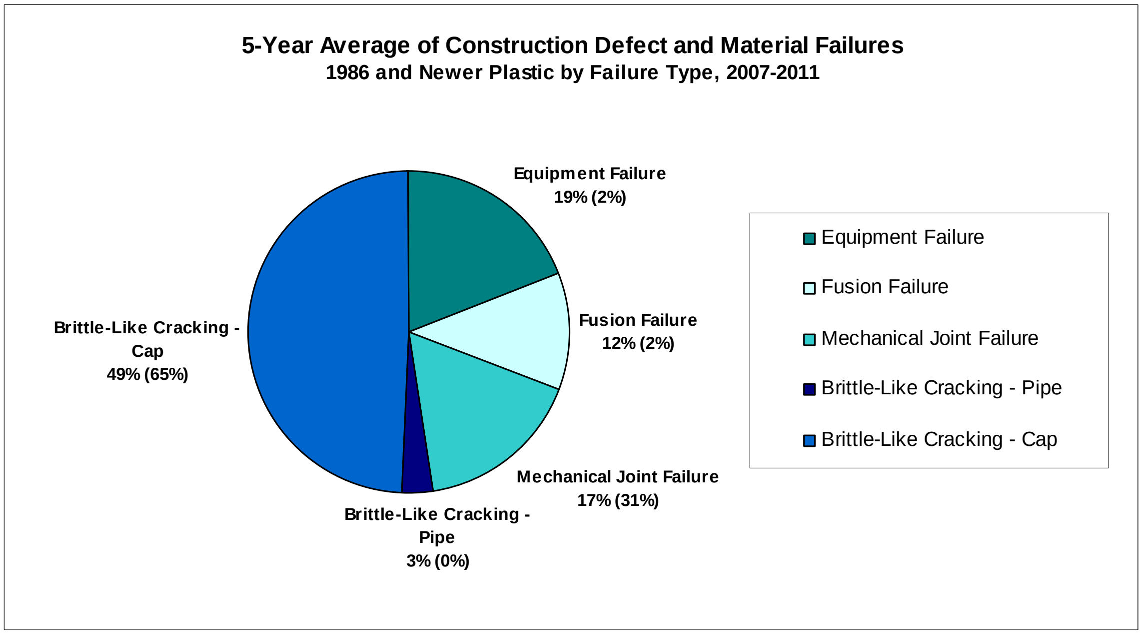


Figure 27. 5-Year Average of Construction Defect and Material Failures – 1986 and Newer PE

This graph shows an increase in the percent of construction defects and material failures due to mechanical joint failures in 2011. This increase may be indicative of a trend or it may be due to continuous improvement in the Failure Analysis process that has resulted in more failures being categorized; i.e. fewer failures are categorized as Undetermined, Other, and Unknown. It may also be due to increased attention on accurately categorizing mechanical fitting failures due to the requirement to report these to PHMSA. PSE will continue to monitor these trends as additional years of data are obtained to determine if there are any trends that indicate additional mitigative measures should be implemented.

Failure Analysis Trends Conclusion

A review of the failure analysis data indicates the year of installation is a significant factor in determining the likelihood of failure. The data indicates that wrapped steel pipe installed prior to 1972 and plastic pipe installed prior to 1986 have experienced the majority of failures due to construction defects and material failures. Other potential trends relative to wrapped steel and plastic pipe and fitting failures will continue to be evaluated and monitored, but at this time PSE's Older Wrapped Steel Pipe Mitigation Program and Older Vintage PE Pipe Mitigation Program are focused on identifying and replacing segments of pipe that are susceptible to these types of failures and should be addressing any potential future trends related to these failures.

System Condition Trends

Information on the system condition is gathered through various methods including through the Exposed Pipe Condition Reports, corrosion calls, and the inspections on the cathodic protection system. This data illustrates the health of the wrapped steel system based on how frequent corrosion is found on wrapped steel pipe, when corrosion is found how severe it is, what the different factors may have caused the corrosion, and the performance of the cathodic protection systems. The system condition trends have been analyzed and the following section presents the results.

Exposed Pipe Condition Reports

Based on a 4-year average from 2008 through 2011, wrapped steel pipe is exposed at nearly 5,000 locations each year due to routine maintenance, system expansion, and new customer hook-ups. Each of these exposures provides an opportunity to examine and report on the condition of the pipe. Figure 28 presents data obtained each time a section of wrapped steel pipe is exposed.

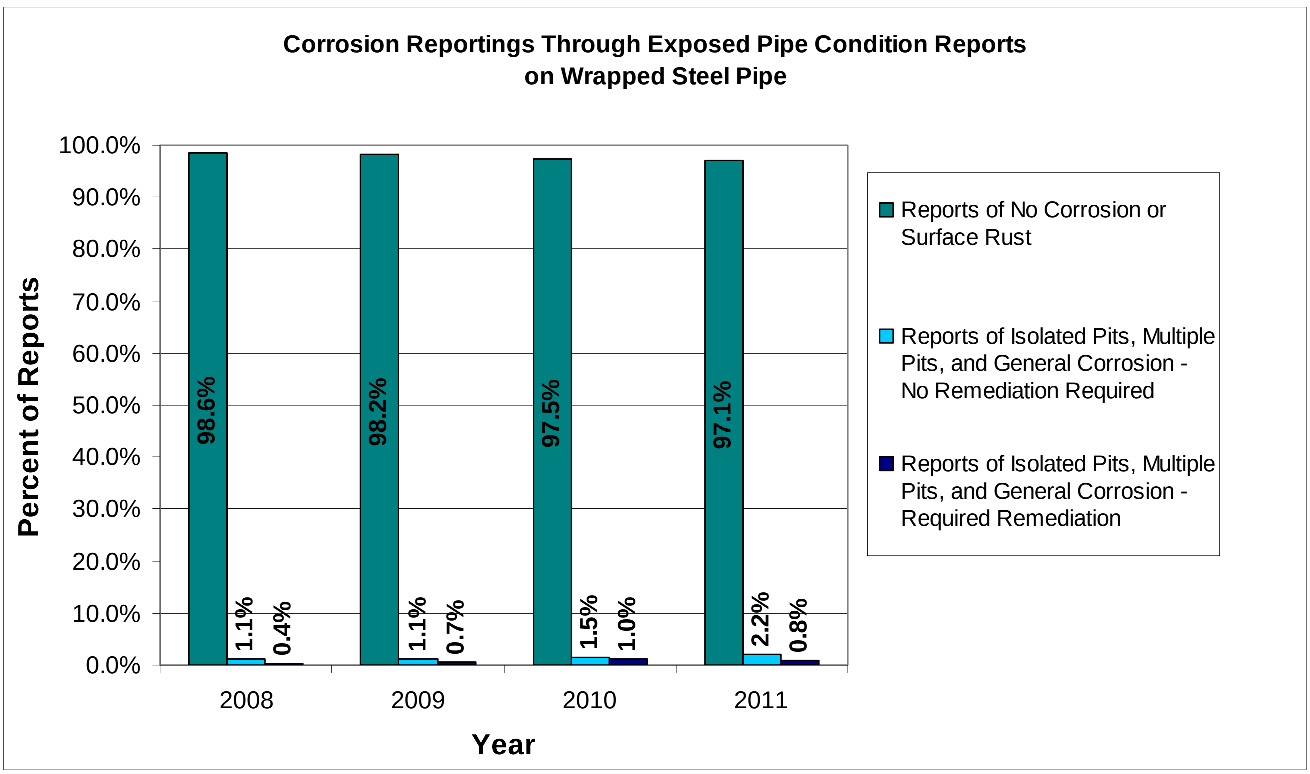


Figure 28. Corrosion Reportings through Exposed Pipe Condition Reports

This data shows that on average 98% of the time wrapped steel pipe is exposed there is no corrosion or only minor surface rust. It also shows that for the 2% of the time when corrosion is found, less than half require remediation.

PSE has limited the number of years of data that has been presented as additional training and emphasis on reporting corrosion has been undertaken since 2008 to provide consistency and additional clarity in the data. The data reported continues to improve and provide a more accurate representation of pipe condition. This makes it difficult to determine if there is a historical (pre-2008) trend related to corrosion, but will result in more accurate data in future years. PSE will continue to monitor this data to determine if there is a trend that warrants additional or modified mitigation activities.

Corrosion Calls

When Gas System Integrity department is notified that corrosion is found on wrapped steel pipe, additional data is collected. This data includes more specific information on coating conditions, corrosion characteristics, soil and environment conditions, and any other information that may assist in understanding what caused the corrosion. PSE analyzes this information to try to determine the primary root cause of the corrosion and the secondary cause. This data is further analyzed to determine if there are any trends that warrant attention. The results of this analysis are presented in the following section.

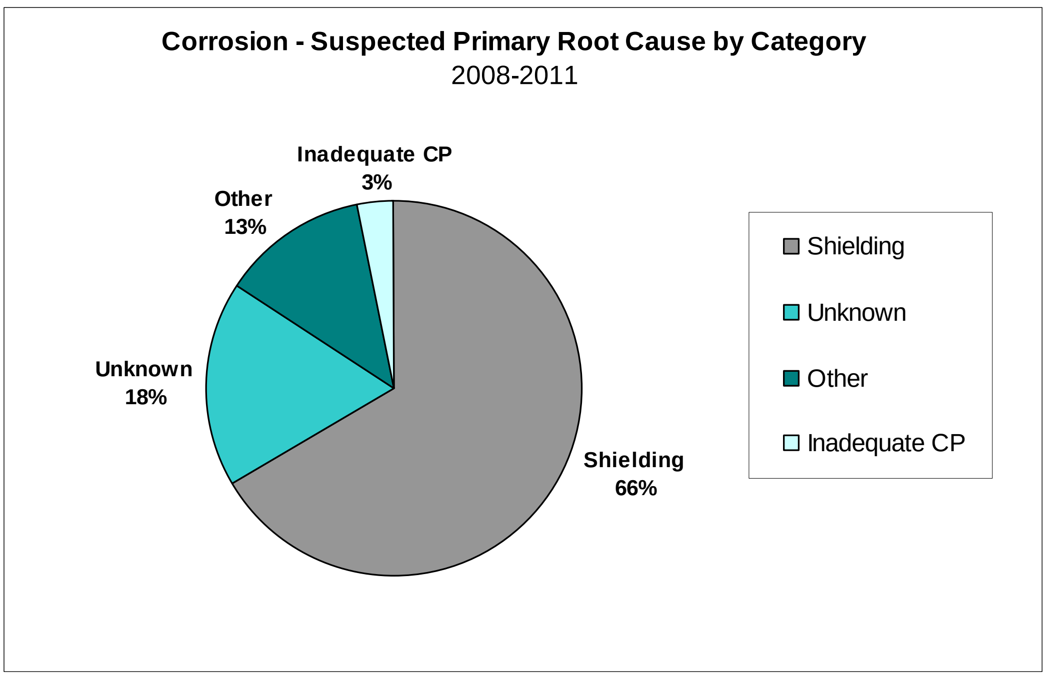


Figure 29. Corrosion Suspected Root Cause by Category

As shown in this graph, the most common cause of corrosion is due to the pipe being shielded from cathodic protection (CP). Shielding occurs when the CP current is not able to reach the pipe due to either disbonded coating or a foreign object near or in contact with the pipeline. Additional suspected root causes are categorized as either Unknown, Inadequate CP, or Other, The root cause is categorized as Inadequate CP when the cathodic protection is low at the time the pipe was exposed. Other includes where there are multiple contributors and it is difficult to determine which ultimately caused the corrosion.

As shielding is the most significant root cause of corrosion, Figure 30 provides additional information on the secondary root cause; i.e. what caused to the pipe to be shielded. Shielding of cathodic protection could be caused by either disbonded coating or an object in contact with the pipe. As shown in this graph, the most common causes are incorrect application of the coating, rocks in the backfill, and third party damage. Corrosion can also occur when the pipe is shielded by to foreign facilities and coating failures due to soil stress. Examples of shielding due to “Other” include material near the pipe such as wood timbers or asphalt that shields the pipe from CP.

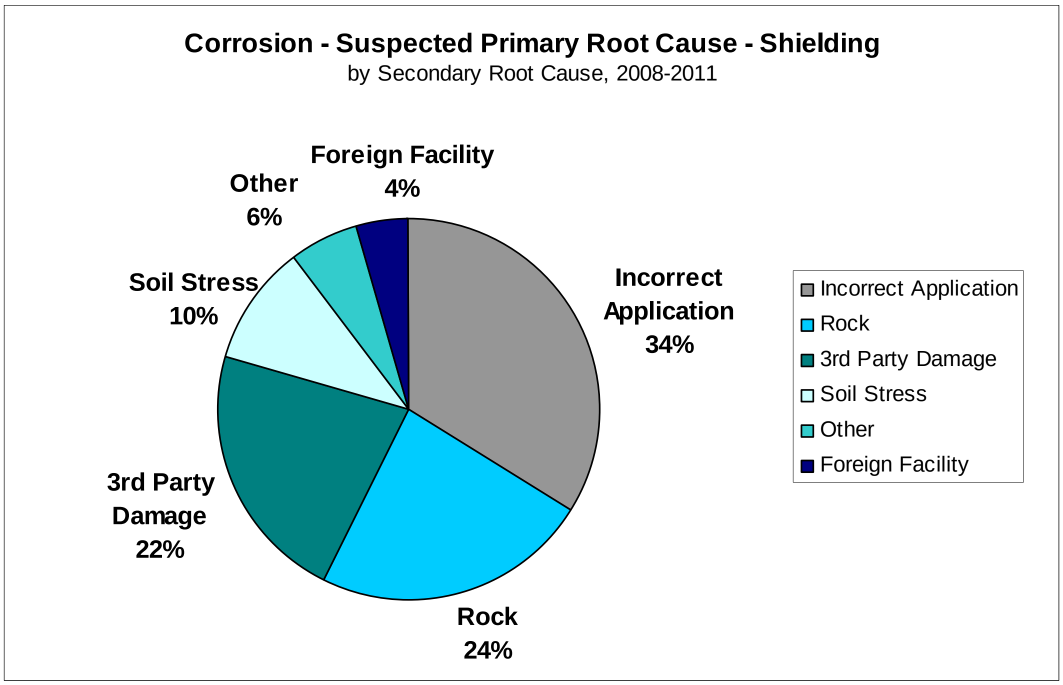


Figure 30. Corrosion Due to Shielding by Secondary Root Cause

Several measures have been implemented to address these issues. The Damage Prevention Program helps minimize damages that could cause coating failures, backfill procedures have improved to minimize the potential for rocks in the backfill that could damage the coating or shield the pipe from CP, and improved coatings and coating procedures are used minimize the potential for coating failures due to aging and incorrect application. Research into the failures due to incorrect application indicates that most of these failures occur where a field applied coal tar enamel tape (referred to as hot wrap) coating has been used. These failures also occur most frequently on service tees. This coating is difficult to correctly apply especially on irregular shaped surfaces such as service tees. Newer coatings that are now used for service tees include wax tape, mastic or epoxy. In addition, PVC or vinyl backed tape is primarily used for girth welds. These coatings are easier to apply and increase the likelihood of correct application.

Since shielding is the largest contributor to corrosion failures, the soil types and pipe vintages are further analyzed to understand what combinations of factors may lead to shielding. This data will continue to be monitored and may be incorporated into PSE's risk models if the data indicates this is appropriate. Figure 31 shows the different soil types that have been found in the backfill of where shielding has occurred.

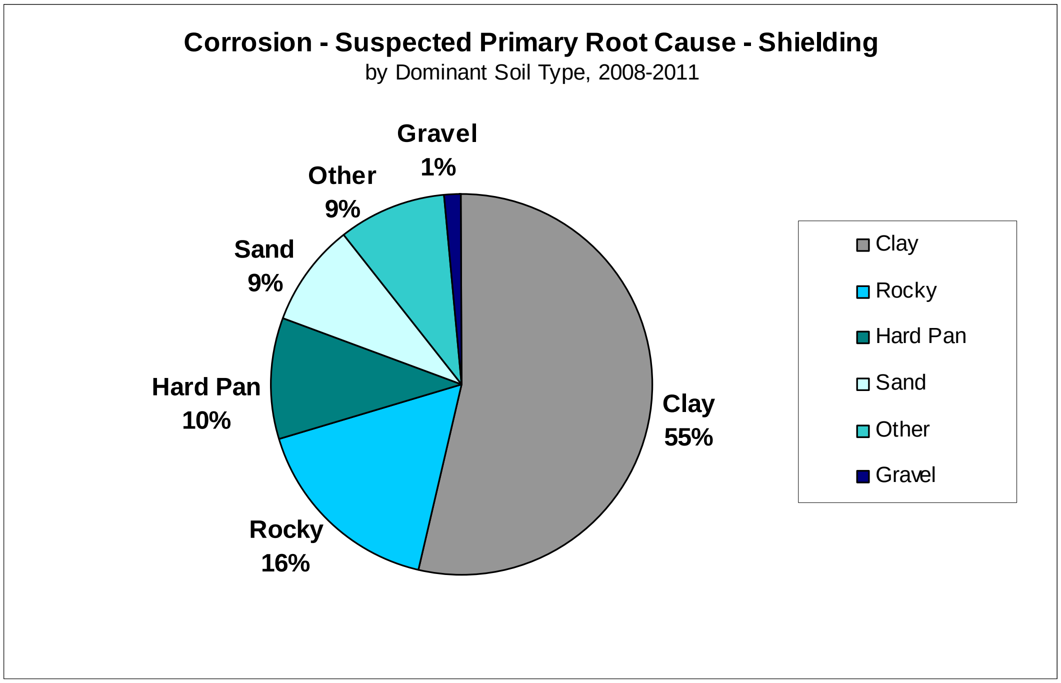


Figure 31. Corrosion Due to Shielding by Soil Type

Clay is the most dominant soil type found near corrosion failures due to shielding. Clay can contribute to coating becoming disbonded as it binds to the coating and expands and contracts with changes in moisture placing stress on the coating.

As seen in Figure 32, shielding occurs mostly on older vintage wrapped steel.

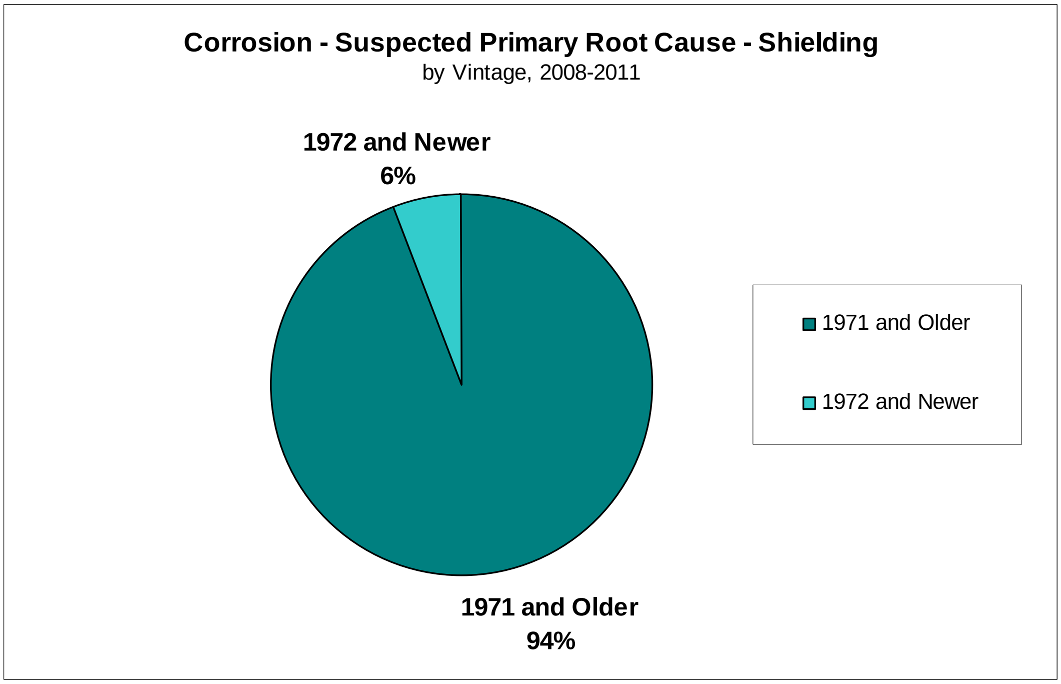


Figure 32. Corrosion Due to Shielding by Vintage

While shielding of cathodic protection is responsible for the majority of corrosion leaks, PSE will continue to monitor the trends to ensure that if any new trends emerge they are identified for further analysis to determine whether any additional risk mitigation actions should be implemented. PSE also includes these past failures in its Older Wrapped Steel Pipe Mitigation Program to assess the risk of additional failures occurring in a localized area and to understand system-wide risks. In addition to improved field procedures and materials, in 2011 improvements to the data capture has resulted in more consistent and comprehensive data collection. Also training and communication to field personnel will continue through 2012 to continue to improve the process on reporting corrosion and capturing data.

Cathodic Protection (CP) System Inspections

The cathodic protection (CP) systems in place are mainly made up of impressed current and galvanic systems. Each system has test sites that are monitored to confirm the pipe within the system is cathodically protected. Individually protected services also have a test site to confirm the service is cathodically protected.

Table 6 shows the number of systems, the number of test sites, and the miles of main protected for each CP system in addition to the number of individually protected services.

Table 6. 2011 Number of CP Systems and Miles of Main Protected[1]

CP System Type	Number of Systems	Number of Test Sites	Miles of Main Protected
Impressed Current System	294	7,454	3,574
Galvanic System	3,121	5,335	456
Individually Protected Services	36,345	36,345	-
Total	39,760	49,134	4,030

[1] Number of CP systems and miles of main protected are as of 4/4/2012

Annually test sites in each impressed current and galvanic system and at least 10% of test sites of individually protected services are inspected to confirm that the CP is adequately protecting the wrapped steel mains and services in the distribution system. As shown in Table 7, since 2008 the number of test sites passing inspection (i.e. found to be meeting cathodic protection criteria) is on average 97%. The remaining test sites that do not pass initial inspection require additional investigation and possibly remediation.

Table 7. 2008-2011 Total Number of Test Site Inspections and Results per Year

Year	Total Active Test Sites Inspected	Number of Active Test Sites Without Requiring Additional Investigation or Remediation	Number of Active Test Sites Requiring Additional Investigation or Remediation	% of Active Test Sites Without Requiring Additional Investigation or Remediation	% of Active Test Sites Requiring Additional Investigation or Remediation
2008	22,015	21,402	613	97.2%	2.8%
2009	19,789	19,216	573	97.1%	2.9%
2010	17,697	17,156	541	96.9%	3.1%
2011	15,738	15,296	442	97.2%	2.8%

Test sites associated with the impressed current or galvanic systems also provide more information into the CP system as shown in the following table.

Table 8. 2008-2011 Number of Cathodic Protection Systems Inspected and Results

CP System Type	2008	2009	2010	2011
Galvanic Systems				
Number of Systems Inspected	2831	3111	3110	3083
Percent of Systems Requiring No Additional Investigation or Remediation	98%	97%	97%	98%
Percent of Systems Requiring Additional Investigation or Remediation	2%	3%	3%	2%
Impressed Current Systems				
Number of Systems Inspected	281	296	295	297
Percent of Systems Requiring No Additional Investigation or Remediation	76%	75%	74%	78%
Percent of Systems Requiring Additional Investigation or Remediation	24%	25%	26%	22%

One trend that is illustrated in

Table 8 is that the an average of 98% of galvanic systems pass the initial inspection requiring no additional investigation or remediation compared to impressed current systems where the average systems that pass initial inspection is 76%. This is likely to be attributed to the fact that impressed current systems are much larger than galvanic systems. As shown previously in

Table 6, impressed current systems protect about 90% of the wrapped steel pipe while comprising less than 10% of the total number of CP systems.

It is important to note in evaluating this trend that a system is only considered to pass the initial inspection if all the test sites on the system pass the initial inspection. Due to the size of the impressed current systems, they are more likely than the galvanic system to have troubleshooting or maintenance work being performed that may result in one or more test sites not meeting the inspection criteria but may not indicate the system requires remediation.

In recent years, PSE has been working to make the impressed current systems smaller. This is beneficial as it makes troubleshooting easier when CP does not meet the inspection criteria, thus decreasing the length of time to determine whether remediation is required and subsequently also reducing the time to complete remediation when required. It also provides better current distribution, resulting in more evenly applied cathodic protection throughout the system.

Another trend is the increase in the number of individual test sites that pass the initial inspection. These test sites are inspected at least every 10 years. As shown in

Table 9, the percent of test sites passing inspection was fairly steady from 2000 – 2004. In 2005, the number passing initial inspection began increasing and has remained above previous levels.

Table 9. Number of Individual Test Sites Inspected

Year	Total Number of Active Individual Test Sites Inspected	Number of Individual Test Sites without Requiring Additional Investigation or Remediation	Number of Individual Test Sites that Require Additional Investigation or Remediation	% of Individual Test Sites that Sites without Requiring Additional Investigation or Remediation	% of Individual Test Sites that Require Additional Investigation or Remediation
2001	3457	3247	210	94%	6%
2002	3691	3473	218	94%	6%
2003	2829	2636	193	93%	7%
2004	2862	2684	178	94%	6%
2005	2642	2517	125	95%	5%
2006	3656	3543	113	97%	3%
2007	5256	5067	189	96%	4%
2008	8756	8619	137	98%	2%
2009	6747	6608	139	98%	2%
2010	4679	4548	131	97%	3%
2011	2918	2808	110	96%	4%

System Condition Report Trends Conclusion

Analysis of the data gained from Exposed Pipe Condition Reports and data obtained when corrosion is found indicates that our cathodic protection is adequately protecting the wrapped steel pipe from corrosion. Over 98% of the time wrapped steel pipe is exposed there is no corrosion or only minor surface rust. When corrosion is found, the cause is typically related to shielding due to a local issue that is not indicative of system wide issues. Enhancements to backfill procedures, improved materials, and reduced third party damages are all helping reduce future failures. In addition, the risk models PSE uses to evaluate STW systems incorporate these trends.

Federally Reportable Incident Trends

There are very few federally reportable incidents over the past 10 years, thus no trends have been identified. However, these incidents are still worth examining as they represent specific situations where the consequence of a risk is significant. In each of these instances, PSE has examined the root cause and where appropriate PSE has implemented additional measures as described below to reduce future risks.

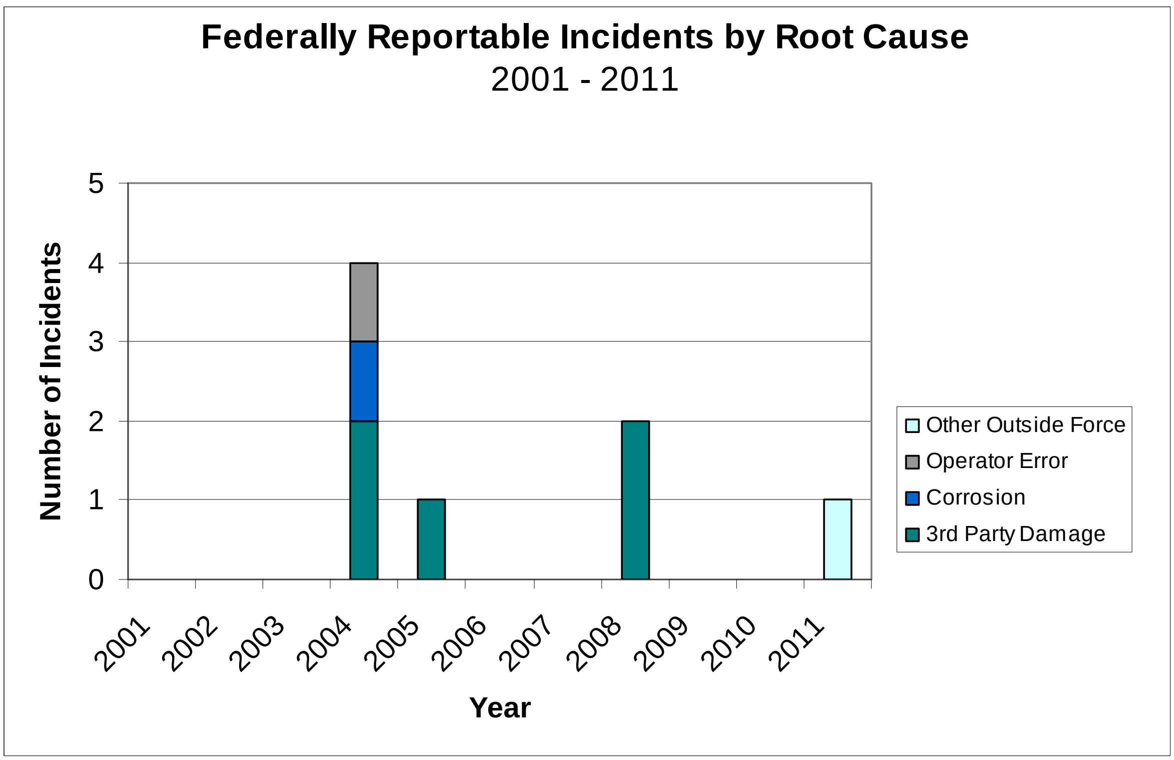


Figure 33. Federally Reportable Incidents by Root Cause

Note: In 2011 there were three incidents that were federally reported. Two of them would have been retracted if there was a process to withdraw reports based on additional information that indicated these incidents did not meet the requirements for federally reporting. Therefore, these two are not included in the analysis and trending.

This data illustrates that third party damage is not only the leading cause of leaks on PSE's system but is also the leading cause of reportable incidents. The Third Party Damage Prevention Trends section discusses PSE's Damage Prevention Program and the efforts to continue to reduce third party damage.

There were three incidents that were not caused by third party damage in the period from 2001 to 2011 and three due to third party damage. The corrosion incident resulted in the Wrapped Steel Service Assessment Program (WSSAP) that is discussed in the Gas Maintenance Programs section of this report. This program addresses the additional risk knowledge gained from this corrosion incident.

The operator error incident caused personal injury requiring hospitalization. PSE's review of this incident concluded that PSE's operating standards and procedures in place at the time were adequate and would have prevented that incident if followed. Both PSE personnel and its contractors reviewed the incident with their employees at safety meetings and reinforced the need and importance of following operating standards and procedures.

The incident that was due to Other Outside Force Damage occurred due to a chain of events that caused the wrapped steel distribution system to become energized resulting in leaks where the current left the pipe. PSE began leak surveying the area following the identification of two leaks due to the pipe being energized. A third leak was identified and all three leaks were repaired. The fourth leak was not identified prior to the incident. PSE has reviewed this incident, has debriefed emergency response personnel on the incident, and does not believe any additional actions are necessary at this time.

Federally Reportable Incidents Trends Conclusion

There are very few federally reportable incidents over time and as a result, there is not a significant trend shown in this data. The data shows that third party damage remains the leading cause of reportable incidents.

Third Party Damage Prevention Trends

Through Damage Prevention and Public Awareness Programs, PSE proactively works with public officials, contractors and homeowners to increase awareness of RCW 19.122, Washington State's call-before-you-dig statute. PSE uses a variety of methods to communicate these messages including bill inserts, direct mailings, on-site safety meetings, training sessions, contractor dinners, home-shows and memberships in state and local utility coordinating councils.

Figure 34 shows both the number of locate requests per year as well as the number of damages per year. Through 2007, locate requests had been surging as a result of the region's active growth and focused "call-before-you-dig" awareness programs. Since 2008, the number of locate requests has steadily decreased, most likely due to the significant reduction in construction activity attributed to the economic slowdown.

Further reductions in the number of locate requests have occurred due to improvements PSE made to its locating processes and procedures. These improvements include refining the maps that the One Call Center uses to identify where PSE has natural gas facilities and revising codes used by the locate contractors to more accurately reflect when PSE natural gas facilities were located versus PSE electric facilities. These improvements had an impact on the number of locate requests counted for 2011 and are expected to have an even larger impact in 2012 when the improvements will be in place for the entire year.

Figure 34 also shows the number of excavation damages per year which have steadily declined over this period of time. While locate requests have continued to decline since 2007, damages have also declined. In 2011, the number of third party damages increased slightly from 2010. However, 2010 and 2011 remain the two lowest years reported in the prior 9 years.

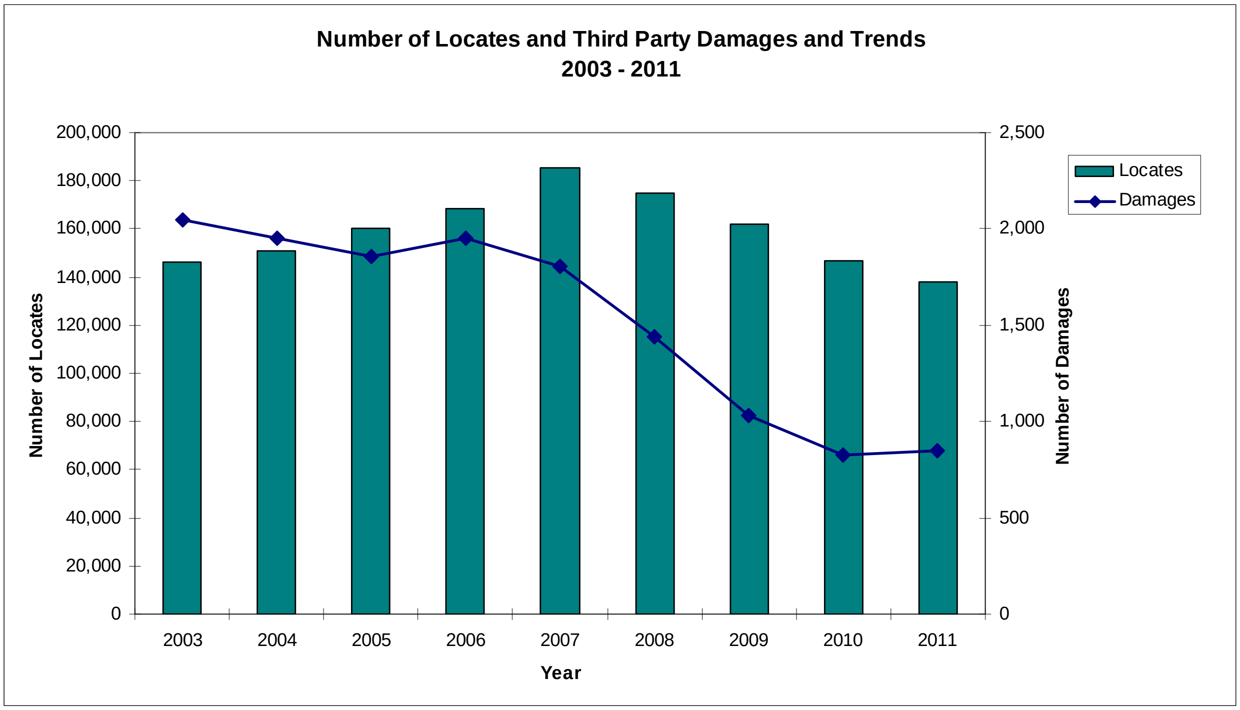


Figure 34. Number of Locates and Third Party Damages and Trends

Figure 35 is another way to look at the data and gain insight into third party damage trends. This graph presents the data as a ratio of number of damages per 1,000 locate requests. The Common Ground Alliance and industry in general have accepted representing the ratio of damages per 1,000 locates in this normalized method in order to better reflect the impact of increasing and decreasing excavation activity on third party damage metrics.

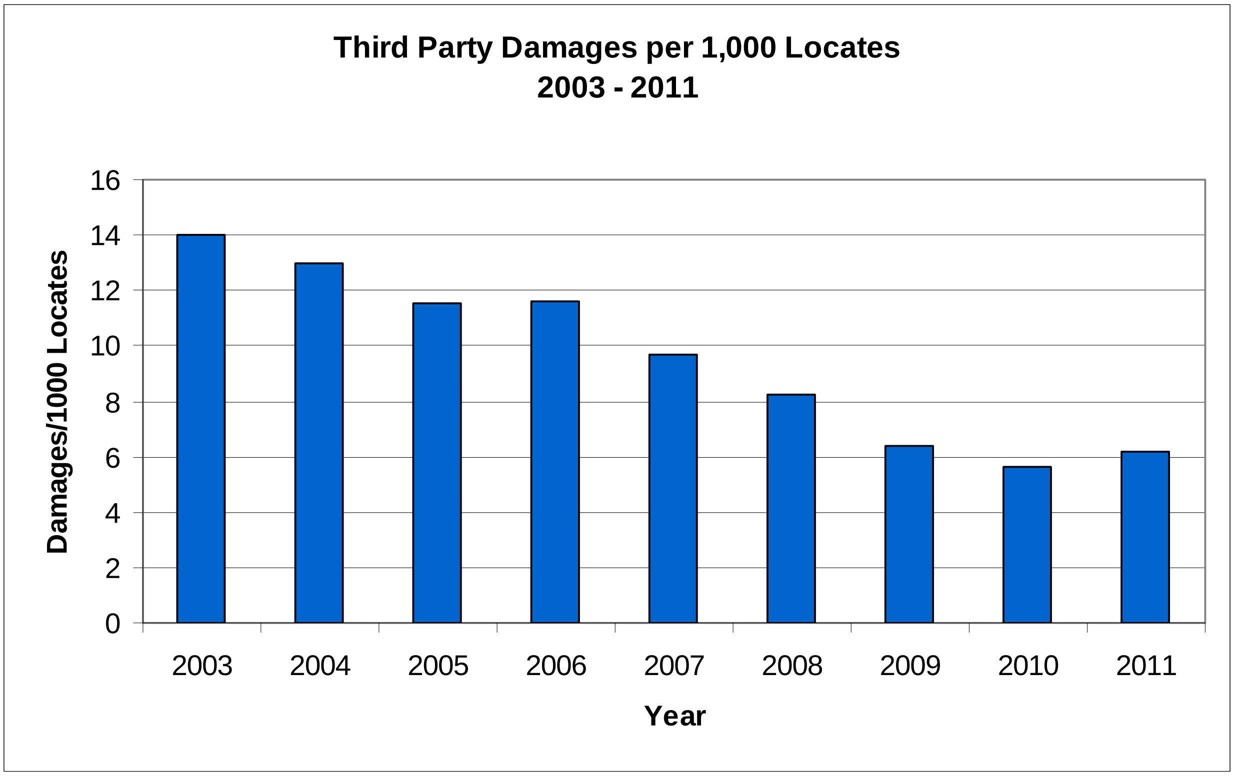


Figure 35. Third Party Damages per 1,000 Locates

This graph illustrates the success PSE has had in reducing damages per locate request. The slight increase in 2011 in the number of damages per 1,000 locate request is due in part to the improvements in the locating process described above that resulted in fewer locate requests being counted. Even with this change, 2010 and 2011 remain the two lowest years reported in the prior 9 years. This positive trend has been achieved through a combination of efforts. The most significant reductions have been achieved by excavators using more careful excavation practices and increased public awareness of and adherence to the regulations that require excavators to call for locates prior to excavating as illustrated in Figure 36.

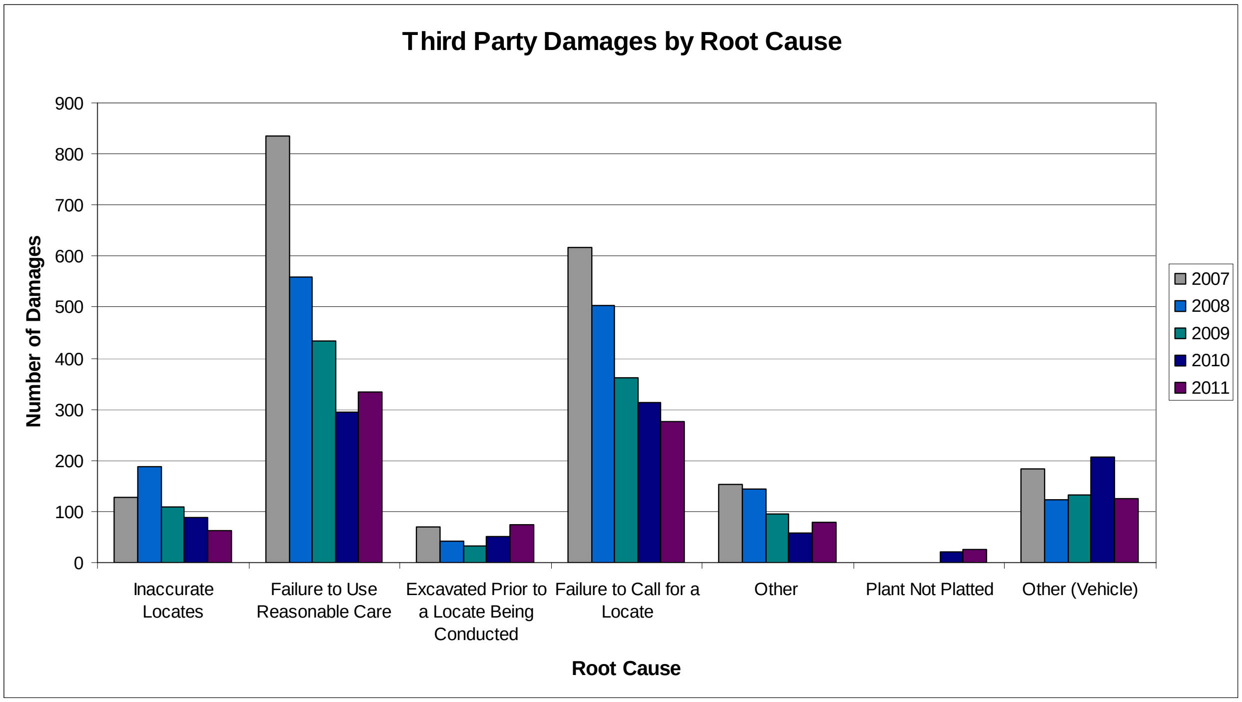


Figure 36. Third Party Damages by Root Cause

While there have been significant reductions in the number of damages due to "Failure to Use Reasonable Care" and "Failure to Call for a Locate", these two categories are still the leading cause of third party damages. PSE recognizes that a key element required to further reduce these damages will require an enhanced approach to enforcing the requirements of RCW 19.122 relative to both calling before excavation and careful excavation practices. This is supported by research AGA has done to benchmark damage prevention programs across the country. Based on this research, distribution companies operating in states that have mechanisms to enforce damage prevention legislation are able to achieve the lowest number of damages per 1,000 locates.

New Washington State damage prevention legislation was passed in 2011 and will become effective on January 1, 2013 that will facilitate enforcement of the damage prevention regulations. This legislation requires a safety committee to be formed to evaluate complaints from both excavators and utilities. Based on their evaluation, the committee will make recommendations to the WUTC regarding fines for violations of the regulations. The WUTC and the Attorney General will use these recommendations to determine when to issue fines. In addition, the regulation specifies more detailed requirements for both utilities and excavators related to locate marking requirements and locate requests. The goal of the legislation is to continue to reduce damages to underground and above ground facilities

Third Party Damage Prevention Trends Conclusion

PSE has achieved significant reductions in third party damage over the past several years. Even with these improvements, third party damage remains the leading cause of leaks on our system. This trend is consistent throughout the industry and highlights the need to continue to work to reduce these damages with a focus on collaborating with all stakeholders to improve awareness of and compliance with the damage prevention regulations. New Washington State legislation that will become effective in 2013 is expected to reduce damages to underground facilities by providing more detailed damage prevention requirements for both excavators and utilities and improving enforcement of the damage prevention regulations.

Potential Threat Identification and Data Initiatives

In analyzing the system trends, PSE does not only gain more risk knowledge into existing threats, but indications of potential threats may emerge from this analysis. In addition to reviewing for potential threats, opportunities for data improvement may also be determined which could include capturing additional data and/or improving data accuracy and integrity.

Potential Threat Identification

PSE has reviewed system performance data and operational metrics to determine whether there are new or emerging threats that have not previously been identified. The results of this review are provided in the following section.

Field Identified System Conditions

PSE obtains information about the condition of the distribution system through a variety of means. This includes conditions identified during inspection and maintenance activities such as leak surveys, leak repairs, cathodic protection test site monitoring, valve inspections, and regulator station inspections as well as when responding to odor calls and customer concerns.

There are two primary methods of recording and reporting this information. These include the Abnormal or Unusual Operating Condition Reporting (Blue Card) process or the Gas Work Request (GWR) process. Both processes are described below including how these processes are used to remediate system conditions and identify potential threats.

Report of Abnormal or Unusual Operating Condition (Blue Card) Process
When "Suspected Unsafe" or "Suspected Unsatisfactory Conditions" are observed, a Report of Abnormal or Unusual Operating Condition (Blue Card) is completed. "Suspected Unsafe Conditions" are investigated by GFR to determine if remediation is required. When appropriate, GFR schedules the remediation or remediates the condition at the time it is identified. Otherwise, GFR creates a work request that follows the GWR process when remediation is required. When remediation involves a complex solution, GFR contacts GSI for assistance in developing and implementing the solution.

When "Suspected Unsatisfactory" conditions are found, the Blue Card is sent to GSI.
Other issues are logged in a database and evaluated to determine remediation priorities. Many issues are site specific such as when access to our facilities has been obstructed or our facilities have been encroached by customer revisions to their property. In addition to prioritizing these site specific issues for remediation, GSI looks for potential threats that may be grouped by

similar issues where remediation may be most efficiently accomplished by developing a specific program. Examples of programs that are being developed based on trends identified from this review include the Buried MSA Remediation Program, Traffic Protection Enhancements Program, and Shallow Main and Service Remediation Program. The 2011 review of Blue Card reports identified the need for the development of an enhanced response to reported encroachments outside of mobile home communities. This program currently is in development and is described in more detail in *Part 4. Mitigative Measures and Additional and Accelerated Actions* of this report.

In addition to “Suspected Unsafe” and “Suspected Unsatisfactory”, “Non-Standard” conditions were reported on the initial version of the Blue Card. This form and the associated Gas Operating Standard were updated in March of 2011 to eliminate future reporting of non-standard conditions. This improvement was made due to the high volume of reports of non-standard conditions that required no action and interfered with the ability to identify and respond in a timely manner to higher risk issues.

Prior to eliminating reports of “Non-Standard” conditions, PSE reviewed the issues being reported as “Non-Standard” to determine if there were some situations that might be appropriate to report as “Suspected Unsatisfactory”. One possible example of this is reports of non-standard regulator vent locations. Any regulator vent within 2 feet of a mechanical air intake is currently reported as “Suspected Unsafe”. In 2012, PSE has begun a pilot program to inspect a sampling of previously reported non-standard vent locations. The data gathered from these inspections will be used by SMEs to determine what conditions constitute an unsatisfactory vent configuration and include this in the next revision of the Blue Card.

Gas Work Request (GWR) Process

When Gas Operations identifies a system condition that requires remediation, they either complete a Blue Card or initiate a work request that is sent to the service provider for remediation. The GWR process was developed and implemented in 2010 to facilitate prioritizing this work, clearly communicating the scope of the work requested, and tracking the progress of completing the work. The process provides guidelines for work requests to be categorized as safety, compliance, or system O&M work. Safety issues are those that should be remediated in 10 business days or less. Compliance issues are those that have a regulatory defined timeframe for remediating. System O&M are issues that do not fit in the other two categories.

All work requests are entered into SAP work management system providing for a more consistent format for communicating the scope of work and providing the ability to track the status of the work. Additional benefits of the GWR process include the ability for GSI to determine if there are any trends in work requests that indicate a potential threat as well as review work to identify opportunities to expand the scope of work to address multiple integrity issues.

Since implementation, potential threats that have been identified through this process are similar to those that have been identified through the Blue Card Process. As a result, GSI has communicated to Gas Operations the benefits of reporting these issues through the Blue Card process to enable these issues to be prioritized and remediated through the appropriate program.

Examples of opportunities to expand the scope of work to address multiple integrity issues include concerns with inaccessible meters and piping, inoperable curb valves, and inadequate traffic protection. GSI manages several service related maintenance programs and projects such as the Alaska Way Viaduct Project and the STW Services in Casing Program that have benefited by being able to combine scope with work identified through the GWR process.

Contaminated Soil

In 2010, PSE identified a wrapped steel high pressure pipeline which had its coating compromised by a petrochemical spill in the area. The segment that was impacted was remediated in 2011 by removing the original coal tar enamel coating, cleaning the pipe, and recoating with a chemical resistant coating. PSE is evaluating whether additional measures should be taken to investigative known or suspected contaminated areas that may adversely impact the coating on PSE's wrapped steel facilities.

A similar issue was investigated regarding PE in the vicinity of contaminated soil. In general, PE is very resistant to contaminated soil. PSE is investigating the manufacturer's recommendations when PE is found to be in contaminated soil and whether there are any additional measures that should be taken depending on the type of contamination and operation and maintenance activity planned; i.e. fusion, squeezing, etc.

Data Initiatives

PSE's review of system knowledge and system performance data and trends has identified four areas where there are opportunities to capture additional data and/or improve in data accuracy to improve system risk understanding. PSE's plans for capturing data and improving data integrity for each of these areas are described in the following section.

Geographic Information System (GIS)

PSE has determined that implementing a Geographic Information System (GIS) will enable it to improve many aspects of its operation including improving risk knowledge and providing additional integrity management tools. As a result, PSE has undertaken a project to implement a GIS for both its gas and electric systems. The process of converting the information captured on both the paper maps (plat maps) and the D-4 cards (service records) to a GIS has begun. The conversion of the entire natural gas system is targeted to be completed by the end of 2012. Some areas of the system have already been fully converted and are available to begin using.

In addition to the baseline GIS, PSE has been evaluating additional applications that may further enhance the overall system knowledge as well as our risk knowledge. These include the leak analysis, cathodic protection system manager, and geospatial analysis applications. PSE has begun developing the specifications for linking these applications to PSE's other databases such as the Leak Management System (LMS) and SAP work management system. Other applications are still being evaluated to more fully understand how these applications would be used to improve risk knowledge and risk ranking as well as what is required for implementation. It is expected that the initial applications will be implemented in 2012 and 2013.

It is also anticipated that GIS will provide a quality assurance tool as many programs are completed. For example, the services in the Wrapped Steel Service Assessment Program (WSSAP) have been identified based on a plat review. These services were then entered into a database that must be updated anytime a pre-1972 wrapped steel service is modified. The information in the GIS will be based on a combination of information from the plat maps as well as information from the D-4s. This will provide an opportunity to compare the GIS data against the WSSAP data and further investigate and resolve any discrepancies potentially resulting in a more comprehensive list of WSSAP services. In addition, all service modifications will be updated in the GIS rather than the current process where data is only maintained for pre-1972 services improving the likelihood that all updates will be recorded by eliminating the exception process.

A similar quality assurance process is anticipated for bare steel services. The list of candidate bare steel services that PSE is using to complete the replacement of individual bare steel services, bare steel services not associated to a bare steel main, was developed using the WSSAP plat review data. A comparison of the bare steel services in the WSSAP database against the GIS data may identify additional services that were not identified in the WSSAP database.

Damage Prevention Data Improvements

PSE has identified that there may be an opportunity to improve data accuracy and capture additional root cause data for third party damages. This is important as third party damage remains the leading cause of leaks on PSE's system. Review of a sampling of the third party damage data indicates the root cause determination process may be improved resulting in more accurate data.

In addition, there may be an opportunity to expand the understanding and trending of the root cause. For example, identifying and trending the damages caused by a homeowner versus a contractor/excavator improves knowledge of the threat, identification of appropriate mitigative measures, and effectiveness of different mitigative measures.

In 2012, PSE will work with stakeholders to further evaluate these opportunities and determine if process improvements to enhance data accuracy and/or additional data capture would be beneficial.

Leak Data Improvements

PSE has begun investigating the possible benefits of expanding the leak cause to include sub-threat root causes. Initial discussions with stakeholders indicate this would likely have benefit but will require careful implementation to ensure data accuracy. We will be evaluating this further in 2012 in conjunction with the overall review of the leak processes described in the Leak Initiative section of this report.

Plastic Pipe Condition Reports

As discussed in the Leak Repair Trends section, pre-1986 PE pipe is susceptible to brittle-like cracking due to rock impingement and squeeze points. Information on rock impingement and rock in backfill is currently captured on the Report of Abnormal or Unusual Operating Conditions.

The rock information is used in the prioritization model of the Older Vintage PE Pipe Mitigation Program. Additional data on the backfill and squeeze locations for PE pipe may provide additional information that could be utilized to prioritize pre-1986 PE pipe replacements and to identify potential threats to newer PE systems. In 2012, PSE plans to evaluate the best approach to capturing this information including how it would interface with the GIS system, and whether the information is worth capturing. If it is determined to be worth capturing, PSE will develop and implement a plan to capture this data.

Part 3. Risk Evaluation and Prioritization

PSE has re-evaluated and prioritized the threats to the distribution system in accordance with the requirements of the DIM Plan, *Section 7 Risk Evaluation and Prioritization*, and *Appendix C, Risk Evaluation and Prioritization Plan*. This evaluation included validation of the results considering both SME input and system data. As a result of this process, PSE has revised the criteria for determining the mitigation category. The revisions to this methodology will be documented in *Appendix C* when the DIM Plan is updated.

The results of this evaluation are documented in the Risk Evaluation and Prioritization Matrix which is provided in *Appendix A, Risk Evaluation and Prioritization Results* of this report.

A summary of the results of the Risk Evaluation and Prioritization Matrix is provided in Figure 37-Figure 39. This documents where additional mitigative measures are not required, where Additional and Accelerated Actions have been implemented to reduce risk, and where Additional and Accelerated Actions need to be developed and/or implemented to reduce risk. This also shows where facilities have been added or revised since 2011 based on additional risk knowledge and the status of the Additional and Accelerated Actions.

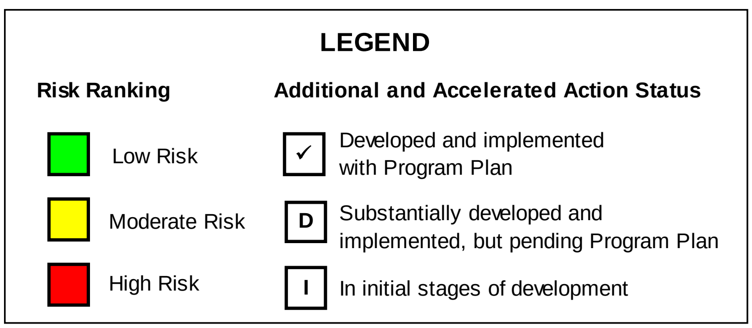


Figure 37. Legend of Summary of Risks by Facility Type and Threat

Level of Risk by Facility Type (Excludes Excavation Damage and Sewer Cross Bores Threats)	Current Relative Risk Ranking (2012)	Current Relative Risk Ranking Considering Existing Mitigative Measures
Main		
Bare Steel Main (LP - IP)	Red	Green ✓
1971 and Older Wrapped Steel Main (LP - IP)	Yellow	Yellow ✓
1972 and Newer Wrapped Steel Main (LP - IP)	Green	Green
1985 and Older Polyethylene Main (LP - IP)	Red	Red ✓
1986 and Newer Polyethylene Main (LP - IP)	Green	Green
Wrapped Steel Main (HP)	Yellow	Yellow I
Wrapped Steel Main in Casing	Yellow	Yellow I
Shallow Main	Yellow	Yellow D
Main in Wall-to-Wall Paving/HOS	Yellow	Yellow D
Main on Bridge	Yellow	Green D
Main on Dock or Wharf	Yellow	Yellow I
Service		
Bare Steel Service (LP - IP)	Red	Yellow ✓
1971 and Older Wrapped Steel Service (LP - IP)	Yellow	Yellow ✓
1972 and Newer Wrapped Steel Service (LP - IP)	Green	Green
1985 and Older Polyethylene Service (LP - IP) - 1-1/4" and Larger	Red	Red ✓
1985 and Older Polyethylene Service (LP - IP) - Smaller than 1-1/4"	Yellow	Yellow ✓
1986 and Newer Polyethylene Service (LP - IP)	Green	Green
Wrapped Steel Service (HP)	Yellow	Yellow D
Wrapped Steel Service in Casing	Yellow	Yellow D
Shallow Service	Yellow	Yellow D
Service in Wall-to-Wall Paving/HOS	Yellow	Yellow D
Extended Service Line in Mobile Home Community	Yellow	Green ✓
Service on Bridge	Yellow	Yellow D
Service on Dock or Wharf	Yellow	Yellow I
Extended Utility Facility (EUF)	Yellow	Yellow I
MSA		
Residential MSA	Green	Green
Buried MSA	Yellow	Yellow D
Commercial and Industrial MSA	Yellow	Yellow D
Sidewalk and Street Vault Regulator	Yellow	Green ✓
Aboveground Regulators	Yellow	Green ✓
Idle Riser	Yellow	Yellow I
Valve		
Newer Wrapped Steel and Polyethylene Valve	Green	Green
Older Wrapped Steel Valve (HP)	Yellow	Yellow D
Older Wrapped Steel Valve (IP)	Yellow	Yellow I
Double Insulated Flanged Valve	Yellow	Yellow I
Farm Tap		
Single Service Farm Tap	Green	Green
Modified Farm Tap (Farm Tap on Riser)	Yellow	Yellow I
Converted Single Service Farm Tap	Yellow	Green ✓
Farm Tap	Green	Green
Regulator Station		
Gate Station, Town Border Station, Limiting Station	Yellow	Green ✓
HP-IP District Regulator Station	Yellow	Green ✓
IP-LP District Regulator Station	Yellow	Green ✓
Propane Peak-Shaving Plant and Distribution System		
Propane Distribution System - Sumner	Yellow	Yellow I
Swarr Propane-Air Plant	Yellow	Green ✓

Figure 38. Summary of Risks by Facility Type and Threat – by Facility Type

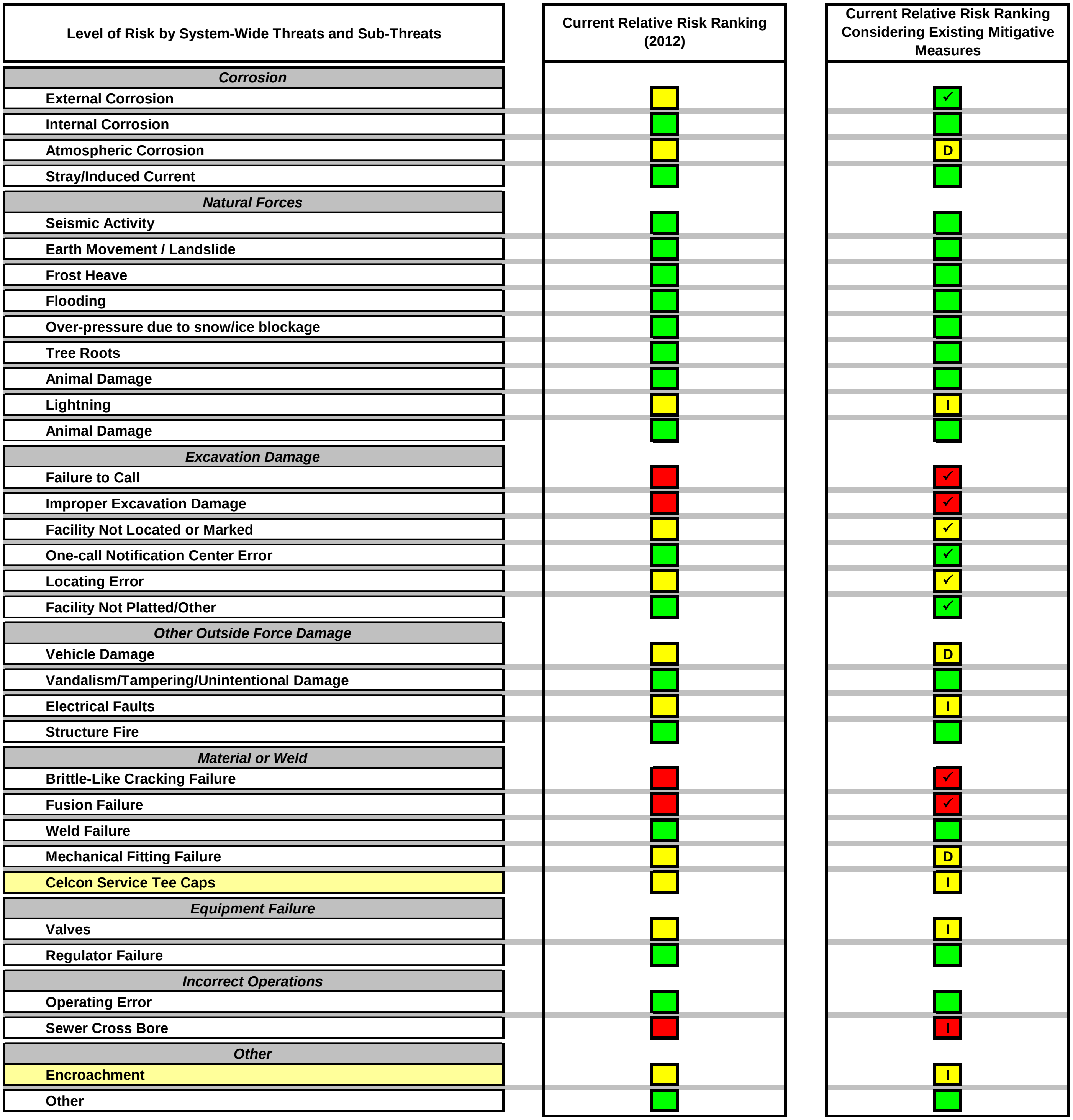


Figure 39. Summary of Risks by Facility Type and Threat – by Threats and Sub-Threats

Part 4. Mitigative Measures and Additional and Accelerated Actions

In accordance with *Section 8. Mitigative Measures and Additional and Accelerated Actions to Address Risks* in the DIM Plan, PSE has assessed where Additional and Accelerated Actions are needed to further reduce risk based on the Risk Evaluation and Prioritization Matrix. As shown in the Risk Evaluation and Prioritization section of this report, Additional and Accelerated Actions are required for all high and moderate risks.

Appendix B includes detail on Additional and Accelerated Actions that have been developed and implemented. These programs have a documented methodology for risk ranking, establishing thresholds where Additional and Accelerated Actions are required, and evaluating the effectiveness of the mitigative measures through specific performance measures. These programs are either documented in the DIM Plan, will be documented when the DIM Plan is next updated, or are documented in a Settlement Agreement.

Appendix B also includes detail on Additional and Accelerated Actions that are in various stages of development and implementation. As these measures are implemented, they will be documented in the DIM Plan or Gas Operating Standards as appropriate.

The following are Additional and Accelerated Actions that have documented program plans:

- Bare Steel Replacement Program
- Older Vintage PE Pipe Mitigation Program
- Wrapped Steel Service Assessment Program (WSSAP)
- Older Wrapped Steel Pipe Mitigation Program
- Isolated Facilities Extension Programs
    - Sidewalk Regulators
    - Above Ground Regulators
    - Steel Services in Casing
    - Extended Service Lines in Mobile Home Communities
- Regulator Station Remediation
- Converted Single Service Farm Tap Program

The following are Additional and Accelerated Actions that are in development:

- Sewer Cross Bores
- Buried MSA Remediation
- Traffic Protection Enhancements
- Industrial Meter Set Remediation
- Shallow Main and Service Remediation
- Mobile Home Community (MHC) Encroachment Surveys
- Bridge and Slide Remediation
- Atmospheric Corrosion Inspections
    - Hard-to-Reach Bridges
    - Docks and Wharves Assessment

    - Pipe on Pipe Supports
- Aging Valve Mitigation
- Double Insulated Flange Valve Mitigation
- High Voltage Alternating Current (HVAC) Mitigation Program
- High Pressure Main Evaluation and Assessment
- Extended Utility Facility Program
- Modified Farm Tap on a Riser
- Main and Services in Wall to Wall Paving and Near HOS
- Sumner Propane Distribution System
- STW Main in Casing
- Encroachments – other than in mobile home communities

Programs that have been completed are also discussed for historical system knowledge and include:

- Isolated Facilities Program
- Cast Iron Replacement Program
- Critical Bond Program

Part 5. Measure Performance, Monitor Results, and Evaluate Effectiveness

This following section presents the overall system performance measures required by PSE's DIM Plan, *Section 9. Measure Performance, Monitor Results, and Evaluate Effectiveness*. More specific performance measures related to Additional and Accelerated Actions that have documented program plans are presented in conjunction with the program discussion provided in *Appendix B, Additional and Accelerated Actions*. Additional detail on the data used to report the following performance measures is provided in *Appendix C, System Performance Data*.

These sections include a discussion on how these performance measures:

- compare to the established baseline
- whether the existing mitigative measures are effectively mitigating the risks they are intended to address
- whether additional time is required to have sufficient data to make a determination on effectiveness of the mitigative measures
- or whether different performance measures are required to make a determination on effectiveness of the mitigative measures.

Hazardous Leaks Repaired by Material

Table 10 shows there has been a general increase in the number of hazardous leaks repaired on each type of material. This data excludes leaks that due to excavation as these leaks are generally not indicative of system integrity and the mitigative measures for this threat are different than for other threats. As a result, there are unique performance measures for excavation damage presented below.

Table 10. Performance Measure – Hazardous Leaks Repaired, Categorized by Material (Excluding Excavation Damage)

Material	Number of Repaired Hazardous Leaks			
	5-Year Average	2011	5-Year Average / Facility Mile	2011
Bare Steel and Wrought Iron	35	46	0.0802	0.1281
Wrapped Steel	176	188	0.0273	0.0295
PE	216	206	0.0120	0.0112

Note: Beginning in 2010, PHMSA required operators to report aboveground hazardous leaks. The data presented in the table above does not include aboveground hazardous leaks as a full 5 years of data is not available by material type.

As seen in this table, there is an increase in the number of hazardous leaks as well as the number of hazardous leaks per facility mile which is the baseline. The increase in the hazardous leaks on bare steel as well as other leakage data for bare steel indicate the Bare Steel Replacement Program continues to be an appropriate strategy. Since 2005, PSE has replaced almost 70% of the bare steel main and the remaining bare steel will be replaced by the end of 2014.

The increase in the hazardous leaks on wrapped steel supports the direction PSE has taken in implementing the WSSAP Program as well as the Wrapped Steel Pipe Mitigation Program. Both of these programs are expected to reduce the number of hazardous and total leaks on wrapped steel facilities. The 5-year average number of hazardous leaks per facility mile of wrapped steel pipe will continue to be monitored to confirm that these programs are effectively mitigating these risks or identify changes to these programs or additional mitigative measures.

The decrease in hazardous leaks on PE is a positive trend. However, the additional data analysis on older vintage PE presented in the *Part 2. System Knowledge and Threat Identification, System Threats and Trends* indicate the Older Vintage PE Pipe Mitigation Program is an important part of reducing the risks associated with brittle-like cracking experienced on pipe of this vintage.

Total and Hazardous Leaks Repaired by Cause

Table 11 illustrates the hazardous leak repairs and the total number of leak repairs by leak cause. Excluding leaks due to excavation damage, there has been an overall increase in the number of hazardous leaks in 2011 compared to the baseline which is the 5 year average and an overall decrease in total leaks.

Table 11. Performance Measure – Leaks Repaired, Categorized by Leak Cause

Leaks Eliminated or Repaired by Leak Cause	Hazardous Leaks				Total Leaks			
	5-Year Average	2011	5-Year Average / Facility Mile	2011	5-Year Average	2011	5-Year Average / Facility Mile	2011
Corrosion	64	61	0.009	0.009	179	137	0.026	0.020
Natural Forces	28	38	0.001	0.002	27	48	0.001	0.002
Other Outside Force Damage	37	35	0.001	0.001	32	38	0.001	0.002
Material or Weld	76	118	0.003	0.005	183	200	0.007	0.008
Equipment Failure	59	93	0.002	0.004	324	313	0.013	0.012
Incorrect Operation	16	18	0.001	0.001	25	35	0.001	0.001
Other	161	107	0.006	0.004	335	270	0.013	0.011
Total (Excludes Excavation Damage)	442	470	0.024	0.025	1,106	1,041	0.063	0.056
Excavation Damage	1,025	758	0.041	0.030	1,088	771	0.044	0.031
Total	1,467	1,228	0.066	0.055	2,194	1,812	0.107	0.087

The overall increase in hazardous leaks is consistent with the increase in new leaks being found on the distribution system. The additional analysis of the different leak cause trends presented in *Part 2. System Knowledge and Threat Identification, System Threats and Trends* indicates the direction PSE is heading with continuing to make progress on the Additional and Accelerated Actions that have documented program plans as well as those that are in development is appropriate. These mitigative measures as well as the additional insight that will be gained through the Leak Initiative as well as the Data Initiatives will facilitate future analysis and identification of any additional mitigative measures. At this time, PSE believes the measures in place and in development are appropriately reducing risks.

Excavation Damage

As shown in Table 12, there has been a decrease in both the number of damages due to excavation, the number of locate requests, as well as the number of excavation damages per 1,000 locate requests.

Table 12. Performance Measure – Excavation Damage

Excavation Damage Performance Measures	Excavation Damages and Tickets	
	5-Year Average	2011
Number of Excavation Damages	1,189	850
Number of Excavation Tickets received from the notification center	161,421	138,028
Number of Excavation Damages per 1,000 Excavation Tickets	7.37	6.16

The decrease in locate requests is most likely due to the significant reduction in construction activity attributed to the economic slowdown. Even with the decrease in the number of locate requests, the number of total damages as well as damages per 1,000 locate requests has decreased significantly. The baseline performance measure for the excavation damage prevention program is the 5-year average number of damages per 1,000 locate requests and currently does not show trends that warrant additional analysis. While the trends are positive, excavation damage remains the leading cause of hazardous leaks on PSE's system. This emphasizes the importance of continuing PSE's efforts on reducing excavation damages through the Damage Prevention Program.

Response Time to Emergency Calls

Table 40 shows the number of emergencies that Gas First Response responds to, the percentage of those emergencies that are responded to within 60 minutes, and the average response time. Emergencies include both odor or leak calls.

Table 13. Performance Measure – Gas Emergency Responses and Response Times

Gas Emergency Response Time Performance Measure	Gas Emergency Response Time	
	4-Year Average	2011
Number of Emergency Calls	22,852	22,806
Percentage of Emergencies Responded to Within 60 Minutes	93.59%	96.73%
Average Response Time	32 minutes	29 minutes

The baseline for this performance measure is a 4-year average at this time. Data accuracy improvements make the 4-year average a more appropriate baseline. In 2011, both the percentage of emergencies that are responded to within 60 minutes and the average emergency response time improved compared to the 4-year average.

Effectiveness of Leak Management Program Evaluation

PSE continues to perform a variety of audits of the leakage management program. These audits encompass a range of scope and formality, from comprehensive reviews of the overall leakage management program to focused reviews of specific elements of the program. In addition to these audits, PSE monitors a variety of leakage metrics on a monthly basis to ensure:

- leak surveys are being conducted at the required frequency,
- leaks are graded consistently,
- leaks are being re-evaluated and repaired in a timely manner, and
- leak repairs are effective.

These audits and metrics show that overall PSE has an effective leakage management program. Examples of the types of metrics and audit items include:

- leak surveys are completed on-time
- leaks are repaired and re-evaluated on-time
- Grade "B" leaks are repaired in a timely manner
- leak grade changes by month

In 2012, PSE is developing a more structured leak management self audit program. This will include a documented audit protocol and process for responding to the results of the audit findings. PSE also continues to monitor its leakage trends and is performing a comprehensive review of the leak management process through the Leak Initiative as previously discussed in *Part 2. System Knowledge and Threat Identification* to determine whether any changes are recommended to the process. This review will be performed in 2012 and any recommendations for changes will be developed along with an implementation schedule.

Part 6. Periodic Evaluation and Improvement

This report in conjunction with the DIM Plan comprises PSE's DIM Program. The DIM Plan specifies the procedures for developing and implementing the DIM Program and documents the relatively static elements of PSE's DIM Program. The DIM Plan will be reviewed in 2012 and updated to incorporate Additional and Accelerated Actions that have been implemented since it was last updated.

The evaluation of PSE's DIM Program in accordance with *Section 10. Periodic Evaluation and Improvement* in the DIM Plan indicates the DIM Plan in conjunction with this Continuing Surveillance Annual Report are effectively mitigating system risks and identifying where Additional and Accelerated Actions need to be developed and implemented to further mitigate risks.

Appendix A: Risk Evaluation and Prioritization Results

Distribution Integrity Management Program - Risk Evaluation and Prioritization Matrix by Facility Type

Frequency of Failure (FOF) or Pontential Failure:
0.5 - Occurs Almost Never
1.0 - Occurs Occasionally
1.5 - Occurs Sometimes
2.0 - Occurs Frequently
2.5 - Occurs More than Frequently
3.0 - Occurs Most Frequently

Consequence of Failure (COF) or Potential Consequence:
0.5 - Little or No Consequence
1.0 - Little to Moderate Consequence
1.5 - Moderate Consequence
2.0 - Moderate to High Consequence
2.5 - High Consequence
3.0 - Highest Consequence

Total Relative Score (TOT):
TOT = FOF x COF

Threats and Sub-Threats

Corrosion

Facility	External Corrosion FOF	COF	TOT	Internal Corrosion FOF	COF	TOT	Atmospheric Corrosion FOF	COF	TOT	Stray/Induced Current FOF	COF	TOT
Main												
Bare Steel (LP - IP) Main	3.0	1.5	4.5	0.5	1.5	0.8				1.0	1.5	1.5
1971 and Older Wrapped Steel (LP - IP) Main	2.0	1.5	3.0	0.5	1.5	0.8				1.0	1.5	1.5
1972 and Newer Wrapped Steel (LP - IP) Main	0.5	1.5	0.8	0.5	1.5	0.8				1.0	1.5	1.5
1985 and Older Polyethylene (LP - IP) Main												
1986 and Newer Polyethylene (LP - IP) Main												
Wrapped Steel (HP) Main	0.5	3.0	1.5	0.5	3.0	1.5				0.5	3.0	1.5
Main in Wall-to-Wall Paving/HOS - Wrapped Steel	0.5	2.0	1.0	0.5	2.0	1.0				1.0	2.0	2.0
Main in Wall-to-Wall Paving/HOS - PE												
Service												
Bare Steel (LP - IP) Service	3.0	2.0	6.0	0.5	2.0	1.0				1.0	2.0	2.0
1971 and Older Wrapped Steel (LP - IP) Service	2.0	2.0	4.0	0.5	2.0	1.0				1.0	2.0	2.0
1972 and Newer Wrapped Steel (LP - IP) Service	0.5	2.0	1.0	0.5	2.0	1.0				1.0	2.0	2.0
1985 and Older Polyethylene (LP - IP) - 1-1/4" and Larger												
1985 and Older Polyethylene (LP - IP) - Smaller than 1-1/4"												
1986 and Newer Polyethylene (LP - IP) Service												
Wrapped Steel (HP) Service	1.0	3.0	3.0	0.5	3.0	1.5				0.5	3.0	1.5
Extended Utility Facility (EUF)												
Service in Wall-to-Wall Paving/HOS - Wrapped Steel	0.5	2.5	1.3	0.5	2.5	1.3				1.0	2.5	2.5
Service in Wall-to-Wall Paving/HOS - PE												
MSA												
Residential MSA				0.5	2.0	1.0	1.5	1.5	2.3			
Buried MSA	2.5	1.5	3.8	0.5	2.0	1.0	1.5	1.5	2.3	1.0	2.0	2.0
Commercial and Industrial MSA				0.5	1.0	0.5	1.5	2.0	3.0			
Sidewalk and Street Vault Regulators	2.0	2.0	4.0	0.5	2.0	1.0	1.5	1.5	2.3	1.0	2.0	2.0
Aboveground Regulators	2.0	2.0	4.0	0.5	2.0	1.0	1.5	1.5	2.3	1.0	2.0	2.0
Idle Riser				0.5	2.0	1.0	2.0	1.5	3.0	1.0	2.0	2.0
Valves												
Newer STW Valves	1.0	2.0	2.0	0.5	2.0	1.0				1.0	2.0	2.0
PE Valves												
Older STW Valves (HP)	0.5	2.5	1.3	0.5	2.5	1.3				0.5	2.5	1.3
Older STW Valves (IP)	1.0	2.0	2.0	0.5	2.0	1.0				1.0	2.0	2.0
Double IF Valves	2.0	2.0	4.0	0.5	2.0	1.0				1.0	2.0	2.0
Farm Tap												
Single Service Farm Tap	0.5	2.0	1.0	0.5	1.5	0.8	1.0	2.0	2.0	1.0	2.0	2.0
Modified Farm Tap (Farm Tap on Riser)				0.5	3.0	1.5	1.0	2.0	2.0			
Converted Single Service Farm Tap	0.5	2.5	1.3	0.5	2.5	1.3	1.0	1.5	1.5	0.5	2.5	1.3
Farm Tap	0.5	2.0	1.0	0.5	1.5	0.8	1.0	1.5	1.5	1.0	2.0	2.0
Regulator Stations												
Gate Station, Town Border Station, Limiting Station	0.5	2.0	1.0	0.5	2.0	1.0	1.0	1.0	1.0	0.5	2.0	1.0
HP-IP District Regulator Station	0.5	2.5	1.3	0.5	2.5	1.3	1.0	1.5	1.5	0.5	2.5	1.3
IP-LP District Regulator Station	0.5	2.0	1.0	0.5	2.0	1.0	1.0	1.5	1.5	0.5	2.0	1.0
Propane Peak-Shaving Plant and Distribution System												
Propane Distribution System - Sumner	1.0	2.5	2.5	0.5	2.5	1.3	1.5	2.0	3.0	1.0	2.5	2.5
Swarr Propane-Air Plant	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.5	0.8	1.0	1.5	1.5
Facilities with Non-Standard Risks												
Main												
Wrapped Steel Main in Casing	2.0	2.0	4.0				1.0	1.5	1.5			
Shallow Main												
Main on Bridges							1.0	2.0	2.0			
Main on Docks and Wharves							1.5	1.0	1.5			
Service												
Wrapped Steel Service in Casing	2.0	2.0	4.0									
Shallow Service												
Extended Service Line in Mobile Home Communities	2.0	2.0	4.0									
Service on Bridges							1.0	1.0	1.0			
Service on Docks and Wharves							1.5	1.0	1.5			

Natural Forces

Facility	Seismic Activity FOF	COF	TOT	Earth Movement / Landslide FOF	COF	TOT	Frost Heave FOF	COF	TOT	Flooding FOF	COF	TOT	Over-pressure due to snow/ice blockage FOF	COF	TOT	Tree Roots FOF	COF	TOT	Animal Damage FOF	COF	TOT	Lightning FOF	COF	TOT
Main																								
Bare Steel (LP - IP) Main	1.0	1.5	1.5	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5				0.5	1.5	0.8				0.5	2.5	1.3
1971 and Older Wrapped Steel (LP - IP) Main	1.0	1.5	1.5	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5				0.5	1.5	0.8				0.5	2.5	1.3
1972 and Newer Wrapped Steel (LP - IP) Main	0.5	1.5	0.8	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5				0.5	1.5	0.8				0.5	2.5	1.3
1985 and Older Polyethylene (LP - IP) Main	1.0	1.5	1.5	2.0	1.5	3.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.5	1.3	0.5	1.5	0.8	0.5	2.5	1.3
1986 and Newer Polyethylene (LP - IP) Main	1.0	1.5	1.5	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5				0.5	1.5	0.8	0.5	1.5	0.8	0.5	2.5	1.3
Wrapped Steel (HP) Main	1.0	3.0	3.0	1.0	3.0	3.0	0.5	3.0	1.5	0.5	1.0	0.5				0.5	3.0	1.5				0.5	3.0	1.5
Main in Wall-to-Wall Paving/HOS - Wrapped Steel	0.5	2.0	1.0	1.0	2.0	2.0	0.5	2.0	1.0	1.0	1.0	1.0				1.0	2.0	2.0				1.0	3.0	3.0
Main in Wall-to-Wall Paving/HOS - PE	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	1.0	1.0	1.0				1.0	2.0	2.0	0.5	2.0	1.0	1.0	3.0	3.0
Service																								
Bare Steel (LP - IP) Service	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0				0.5	3.0	1.5
1971 and Older Wrapped Steel (LP - IP) Service	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0				0.5	3.0	1.5
1972 and Newer Wrapped Steel (LP - IP) Service	0.5	2.0	1.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0				0.5	3.0	1.5
1985 and Older Polyethylene (LP - IP) - 1-1/4" and Larger	1.0	2.0	2.0	2.0	2.0	4.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.5	1.3	0.5	2.0	1.0	0.5	3.0	1.5
1985 and Older Polyethylene (LP - IP) - Smaller than 1-1/4"	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0	0.5	2.0	1.0	0.5	3.0	1.5
1986 and Newer Polyethylene (LP - IP) Service	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0	0.5	2.0	1.0	0.5	3.0	1.5
Wrapped Steel (HP) Service	1.0	3.0	3.0	1.0	3.0	3.0	0.5	3.0	1.5	0.5	1.0	0.5				0.5	3.0	1.5				0.5	3.0	1.5
Extended Utility Facility (EUF)	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0	0.5	2.0	1.0	0.5	3.0	1.5
Service in Wall-to-Wall Paving/HOS - Wrapped Steel	0.5	2.5	1.3	1.0	1.5	1.5	0.5	2.5	1.3	1.0	1.0	1.0				1.0	2.5	2.5				1.0	3.0	3.0
Service in Wall-to-Wall Paving/HOS - PE	1.0	2.5	2.5	1.0	1.5	1.5	0.5	2.5	1.3	1.0	1.0	1.0				0.5	2.5	1.3	0.5	2.5	1.3	1.0	3.0	3.0
MSA																								
Residential MSA	1.0	1.5	1.5	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5	0.5	2.5	1.3							0.5	2.0	1.0
Buried MSA	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	2.0	1.0
Commercial and Industrial MSA	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	2.0	1.0
Sidewalk and Street Vault Regulators	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	2.0	1.0
Aboveground Regulators	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	2.0	1.0
Idle Riser	1.0	1.5	1.5	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5										0.5	2.0	1.0
Valves																								
Newer STW Valves	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0				0.5	2.5	1.3
PE Valves	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0	0.5	2.0	1.0	0.5	2.5	1.3
Older STW Valves (HP)	1.0	2.5	2.5	1.0	2.5	2.5	0.5	2.5	1.3	0.5	1.0	0.5				0.5	2.0	1.0				0.5	3.0	1.5
Older STW Valves (IP)	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0				0.5	2.5	1.3
Double IF Valves	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5				0.5	2.0	1.0				0.5	2.5	1.3
Farm Tap																								
Single Service Farm Tap	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	3.0	1.5
Modified Farm Tap (Farm Tap on Riser)	1.0	3.0	3.0	1.0	3.0	3.0	0.5	3.0	1.5	0.5	1.0	0.5	0.5	2.5	1.3							0.5	3.0	1.5
Converted Single Service Farm Tap	1.0	2.5	2.5	1.0	2.5	2.5	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	3.0	1.5
Farm Tap	1.0	2.0	2.0	1.0	2.0	2.0	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	3.0	1.5
Regulator Stations																								
Gate Station, Town Border Station, Limiting Station	1.0	3.0	3.0	1.0	3.0	3.0	0.5	2.5	1.3	0.5	2.0	1.0	0.5	2.5	1.3							0.5	3.0	1.5
HP-IP District Regulator Station	1.0	2.5	2.5	1.0	2.5	2.5	0.5	2.0	1.0	0.5	1.0	0.5	0.5	2.5	1.3							0.5	3.0	1.5
IP-LP District Regulator Station	1.0	1.5	1.5	1.0	1.5	1.5	0.5	1.5	0.8	0.5	1.0	0.5	0.5	3.0	1.5							0.5	2.5	1.3
Propane Peak-Shaving Plant and Distribution System																								
Propane Distribution System - Sumner	1.0	2.5	2.5	1.0	2.5	2.5	0.5	2.5	1.3	0.5	1.0	0.5	0.5	2.5	1.3	0.5	2.0	1.0	0.5	2.0	1.0	0.5	3.0	1.5
Swarr Propane-Air Plant	1.0	1.5	1.5	1.5	1.5	2.3	0.5	1.5	0.8	2.0	0.5	1.0	0.5	1.5	0.8	0.5	1.5	0.8				0.5	3.0	1.5
Facilities with Non-Standard Risks																								
Main																								
Wrapped Steel Main in Casing																								
Shallow Main																								
Main on Bridges	1.5	2.0	3.0	1.5	2.0	3.0				1.5	2.0	3.0												
Main on Docks and Wharves	1.5	1.5	2.3	1.5	1.5	2.3				1.5	1.5	2.3												
Service																								
Wrapped Steel Service in Casing																								
Shallow Service																								
Extended Service Line in Mobile Home Communities																								
Service on Bridges	1.5	1.0	1.5	1.5	1.0	1.5				1.5	1.0	1.5												
Service on Docks and Wharves	1.5	2.0	3.0	1.5	2.0	3.0				1.5	2.0	3.0												

Excavation Damage

Facility	Failure to Call FOF	COF	TOT	Improper Excavation Practice FOF	COF	TOT	Facility Not Located or Marked FOF	COF	TOT	One-call Notif. Center Error FOF	COF	TOT	Locating Error FOF	COF	TOT	Facility Not Platted/Other FOF	COF	TOT
Main																		
Bare Steel (LP - IP) Main	3.0	2.0	6.0	3.0	2.0	6.0	2.0	2.0	4.0	1.0	2.0	2.0	2.5	2.0	5.0	1.0	2.0	2.0
1971 and Older Wrapped Steel (LP - IP) Main	3.0	2.0	6.0	3.0	2.0	6.0	2.0	2.0	4.0	1.0	2.0	2.0	2.5	2.0	5.0	1.0	2.0	2.0
1972 and Newer Wrapped Steel (LP - IP) Main	3.0	2.0	6.0	3.0	2.0	6.0	2.0	2.0	4.0	1.0	2.0	2.0	2.5	2.0	5.0	1.0	2.0	2.0
1985 and Older Polyethylene (LP - IP) Main	3.0	2.0	6.0	3.0	2.0	6.0	2.0	2.0	4.0	1.0	2.0	2.0	2.5	2.0	5.0	1.0	2.0	2.0
1986 and Newer Polyethylene (LP - IP) Main	3.0	2.0	6.0	3.0	2.0	6.0	2.0	2.0	4.0	1.0	2.0	2.0	2.5	2.0	5.0	1.0	2.0	2.0
Wrapped Steel (HP) Main	3.0	3.0	9.0	0.5	3.0	1.5	2.0	3.0	6.0	1.0	3.0	3.0	0.5	3.0	1.5	0.5	3.0	1.5
Main in Wall-to-Wall Paving/HOS - Wrapped Steel	3.0	2.0	6.0	3.0	2.0	6.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Main in Wall-to-Wall Paving/HOS - PE	3.0	2.0	6.0	3.0	2.0	6.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Service																		
Bare Steel (LP - IP) Service	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
1971 and Older Wrapped Steel (LP - IP) Service	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
1972 and Newer Wrapped Steel (LP - IP) Service	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
1985 and Older Polyethylene (LP - IP) - 1-1/4" and Larger	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
1985 and Older Polyethylene (LP - IP) - Smaller than 1-1/4"	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
1986 and Newer Polyethylene (LP - IP) Service	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
Wrapped Steel (HP) Service	3.0	3.0	9.0	0.5	3.0	1.5	2.0	3.0	6.0	1.0	3.0	3.0	0.5	3.0	1.5	1.0	3.0	3.0
Extended Utility Facility (EUF)	3.0	2.5	7.5	3.0	2.5	7.5	2.5	2.5	6.3	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
Service in Wall-to-Wall Paving/HOS - Wrapped Steel	3.0	2.5	7.5	3.0	2.5	7.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Service in Wall-to-Wall Paving/HOS - PE	3.0	2.5	7.5	3.0	2.5	7.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
MSA																		
Residential MSA																		
Buried MSA																		
Commercial and Industrial MSA																		
Sidewalk and Street Vault Regulators	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Aboveground Regulators	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Idle Riser																		
Valves																		
Newer STW Valves	1.0	2.0	2.0	3.0	2.0	6.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
PE Valves	1.0	2.0	2.0	3.0	2.0	6.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Older STW Valves (HP)	1.0	2.5	2.5	0.5	2.5	1.3	1.0	2.5	2.5	1.0	2.5	2.5	0.5	2.5	1.3	0.5	2.5	1.3
Older STW Valves (IP)	1.0	2.0	2.0	3.0	2.0	6.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Double IF Valves	1.0	2.0	2.0	3.0	2.0	6.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Farm Tap																		
Single Service Farm Tap	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Modified Farm Tap (Farm Tap on Riser)																		
Converted Single Service Farm Tap	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Farm Tap	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Regulator Stations																		
Gate Station, Town Border Station, Limiting Station	0.5	2.5	1.3	0.5	2.5	1.3	0.5	2.5	1.3	0.5	2.5	1.3	0.5	2.5	1.3	0.5	2.5	1.3
HP-IP District Regulator Station	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
IP-LP District Regulator Station	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5	1.0	2.5	2.5
Propane Peak-Shaving Plant and Distribution System																		
Propane Distribution System - Sumner	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.5	2.5	6.3	1.0	2.5	2.5
Swarr Propane-Air Plant				0.5	1.5	0.8	0.5	1.5	0.8				0.5	1.5	0.8			
Facilities with Non-Standard Risks																		
Main																		
Wrapped Steel Main in Casing	2.0	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	0.5	1.0	0.5	1.0	1.0	1.0	0.5	1.0	0.5
Shallow Main	3.0	2.0	6.0	3.0	2.0	6.0	2.0	2.0	4.0	1.0	2.0	2.0	2.0	2.0	4.0	1.0	2.0	2.0
Main on Bridges																		
Main on Docks and Wharves																		
Service																		
Wrapped Steel Service in Casing	2.0	1.5	3.0	2.0	1.5	3.0	1.0	1.5	1.5	0.5	1.5	0.8	1.0	1.5	1.5	0.5	1.5	0.8
Shallow Service	3.0	2.5	7.5	3.0	2.5	7.5	2.0	2.5	5.0	1.0	2.5	2.5	2.0	2.5	5.0	1.0	2.5	2.5
Extended Service Line in Mobile Home Communities																		
Service on Bridges																		
Service on Docks and Wharves																		

Effective Date: 05/09/2012
Cancelling Date: 08/02/2011

Distribution Integrity Management Program - Risk Evaluation and Prioritization Matrix by Facility Type

Frequency of Failure (FOF) or Pontential Failure:
0.5 - Occurs Almost Never
1.0 - Occurs Occasionally
1.5 - Occurs Sometimes
2.0 - Occurs Frequently
2.5 - Occurs More than Frequently
3.0 - Occurs Most Frequently

Consequence of Failure (COF) or Potential Consequence:
0.5 - Little or No Consequence
1.0 - Little to Moderate Consequence
1.5 - Moderate Consequence
2.0 - Moderate to High Consequence
2.5 - High Consequence
3.0 - Highest Consequence

Total Relative Score (TOT):
TOT = FOF x COF

Group	Facility	Other Outside Force Damage: Vehicle Damage FOF	COF	TOT	Vandalism/Tampering/Unintentional Damage FOF	COF	TOT	Electrical Faults FOF	COF	TOT	Structure Fire FOF	COF	TOT
Main	***Main***												
	Bare Steel (LP - IP) Main							1.5	2.5	3.8			
	1971 and Older Wrapped Steel (LP - IP) Main							1.5	2.5	3.8			
	1972 and Newer Wrapped Steel (LP - IP) Main							1.5	2.5	3.8			
	1985 and Older Polyethylene (LP - IP) Main							1.5	2.5	3.8			
	1986 and Newer Polyethylene (LP - IP) Main							1.5	2.5	3.8			
	Wrapped Steel (HP) Main							1.5	3.0	4.5			
	Main in Wall-to-Wall Paving/HOS - Wrapped Steel							1.0	3.0	3.0			
	Main in Wall-to-Wall Paving/HOS - PE							1.0	3.0	3.0			
Service	***Service***												
	Bare Steel (LP - IP) Service							1.5	3.0	4.5	0.5	2.0	1.0
	1971 and Older Wrapped Steel (LP - IP) Service							1.5	3.0	4.5	0.5	2.0	1.0
	1972 and Newer Wrapped Steel (LP - IP) Service							1.5	3.0	4.5	0.5	2.0	1.0
	1985 and Older Polyethylene (LP - IP) - 1-1/4" and Larger							1.5	3.0	4.5	0.5	2.0	1.0
	1985 and Older Polyethylene (LP - IP) - Smaller than 1-1/4"							1.5	3.0	4.5	0.5	2.0	1.0
	1986 and Newer Polyethylene (LP - IP) Service							1.5	3.0	4.5	0.5	2.0	1.0
	Wrapped Steel (HP) Service							1.5	3.0	4.5	0.5	3.0	1.5
	Extended Utility Facility (EUF)							1.5	3.0	4.5	0.5	2.0	1.0
	Service in Wall-to-Wall Paving/HOS - Wrapped Steel							1.0	3.0	3.0	0.5	2.5	1.3
	Service in Wall-to-Wall Paving/HOS - PE							1.0	3.0	3.0	0.5	2.5	1.3
MSA	***MSA***												
	Residential MSA	1.5	2.0	3.0	1.5	2.0	3.0	1.5	2.0	3.0	1.0	2.0	2.0
	Buried MSA	1.5	2.0	3.0	1.5	2.0	3.0	1.5	2.0	3.0	1.0	2.0	2.0
	Commercial and Industrial MSA	1.5	2.5	3.8	1.5	2.5	3.8	1.5	2.0	3.0	1.0	2.0	2.0
	Sidewalk and Street Vault Regulators	1.5	2.0	3.0	1.5	2.0	3.0	1.5	2.0	3.0	1.0	2.0	2.0
	Aboveground Regulators	1.5	2.0	3.0	1.5	2.0	3.0	1.5	2.0	3.0	1.0	2.0	2.0
	Idle Riser	1.5	2.0	3.0	2.0	2.0	4.0	1.5	2.0	3.0	1.0	2.0	2.0
Valve	***Valves***												
	Newer STW Valves				0.5	2.5	1.3	1.5	2.5	3.8			
	PE Valves				0.5	2.5	1.3	1.5	2.5	3.8			
	Older STW Valves (HP)				0.5	3.0	1.5	1.5	3.0	4.5			
	Older STW Valves (IP)				0.5	2.5	1.3	1.5	2.5	3.8			
	Double IF Valves				0.5	2.5	1.3	1.5	2.5	3.8			
FT	***Farm Tap***												
	Single Service Farm Tap				0.5	2.0	1.0	1.5	3.0	4.5	0.5	2.0	1.0
	Modified Farm Tap (Farm Tap on Riser)	1.5	2.5	3.8	1.0	2.5	2.5	1.5	3.0	4.5	1.0	3.0	3.0
	Converted Single Service Farm Tap	1.0	3.0	3.0	1.0	2.5	2.5	1.5	3.0	4.5	0.5	2.0	1.0
	Farm Tap				0.5	2.0	1.0	1.5	3.0	4.5	0.5	2.0	1.0
RS	***Regulator Stations***												
	Gate Station, Town Border Station, Limiting Station	0.5	3.0	1.5	0.5	3.0	1.5	1.5	3.0	4.5	0.5	2.5	1.3
	HP-IP District Regulator Station	1.0	3.0	3.0	1.0	2.5	2.5	1.5	3.0	4.5	0.5	2.0	1.0
	IP-LP District Regulator Station	1.0	2.0	2.0	1.0	3.0	3.0	1.5	2.5	3.8	0.5	1.5	0.8
Pro	***Propane Peak-Shaving Plant and Distribution System***												
	Propane Distribution System - Sumner	0.5	2.5	1.3	0.5	2.5	1.3	1.5	3.0	4.5	0.5	2.5	1.3
	Swarr Propane-Air Plant	0.5	1.5	0.8	0.5	1.5	0.8	1.0	3.0	3.0	0.5	1.5	0.8
	Facilities with Non-Standard Risks												
Main	***Main***												
	Wrapped Steel Main in Casing												
	Shallow Main												
	Main on Bridges				1.0	1.5	1.5						
	Main on Docks and Wharves				1.0	1.5	1.5				1.0	1.5	1.5
Service	***Service***												
	Wrapped Steel Service in Casing												
	Shallow Service												
	Extended Service Line in Mobile Home Communities												
	Service on Bridges				1.0	1.0	1.0						
	Service on Docks and Wharves				1.0	2.0	2.0				1.0	2.0	2.0

Facility	Material or Weld: Brittle-like cracking failure FOF	COF	TOT	Fusion failure FOF	COF	TOT	Weld failure FOF	COF	TOT	Mechanical fitting failure FOF	COF	TOT	Celcon Service Tee Caps FOF	COF	TOT
Main															
Bare Steel (LP - IP) Main							1.5	1.5	2.3	1.0	2.0	2.0			
1971 and Older Wrapped Steel (LP - IP) Main							1.5	1.5	2.3	1.0	2.0	2.0			
1972 and Newer Wrapped Steel (LP - IP) Main							0.5	1.5	0.8	0.5	2.0	1.0			
1985 and Older Polyethylene (LP - IP) Main	1.5	3.0	4.5	1.5	3.0	4.5				1.5	2.0	3.0			
1986 and Newer Polyethylene (LP - IP) Main	0.5	3.0	1.5	0.5	3.0	1.5				0.5	2.0	1.0			
Wrapped Steel (HP) Main							0.5	3.0	1.5						
Main in Wall-to-Wall Paving/HOS - Wrapped Steel							1.0	2.0	2.0	1.0	2.5	2.5			
Main in Wall-to-Wall Paving/HOS - PE	0.5	3.0	1.5	0.5	3.0	1.5				0.5	2.5	1.3			
Service															
Bare Steel (LP - IP) Service							1.5	2.0	3.0	1.0	2.5	2.5			
1971 and Older Wrapped Steel (LP - IP) Service							1.5	2.0	3.0	1.0	2.5	2.5			
1972 and Newer Wrapped Steel (LP - IP) Service							0.5	2.0	1.0	0.5	2.5	1.3			
1985 and Older Polyethylene (LP - IP) - 1-1/4" and Larger	1.5	3.0	4.5	1.5	3.0	4.5				1.5	2.5	3.8			
1985 and Older Polyethylene (LP - IP) - Smaller than 1-1/4"	0.5	3.0	1.5	1.0	3.0	3.0				1.5	2.5	3.8			
1986 and Newer Polyethylene (LP - IP) Service	0.5	3.0	1.5	0.5	3.0	1.5				0.5	2.5	1.3	1.5	2.5	3.8
Wrapped Steel (HP) Service							0.5	3.0	1.5						
Extended Utility Facility (EUF)	0.5	3.0	1.5	0.5	3.0	1.5				1.0	2.5	2.5			
Service in Wall-to-Wall Paving/HOS - Wrapped Steel							1.0	2.5	2.5	1.0	3.0	3.0			
Service in Wall-to-Wall Paving/HOS - PE	0.5	3.0	1.5	0.5	3.0	1.5				0.5	3.0	1.5	1.5	3.0	4.5
MSA															
Residential MSA															
Buried MSA															
Commercial and Industrial MSA							0.5	2.0	1.0	1.0	2.0	2.0			
Sidewalk and Street Vault Regulators							1.0	2.0	2.0	1.0	2.5	2.5			
Aboveground Regulators							1.0	2.0	2.0						
Idle Riser															
Valves															
Newer STW Valves							0.5	2.0	1.0						
PE Valves				0.5	3.0	1.5									
Older STW Valves (HP)							0.5	2.5	1.3						
Older STW Valves (IP)							0.5	2.0	1.0						
Double IF Valves							0.5	2.0	1.0						
Farm Tap															
Single Service Farm Tap							1.0	2.5	2.5						
Modified Farm Tap (Farm Tap on Riser)							1.0	3.0	3.0						
Converted Single Service Farm Tap							0.5	2.5	1.3						
Farm Tap							0.5	2.5	1.3						
Regulator Stations															
Gate Station, Town Border Station, Limiting Station							0.5	2.5	1.3						
HP-IP District Regulator Station							0.5	2.5	1.3						
IP-LP District Regulator Station							1.0	2.0	2.0						
Propane Peak-Shaving Plant and Distribution System															
Propane Distribution System - Sumner							1.0	2.5	2.5	0.5	2.0	1.0			
Swarr Propane-Air Plant							1.0	3.0	3.0	0.5	1.5	0.8			
Facilities with Non-Standard Risks															
Main															
Wrapped Steel Main in Casing															
Shallow Main															
Main on Bridges															
Main on Docks and Wharves															
Service															
Wrapped Steel Service in Casing															
Shallow Service															
Extended Service Line in Mobile Home Communities															
Service on Bridges															
Service on Docks and Wharves															

Facility	Equipment Failure: Valves FOF	COF	TOT	Regulator Failure FOF	COF	TOT	Incorrect Operations: Operating Error FOF	COF	TOT	Sewer Cross Bore FOF	COF	TOT	Other: Encroachment FOF	COF	TOT	Other FOF	COF	TOT	Total Risk Score	Risk Score from Excavation Damage	Risk Score from Sewer Crossbore	Adjusted Risk Score
Main																						
Bare Steel (LP - IP) Main							1.5	2.0	3.0	0.5	3.0	1.5	0.5	3.0	1.5	1.0	1.0	1.0	53	25	2	26.5
1971 and Older Wrapped Steel (LP - IP) Main							1.5	2.0	3.0	0.5	3.0	1.5	0.5	3.0	1.5	1.0	1.0	1.0	52	25	2	25.0
1972 and Newer Wrapped Steel (LP - IP) Main							1.0	2.0	2.0	0.5	3.0	1.5	0.5	3.0	1.5	1.0	1.0	1.0	45	25	2	18.5
1985 and Older Polyethylene (LP - IP) Main							1.5	2.5	3.8	1.5	3.0	4.5	0.5	3.0	1.5	1.0	1.0	1.0	61	25	5	31.3
1986 and Newer Polyethylene (LP - IP) Main							0.5	2.0	1.0	1.5	3.0	4.5	0.5	3.0	1.5	1.0	1.0	1.0	48	25	5	18.3
Wrapped Steel (HP) Main							0.5	3.0	1.5	0.5	3.0	1.5	0.5	3.0	1.5	1.0	1.0	1.0	50	22.5	2	25.5
Main in Wall-to-Wall Paving/HOS - Wrapped Steel							1.0	2.5	2.5	1.5	3.0	4.5	1.0	3.0	3.0	1.0	1.0	1.0	53	20	5	28.0
Main in Wall-to-Wall Paving/HOS - PE							0.5	2.5	1.3	1.5	3.0	4.5	1.0	3.0	3.0	1.0	1.0	1.0	49	20	5	24.5
Service																						
Bare Steel (LP - IP) Service							1.5	2.5	3.8	0.5	3.0	1.5	1.5	3.0	4.5	1.0	1.0	1.0	70	31.25	2	37.3
1971 and Older Wrapped Steel (LP - IP) Service							1.5	2.5	3.8	0.5	3.0	1.5	1.5	3.0	4.5	1.0	1.0	1.0	68	31.25	2	35.3
1972 and Newer Wrapped Steel (LP - IP) Service							1.0	2.5	2.5	0.5	3.0	1.5	1.5	3.0	4.5	1.0	1.0	1.0	60	31.25	2	26.8
1985 and Older Polyethylene (LP - IP) - 1-1/4" and Larger							1.5	3.0	4.5	2.0	3.0	6.0	1.5	3.0	4.5	1.0	1.0	1.0	77	31.25	6	39.5
1985 and Older Polyethylene (LP - IP) - Smaller than 1-1/4"							1.5	2.5	3.8	2.0	3.0	6.0	1.5	3.0	4.5	1.0	1.0	1.0	69	31.25	6	32.0
1986 and Newer Polyethylene (LP - IP) Service							0.5	2.5	1.3	2.0	3.0	6.0	1.5	3.0	4.5	1.0	1.0	1.0	67	31.25	6	29.3
Wrapped Steel (HP) Service							0.5	3.0	1.5	0.5	3.0	1.5	1.5	3.0	4.5	1.0	1.0	1.0	57	24	2	31.5
Extended Utility Facility (EUF)							1.5	2.5	3.8	1.5	3.0	4.5	2.0	3.0	6.0	1.0	1.0	1.0	68	32.5	5	30.8
Service in Wall-to-Wall Paving/HOS - Wrapped Steel							1.0	3.0	3.0	1.5	3.0	4.5	1.0	3.0	3.0	1.0	1.0	1.0	62	25	5	32.3
Service in Wall-to-Wall Paving/HOS - PE							0.5	3.0	1.5	1.5	3.0	4.5	1.0	3.0	3.0	1.0	1.0	1.0	60	25	5	30.5
MSA																						
Residential MSA				0.5	1.5	0.8	1.0	1.0	1.0				1.5	3.0	4.5	1.0	1.0	1.0	28	0	0	28.0
Buried MSA				0.5	1.5	0.8	1.0	1.0	1.0				1.5	3.0	4.5	1.0	1.0	1.0	35	0	0	35.0
Commercial and Industrial MSA				0.5	1.5	0.8	1.0	1.0	1.0				0.5	3.0	1.5	1.0	1.0	1.0	31	0	0	31.0
Sidewalk and Street Vault Regulators				0.5	1.5	0.8	1.0	1.0	1.0				0.5	3.0	1.5	1.0	1.0	1.0	52	15	0	36.8
Aboveground Regulators				0.5	1.5	0.8	1.0	1.0	1.0				1.5	3.0	4.5	1.0	1.0	1.0	52	15	0	37.3
Idle Riser				0.5	1.5	0.8	1.0	1.0	1.0				2.0	3.0	6.0	1.0	1.0	1.0	32	0	0	32.0
Valves																						
Newer STW Valves	0.5	2.0	1.0				1.0	1.0	1.0							1.0	1.0	1.0	38	16	0	21.8
PE Valves	0.5	1.5	0.8				1.0	1.0	1.0							1.0	1.0	1.0	34	16	0	18.0
Older STW Valves (HP)	1.5	2.5	3.8				1.0	2.5	2.5							1.0	2.5	2.5	40	11.25	0	29.0
Older STW Valves (IP)	2.0	1.5	3.0				1.0	1.0	1.0							1.0	1.0	1.0	40	16	0	23.8
Double IF Valves	2.0	1.5	3.0				1.0	1.0	1.0							1.0	1.0	1.0	42	16	0	25.8
Farm Tap																						
Single Service Farm Tap				0.5	1.0	0.5	1.0	1.0	1.0							1.0	1.0	1.0	41	15	0	25.5
Modified Farm Tap (Farm Tap on Riser)				0.5	1.5	0.8	1.0	2.0	2.0				1.5	3.0	4.5	1.0	1.0	1.0	39	0	0	39.3
Converted Single Service Farm Tap				1.0	1.5	1.5	1.0	2.5	2.5							1.0	1.0	1.0	47	15	0	31.8
Farm Tap				1.0	1.5	1.5	1.0	1.5	1.5							1.0	1.0	1.0	40	15	0	25.3
Regulator Stations																						
Gate Station, Town Border Station, Limiting Station				0.5	2.0	1.0	1.0	3.0	3.0							1.0	1.0	1.0	38	7.5	0	30.0
HP-IP District Regulator Station				0.5	1.5	0.8	1.0	2.5	2.5							1.0	1.0	1.0	46	15	0	31.0
IP-LP District Regulator Station				0.5	2.0	1.0	1.0	3.0	3.0							1.0	1.0	1.0	43	15	0	28.0
Propane Peak-Shaving Plant and Distribution System																						
Propane Distribution System - Sumner							1.0	2.5	2.5	2.0	3.0	6.0	1.5	3.0	4.5	0.5	1.0	0.5	77	31.25	6	40.0
Swarr Propane-Air Plant	1.0	1.5	1.5	0.5	1.5	0.8	0.5	2.0	1.0							0.5	1.5	0.8	28	2.25	0	26.0
Facilities with Non-Standard Risks																						
Main																						
Wrapped Steel Main in Casing																			13	7	0	5.5
Shallow Main																			24	24	0	0.0
Main on Bridges																			13	0	0	12.5
Main on Docks and Wharves																			11	0	0	11.3
Service																						
Wrapped Steel Service in Casing																			15	10.5	0	4.0
Shallow Service																			30	30	0	0.0
Extended Service Line in Mobile Home Communities																			4	0	0	4.0
Service on Bridges																			7	0	0	6.5
Service on Docks and Wharves																			15	0	0	14.5

Effective Date: 05/09/2012
Cancelling Date: 08/02/2011

Distribution Integrity Management Program

Risk Evaluation and Prioritization by Threat

Threat	Sub-Threat	FOF	COF	TOT
Corrosion	Internal Corrosion	0.5	1.5	0.8
Equipment Failure	Regulator Failure	0.5	1.5	0.8
Natural Force	Animal Damage	0.5	1.5	0.8
Natural Force	Frost Heave	0.5	1.5	0.8
Natural Force	Tree Roots	0.5	2.0	1.0
Natural Force	Over-pressure due to snow/ice blockage	0.5	2.5	1.3
Corrosion	Stray/Induced Current	1.0	1.5	1.5
Excavation Damage	Facility Not Platted/Other	1.0	2.0	2.0
Excavation Damage	One-call Notif. Center Error	1.0	2.0	2.0
Natural Force	Earth Movement / Landslide	1.0	2.0	2.0
Natural Force	Flooding	1.0	2.0	2.0
Natural Force	Seismic Activity	1.0	2.0	2.0
Outside Force Damage	Structure Fire	1.0	2.0	2.0
Incorrect Operation	Operating Error	1.5	2.0	3.0
Material or Weld	Weld failure	1.5	2.0	3.0
Other	Other	3.0	1.0	3.0
Outside Force Damage	Vandalism/Tampering/Unintentional Damage	1.5	2.0	3.0
Corrosion	Atmospheric Corrosion	2.5	1.5	3.8
Equipment Failure	Celcon Service Tee Caps	1.5	2.5	3.8
Excavation Damage	Facility Not Located or Marked	2.0	2.0	4.0
Outside Force Damage	Vehicle Damage	2.0	2.0	4.0
Corrosion	External Corrosion	3.0	1.5	4.5
Equipment Failure	Valves	3.0	1.5	4.5
Natural Force	Lightning	1.5	3.0	4.5
Other	Encroachment	1.5	3.0	4.5
Outside Force Damage	Electrical Faults	1.5	3.0	4.5
Excavation Damage	Locating Error	2.5	2.0	5.0
Material or Weld	Mechanical fitting failure	2.0	2.5	5.0
Material or Weld	Brittle-like cracking failure	2.0	3.0	6.0
Material or Weld	Fusion failure	2.0	3.0	6.0
Excavation Damage	Failure to Call	3.0	2.0	6.0
Excavation Damage	Improper Excavation Practice	3.0	2.0	6.0
Incorrect Operation	Sewer Cross Bore	2.0	3.0	6.0

Appendix B: Additional and Accelerated Actions

This appendix describes the Additional and Accelerated Actions that resulted from the risk evaluation and prioritization that identified the need for additional mitigative measures to reduce risk in the system. The Additional and Accelerated Actions presented in this section are in order of those programs that have documented program plans, those that are in development, and those that have completed.

Additional and Accelerated Actions with Documented Program Plans

The following section reports Additional and Accelerated Actions that have been implemented and have a documented program plan. A summary of the program, the mitigation plans, and the performance measures are also provided.

The detailed methodology used to risk rank these facilities, establish thresholds where Additional and Accelerated Actions are required, and the performance measures for these Additional and Accelerated Actions are or will be documented either in the DIM Plan or a Settlement Agreement. Programs that have been finalized since the DIM Plan was last updated will be documented in the next update of the Plan.

Bare Steel Replacement Program

PSE is currently working to replace all bare steel and wrought iron facilities in PSE's system by the end of 2014. In 2011, a total of 98,768 feet of bare steel and wrought iron main were retired. Since 2005, 745,259 feet (141.1 miles) have been taken out of service leaving approximately 338,977 feet (64.2 miles) to be completed by the end of 2014. A summary of program progress is provided in the chart below.

Table 14. 2005-2012 Bare Steel Performance Measures - Replacement Footages

Year	2005	2006	2007	2008	2009	2010	2011	2012 (Planned)
Planned Replacement (feet)	46,995	99,205	99,205	99,205	99,205	99,205	120,000	140,000
Actual Replacement (feet)	48,078	90,272	175,386	112,253	109,375	111,127	98,768	TBD
Cumulative Actual Replacement (feet)	48,078	138,350	313,736	425,989	535,364	646,491	745,259	TBD

Results Discussion and Evaluation of Effectiveness

PSE is on track to complete the replacement of all bare steel pipe by the end of 2014. No changes are recommended to this program.

Older Vintage PE Pipe Mitigation Program

Some segments of older (defined as pre-1986) PE pipe have factors that lead to an increased risk of repeat failures including fusion failures and brittle-like cracking. These factors include older fusion and backfill practices as well as older style mechanical fittings and a pipe resin inferior to that in use today.

In 2008, PSE implemented improved processes in materials failure analysis that greatly enhanced the ability to identify fusion and brittle-like cracking failures on older PE pipe, especially the HDPE pipe manufactured by DuPont also known as DuPont Aldyl HD, that is most susceptible to these failures. In 2009, PSE developed a risk model for DuPont pipe segments based on their failure history. The risk model was developed to generally align with the risk model used to rank main segments for the Bare Steel Program, allowing for a risk comparison between programs to assist in validating the approach and scope of PSE's DuPont pipe replacement efforts.

Mitigation is accomplished through replacing or retiring pipeline segments as indicated by the results of the risk model within these mitigation categories and by SME review. Further remediation is accomplished through replacing pre-1986 PE services when mains are replaced through integrity management programs. This approach was implemented in 2010 and will result in additional replacement of older PE services eliminating some of the older style mechanical fittings.

The following table shows the footage of main that has been replaced or retired since 2009.

Table 15. Footage of Main Replaced or Retired

Year	Footage of Main Replaced or Retired
2009	9,153
2010	9,541
2011	9,185

In 2011, PSE began prioritizing pipe for replacement in accordance with the Older Vintage PE Pipe Mitigation Program detailed in *Appendix F* of the DIM Plan. In accordance with this program, pipe is categorized as Priority Replacement, Scheduled Replacement, Phased Program Replacement, or Suitable for Monitoring. The mitigation category defines the timeframe for mitigating the pipe.

Also in 2011, PSE began identifying an additional risk reduction opportunity for older PE mains and services that are 1 ¼" or larger and in the vicinity of high occupancy structures (HOS) and wall-to-wall paving areas. PSE will begin excavating these services to determine if they are Dupont and once confirmed these services will be replaced or prioritized for replacement.

The Older Vintage PE Pipe Mitigation Program detailed in *Appendix F* of the DIM Plan also specifies the performance measures that will be used to evaluate the effectiveness of these mitigative measures. These performance measures are reported in the following along with a discussion of what the trends show.

Older Vintage PE Pipe Mitigation Performance Measures

The following tables show the performance measures for the Older Vintage PE Pipe Mitigation Program.

Table 16. 2012 Replacement Planned by Mitigation Category

2012 Planned Priority Replacement	2012 Planned Scheduled Replacement	2012 Planned Phased Program Replacement
10 services	8,025 feet	16,055 feet

Table 17. Hazardous Leak Repairs Due to Brittle-Like Cracking and Fusion Failures

Brittle-like Cracking 2011	Brittle-like Cracking 5-Year Average	Fusion Failures 2011	Fusion Failures 5-Year Average
16	12	26	22

Table 18. All Leak Repairs Due to Brittle-Like Cracking and Fusion Failures

Brittle-like Cracking 2011	Brittle-like Cracking 5-Year Average	Fusion Failures 2011	Fusion Failures 5-Year Average
26	19	38	36

Results Discussion and Evaluation of Effectiveness

Both hazardous and total leaks due to brittle-like cracking and fusion failures are increasing in 2011 compared to the 5 year average. This trend indicates that PSE's plan to replace more than 24,000 feet of older vintage PE in 2012 is appropriate. This will result in more than doubling the footage replaced per year in each of the past three years. PSE will continue to monitor these trends as additional pipe is required and determine whether any changes should be made to the Older Vintage PE Pipe Mitigation Program.

Wrapped Steel Service Assessment Program (WSSAP)

The Wrapped Steel Service Assessment Program (WSSAP) was initiated in 2006 to evaluate the risk of the wrapped steel services installed prior to 1972 and ensure those with high risk are mitigated. The program uses a risk model to categorize approximately 90,000 WSSAP services into four mitigation categories: Priority Replacement, Scheduled Replacement, Increased Leak Survey, and Standard Mitigation. These categories specify what mitigation is required.

The data in the risk model is updated each year and a new risk score is calculated for each service. Table 19 shows the results of the annual model run since inception of the program.

Table 19. Historical WSSAP Model Results

Mitigation Category	2006 Model Results	2007 Model Results	2008 Model Results	2009 Model Results	2010 Model Results	2011 Model Results
Priority Replacement	516	216	212	79	91	120
Scheduled Replacement	8,470	8,092	4,682	2,077	303	266
Increased Leak Survey	23,100	23,258	22,913	22,760	22,731	22,240
Standard Mitigation	69,281	69,742	68,660	68,280	67,658	66,719
Subtotal	101,367	101,308	96,467	93,196	90,783	89,345

In 2011, the WSSAP program was incorporated into *Appendix F* of the DIM Plan. In accordance with this program, Priority Replacement services are to be mitigated in the following year and Scheduled Replacement services are to be mitigated within four years except where customer or permit issues prevent mitigation from occurring within these timeframes.

The WSSAP program also specifies the performance measures that will be used to evaluate the effectiveness of these mitigative measures. These performance measures are reported below along with a discussion of what the trends show.

Wrapped Steel Service Assessment Program Performance Measures

Table 20. Leakage Performance Measures by Mitigation Category

Mitigation Category	# Active Leaks	# Repaired Leaks by Cause	# Leaks Discovered in 2011	% of Services with Leak Discovered in 2011	% of Services with Leak Discovered 5-Year Average
Priority Replacement	0	0	0	0	2.42%
Scheduled Replacement	0	0	0	0	0.25%
Increased Leak Survey	11	2 – Corrosion 1 – Excavation 1– Equipment 5– Material or Welds 7 – Other 16 – Total	27	0.12%	0.19%
Standard Mitigation	15	2– Corrosion 2 – Excavation 3– Equipment 5– Material or Welds 2 – Natural Force 1 - Operation 3 – Other 18 – Total	33	0.05%	0.10%

As shown in Table 21, the new leaks discovered in 2011 are below the 5 year average for all mitigation categories. This is a positive trend. In addition, the number of leaks in the standard mitigation category is significantly below the 2.76% threshold that would require the model to be recalibrated.

Table 21. WSSAP Mitigation for 2011

Mitigation Category	2010 Model Results	2011 Target Mitigation Not Completed	Additional Mitigation
Priority Replacement	91	3	NA
Scheduled Replacement	303	1	NA
Increased Leak Survey	22,731	NA	175
Standard Mitigation	67,658	NA	190
Subtotal	90,783	4	365

By March of 2012, only one priority service and one scheduled replacement service were still pending mitigation. The priority service is due to customer issues and will be replaced as soon as these issues are resolved. The scheduled replacement service will be replaced in conjunction with a bare steel main replacement that is scheduled for the summer of 2012.

In addition to mitigating Priority and Scheduled Replacement services, PSE is replaces WSSAP services that are in casing when there is a public improvement project in the area and when other risk or maintenance issues can also be remediated by replacing or retiring the service.

Table 22. WSSAP Mitigation for 2012

Mitigation Category	2011 Model Results
Priority Replacement	120
Scheduled Replacement	266
Increased Leak Survey	NA
Standard Mitigation	NA

PSE is targeting to replace all the Priority services identified in the 2011 WSSAP model run in 2012. PSE is also planning to replace all Scheduled Replacement services not off of a bare steel main in 2012. Scheduled Replacement services off of bare steel main will be replaced in conjunction with the main replacement which will be completed by the end of 2014 in accordance with the Bare Steel Replacement Program.

Results Discussion and Evaluation of Effectiveness

PSE has conducted more than 1,000 electrical surveys on services from the two lowest risk categories; increased leak survey and standard mitigation. These surveys were evaluated and direct examinations performed based on the analysis of the survey data. These surveys and direct examinations were performed to validate the risk model or determine if adjustments were needed to improve the model. The results of this analysis did not indicate any adjustments were needed to the WSSAP model.

In addition to the electrical survey results, the leak performance measures as well as the progress made on replacing Priority and Scheduled Replacement services indicates the WSSAP program is reducing the risks associated with these services. As a result, PSE will continue to run this risk model annually and mitigate services that migrate into the Priority or Scheduled Replacement categories.

In 2012, PSE also plans to expand the replacement of WSSAP services that are in casing. The goal will be to identify and plan the remediation of these services that also have idle risers or a buried meter.

Older Wrapped Steel Pipe Mitigation Program

Pre-1972 wrapped steel main adjacent to WSSAP Priority and Scheduled Replacement services were reviewed as part of the WSSAP program to identify mains that should also be remediated. Remediation of these segments was completed in 2011.

Additional pre-1972 wrapped steel mains not adjacent to WSSAP Priority and Scheduled Replacement services were also reviewed to determine if there was evidence of corrosion and whether replacement or other mitigation was appropriate. Table XX shows the footage of older STW main replaced under these two categories.

Table 23. Footage of Main Replaced or Retired

Year	WSSAP Mains - Footage of Main Replaced or Retired	Older STW Mains - Footage of Main Replaced or Retired
2010	2,422	4,062
2011	350	17,155

PSE has continued to refine the process for evaluating and prioritizing these mains for mitigation. In 2011, PSE began prioritizing pipe for replacement in accordance with the Wrapped Steel Pipe Mitigation Program detailed in *Appendix F* of the DIM Plan. In accordance with this program, pipe is categorized as Scheduled Replacement, Phased Program Replacement, Suitable for Monitoring, or Standard Mitigation. Also included in this document are the criteria for determining the mitigation categories, remediation measures and associated timeframes for each mitigation category as well as the performance measures for this program. These performance measures are reported below along with a discussion of what the trends show.

Wrapped Steel Pipe Mitigation Program Performance Measures

Table 24. 2012 Replacement Planned by Mitigation Category

2012 Planned Scheduled Replacement	2012 Planned Phased Program Replacement
15,000 feet	1,055 feet

Table 25. Corrosion Leak Repairs on Older STW Pipe

Facility Type	Hazardous Corrosion Leak Repairs 2011	Hazardous Corrosion Leak Repairs 5-Year Average	Total Corrosion Leak Repairs 2011	Total Corrosion Leak Repairs 5-Year Average
Mains	12	9	50	38
Services	28	33	41	59
Total	40	41	91	97

Table 26. All Leak Repairs on Older STW (Excluding Excavation Damage)

Facility Type	Hazardous Leak Repairs 2011	Hazardous Leak Repairs 5-Year Average	Total Leak Repairs 2011	Total Leak Repairs 5-Year Average
Mains	52	47	236	242
Services	102	98	216	246
Total	154	145	452	488

Results Discussion and Evaluation of Effectiveness

Hazardous and total leaks due to corrosion on older STW mains is increasing over the 5 year average. Hazardous and total corrosion leaks on older STW services are generally decreasing over the 5 year average. The improvements on services may be attributed to the additional mitigative measures implemented on these services through the WSSAP program. The trends on the STW mains indicates that PSE's plan to continue to risk rank older STW mains and replace mains as indicated by this review and SME input in 2012 is appropriate. PSE will continue to monitor these trends as additional pipe is required and determine if revisions are needed to the risk model and/or Additional and Accelerated Actions.

Isolated Facilities Extension Programs

In 2009, the scope of the Isolated Facilities Program was expanded to include potential isolated facilities associated with sidewalk regulators, above ground regulators, steel services in casings, and extended service lines in mobile home communities. More detail on each of these programs is included below. Each of these programs will be completed by the end of 2014.

Sidewalk Regulators

The primary maintenance issue with Sidewalk Regulators is ensuring the pipe between the regulator and building wall is cathodically protected. In 2009 PSE completed the assessment and investigation of over 600 sidewalk regulators to determine the population of facilities requiring remediation.

Results from the assessment and investigation indicated 95 sidewalk regulators required remediation. Some of these stations have additional issues that will be remediated in conjunction with the CP including vault integrity, venting, and location issues that impact accessibility for operation and maintenance.

Where the regulator could be installed above ground, the sidewalk regulator was retired and new service piping was installed to the new regulator and inside meters. Where an aboveground regulator was not practical, one of the following applied: 1) if the piping was older than 10 years, the piping was replaced or 2) if the piping had been installed within the previous 10 years, CP was added to the piping.

The table below shows the number of sidewalk regulators remediated since 2010. PSE is planning to remediate 30 sidewalk regulators in 2012 with the remaining 40 planned to be remediated in 2013 and 2014.

Table 27. Performance Measure - Number of Sidewalk Regulators Remediated and Pending Remediation

Year	Number of Sidewalk Regulators Remediated	Number of Sidewalk Regulators Pending Remediation
2010	0	95
2011	25	70
2012 (Planned)	30	TBD

In addition to the 95 sidewalk regulators that required CP remediation, 61 locations were identified with potential non-standard venting issues. These will require additional review and may be addressed through the non-standard vent reports as discussed in *Part 2. System Trends and Threat Identification* under the *Report of Abnormal or Unusual Operating Condition (Blue Card) Process* section.

Above Ground Regulators

This part of the program focuses on outside, above ground regulators with service piping that is buried downstream of the regulator and enters the building belowground. In 2009, several such installations were found to have insufficient cathodic protection on the piping between the regulator and the building wall. In 2010, PSE completed a field assessment on 888 locations to confirm adequacy of cathodic protection and that the facility does indeed meet the scope of the program. By the end of 2010, 636 locations were either remediated or eliminated from the scope of the program leaving 252 total locations requiring remediation of CP between 2011 and 2014. Services were prioritized based on the length of time the service was without adequate CP while taking into consideration efficiencies from other neighboring services that need remediation.

Where the regulator could be configured to eliminate the need for buried piping downstream of the regulator, the installation was modified and the buried piping retired. Where eliminating the buried piping downstream of the regulator was not practical, one of the following applied: 1) CP was added if the piping had been installed within the last 10 years or 2) where the piping was older than 10 years, the piping was replaced.

The 252 locations that required remediation have been leak surveyed semi-annually since they were identified at the end of 2010 and will continue to be leak surveyed at this increased frequency until final remediation is completed. The following table shows the number of aboveground regulators remediated since 2010 and the number of aboveground regulators pending remediation. At the end of 2011, 139 of the 252 locations were remediated.

Table 28. Performance Measure - Number of Aboveground Regulators Remediated and Pending Remediation

Year	Number of Aboveground Regulators Remediated	Number of Aboveground Regulators Pending Remediation
2010	37	215
2011	102	113
2012 (Planned)	35	TBD

Steel Services in Casing

This program addresses the risk that corrosion may occur on a STW service due to an unidentified short to its casing. As part of the original Isolated Facilities Program records review, 531 wrapped steel service locations were identified via records review as being installed in casings in the post-1971 timeframe.

Most of these services are being remediated by replacement. Where it is not practical to replace the service, remediation may be accomplished by either removing the casing or installing test sites and monitoring the test site annually to ensure the carrier pipe is isolated from the casing. The following table shows the number of services remediated since 2010 and the cumulative number of services remediated. By the end of 2011, more than half of the locations have been remediated. All 531 locations will be remediated by the end of 2014.

Table 29. Performance Measure - Number of STW Services in Casing Remediated

Year	Number of STW Services in Casing Remediated	Cumulative Number of STW Services in Casing Remediated
2010	117	117
2011	152	269
2012 (Planned)	139	TBD

Extended Service Lines in Mobile Home Communities

Extended Service Lines in mobile home communities are facilities defined as buried piping downstream of the meter to a mobile home. These facilities present operating and maintenance challenges due to their location downstream of the meter. In 2010, PSE performed inspections of all mobile home communities to develop a complete inventory of all such installations. At the time of inspection, each location was leak surveyed and inspected for atmospheric corrosion. The inspection identified 369 installations that include Extended Service Lines.

For any wrapped steel Extended Service Lines, PSE is mitigating the corrosion risk by replacing and relocating the meter to the mobile home eliminating the need for buried piping downstream of the meter set. If the meter is not able to be located on the mobile home, PSE will mitigate the risk of corrosion by replacing the buried piping with plastic. The table below shows the remediation completed by year as well as the remediation planned for 2012. All relocation and replacement work will be complete by the end of 2014 and each location will be leak surveyed twice annually until remediated.

Table 30. Performance Measure - Number of STW Services in Casing Remediated

Year	Number of Extended Service Lines Remediated	Cumulative Number of Extended Service Lines Remediated	Number of Extended Service Lines Pending Remediation
2010	25	25	344
2011	128	153	216
2012 (Planned)	86	TBD	TBD

Results Discussion and Evaluation of Effectiveness

PSE is on track to complete the remediation of sidewalk regulators, aboveground regulators, steel services in casing, and extended service lines in mobile home communities through the Isolated Facilities Extension Programs by the end of 2014. No changes are recommended for these programs.

Regulator Station Remediation

Maintenance issues at regulator stations are typically identified by PSE Pressure Control department during the annual inspection required by Gas Operating Standard 2575.1000 Pressure Regulating and Pressure Relief Device Inspection and Testing. Pressure Control inspects approximately 650 regulator stations and during the annual inspection, Pressure Control may be able to address minor maintenance issues such as replacement of small equipment valves. More extensive maintenance issues that may represent a compliance or safety risk or otherwise impact the proper operation of the station are reported to the Gas System Integrity (GSI) department. GSI works with Pressure Control and the Gas System Engineering department to determine the mitigation priority for each of these stations.

In 2011, PSE began categorizing these stations as either Scheduled Mitigation or Suitable for Monitoring. Regulator Stations that require Scheduled Mitigation include facilities that have inoperable equipment that impacts the safe operation of the station, lack required equipment, pose a public and/or worker safety concern due to the vault structure, have failed a relief review, or have underrated components. Beginning in 2012, PSE will remediate regulator stations categorized as Scheduled Mitigation within 18 months of being categorized as a Scheduled Remediation mitigation priority except where customer issues, permitting issues, or other unusual circumstances prevent mitigation within this timeframe.

Since 2008, approximately 120 stations have been remediated. In 2012, 16 stations are planned to be mitigated. The following chart shows the number of stations in each mitigation category to be mitigated.

Table 31. Number of Facilities by Mitigation Category

Year	Scheduled Mitigation	Suitable for Monitoring
2012 (Planned)	9 Stations	7 Stations

This program was implemented since the last DIM Plan update and the documented program plan will be incorporated into the 2012 DIM Plan. Since this is a new DIMP program the performance measures and evaluation of effectiveness will be reported in the 2012 Continuing Surveillance Annual Report.

Converted Single Service Farm Tap Program

The purpose of this program is to ensure that all single service farm taps (SSFT) that were converted to district regulators meet the more stringent regulatory requirements for pressure regulating stations. In 2006, PSE catalogued the location of each SSFT and a list of potential issues that required remediation as a pressure regulating station. A total of 60 stations were identified requiring remediation. GSI developed a remediation schedule to bring each SSFT up to current pressure regulating station code by the end of 2013. At the end of 2011, 44 of the 60 stations had been remediated. In 2012, the plan is to remediate 7 additional stations with the remaining 9 stations planned for remediation in 2013.

Results Discussion and Evaluation of Effectiveness

PSE is on track to complete the remediation of converted single service farm taps by the end of 2013. No changes are recommended to this program.

Additional and Accelerated Actions in Development

The following section describes measures that are being taken to reduce risks but where a formal program document is in development. When developed, the program document will be included in the DIM Plan and will specify the methodology used to risk rank these facilities, establish thresholds where Additional and Accelerated Actions are required, and the performance measures for these Additional and Accelerated Actions.

Sewer Cross Bores

Gas facilities installed using trenchless methods may intersect a sewer line resulting in a sewer cross bore. This issue has been of national interest over the past few years due to incidents that have occurred as a result of sewer cross bores. PSE identified this as a threat that requires Additional and Accelerated Actions to reduce the risks associated with sewer cross bores.

In 2011, PSE made significant progress understanding the many issues associated with mitigating existing and preventing additional sewer cross bores. A process was developed and implemented to track and consistently respond to reports of existing, or legacy, sewer cross bores. Tracking sewer cross bores will add to PSE's risk knowledge of this threat and provide valuable information to identify risk reduction measures. A consistent process reduces the risks by facilitating a timely response and clear communication when sewer cross bores are identified by third parties.

Also in 2011, PSE worked with its service provider to implement a sewer cross bore Pilot Program. The intent of the Pilot Program was to:

- Evaluate sewer launch camera technology to understand how the camera could be used to locate side sewers prior to trenchless construction to help prevent additional cross bores.
- Evaluate sewer launch camera technology to understand how the camera could be used to inspect sewers in the vicinity of existing natural gas facilities to identify existing cross bores.
- The cost impacts to and scheduling requirements for future projects if locating with a launch camera becomes a requirement.

- Identify challenges of working with municipal and jurisdictional sewer owners to gain access to their facilities.

In addition, PSE identified various approaches being used or considered by other gas operators to reduce the risk of sewer cross bores. This information, as well as the information gained from the Pilot Program, will be used as PSE develops the program to reduce the risk of sewer cross bores. Development of the program will continue in 2012 and consider the following three issues:

- Additional policies or requirements for preventing sewer cross bores on new construction.
- Identifying and remediating legacy sewer cross bores.
- Increasing public awareness about sewers cross bored by gas facilities.

Buried MSA Remediation

The Buried MSA Remediation program was initiated following identification of significant numbers of buried meters in 2007 through the Abnormal or Unusual Operating Condition Reports (Blue Cards). This program addresses the threat of corrosion to facilities that were installed and intended to operate above ground but have subsequently been buried by landscaping, hard surface additions, or other changing field conditions. Additionally, buried MSA valves may not be operable.

Remediation is prioritized considering the type of material the component is buried in, the component that is buried, the accessibility of an outside shutoff valve, and whether the facility being served is designated as an HOS.

A pilot program was completed with the assistance of GFR in 2008. Based on the pilot program, the following process was developed and implemented in 2009. Facilities that are reported to have buried MSA components are reinspected and if possible, remediated by GFR. GFR also communicates with the customer the need to protect the MSA from reburial. If GFR can not remediate the buried components, the Gas System Integrity department develops the scope of work and forwards the work to the service provider.

To date over 50,000 locations have been reported that require reinspection and remediation. The following table shows the status of work performed in 2009 and 2010 as well as the plan for 2011. As remediation will be a multi-year effort, additional leak surveys on these locations have been performed since 2010 and will continue as the program develops and additional risk knowledge is obtained.

Table 32. Number of Facilities Reinspected and Remediated

Year	Number of Facilities Reinspected	Number of Facilities Remediated during Reinspection	Number of Facilities Remediated by Service Provider	Cumulative Number of Facilities Remediated	Number of Facilities Pending Remediation
2009	1,082	605	79	684	398
2010	3,030	2,360	171	3,215	897
2011	1,453	1,252	149	4,616	949
2012 (Planned)	4,356	TBD	TBD	TBD	TBD

Traffic Protection Enhancements

This program addresses the need for new or enhanced traffic protection for PSE's above ground facilities, primarily MSAs. This need may be due to changes in traffic patterns near above ground PSE facilities that have occurred over time or due to facilities that were installed to an older standard that may not provide adequate protection from potential vehicular damage. The potential need for traffic protection is identified by field personnel during operation and maintenance activities.

Remediation is prioritized based on likelihood and consequence of damage. The highest priority is given to facilities with existing guard posts that are damaged and do not provide adequate facility protection, facilities in commercial and industrial locations, and facilities serving locations that are identified as difficult to evacuate such as schools, hospitals, prisons, and elder and daycare facilities. The goal is to remediate facilities in this category within 2 years of identification. PSE has generally been able to meet this goal except where customer issues or acceptable resolution requires more project development time.

Remediation is accomplished by installing traffic protection to current operating standards or moving the above ground facility to a new location that does not require traffic protection. The following table shows the status of work performed since 2009 as well as the plan for 2012.

Table 33. Number of Facilities Remediated

Year	Number of Facilities Remediated
2009	27
2010	32
2011	83
2012 (Planned)	36

Industrial Meter Set Remediation

This program utilizes opportunities to improve integrity of industrial meter set assemblies in conjunction with meter maintenance work. Integrity improvements may include moving meters to more accessible locations, installing new meter set assemblies with more welded connections minimizing the potential for future leaks at the joints, installing bypasses to facilitate future operating and maintenance activities, and installing new components such as valves that will have a longer useful service life.

Meter maintenance work includes replacement of meters in conjunction with periodic meter change outs, replacement of meters that have reported measurement inaccuracies, and replacement of meter sets where the replacement of the meter requires a complete rebuild of the meter set assembly.

PSE prioritizes the remediation of these meter set assemblies based on the likelihood and consequence of failure. This is based on the number and type of issues with the current meter set as well as the location. PSE has made significant progress on remediating MSA with integrity improvement opportunities and is currently remediating most opportunities within 2 years of being identified.

Additional opportunities may be identified through an industrial meter set inspection pilot program beginning in 2012. The pilot program will develop procedures for inspecting industrial meter sets and reporting the results of the inspection. The results will be analyzed to determine whether any revisions are needed to the inspection procedure or the approach to capturing the data from the inspection as well as benefits obtained from the inspection. These results will be evaluated to determine whether PSE should implement an industrial MSA inspection program.

Shallow Main and Service Remediation

Shallow main and service reports were first recognized as a trend in 2008 through the Abnormal or Unusual Operating Condition Reports (Blue Cards) from 2007. The concern with shallow pipe focuses on the increased likelihood of damage to the pipe during third party construction and on the potential for excessive external loading in areas where heavy vehicles travel over the pipeline.

Mains and services are considered shallow where they have less cover than required for new construction in the gas operating standards. Shallow services are planned for remediation if there is less than 12 inches of cover or less than 24 inches if the service is under a bar ditch. Services meeting these criteria are planned to be remediated within the next calendar year.

Shallow mains require further investigation to gain more information to prioritize and scope the main for remediation. The prioritization of shallow mains is based on the initial report of the depth, operating pressure, and location. The investigations determine approximate depth measurement and extent of the shallow facility. The operating pressure, location, and the approximate amount of cover over the main are evaluated to determine the risk and remediation priority.

Remediation is accomplished by replacement, retirement or by installing a protective cap meeting the requirements of the Gas Operating Standards. The following table shows the number of shallow services and mains remediated since 2009 and the plan for 2012.

Table 34. Number of Shallow Facilities Remediated

Year	Number of Shallow Services Remediated	Number of Shallow Mains Remediated
2009	34	1
2010	19	5
2011	10	5
2012 (Planned)	21	8

Encroachments

An encroachment is a third party structure that impedes PSE's ability to safely operate and maintain our gas facility. Additionally if there is gas leak, there is a higher likelihood that gas may migrate into an inhabitable structure. As a result, any inhabitable encroachments are considered an unsafe situation. Non-inhabitable encroachments are reported as an unsatisfactory condition through the Abnormal or Unusual Operating Condition Reports (Blue Cards).

In 2011, there were an increased number of unsatisfactory encroachments reported. As a result, PSE is developing a more formal program for reporting, prioritizing and remediating unsatisfactory encroachments. PSE has an existing program to identify, prioritize and remediate encroachments in mobile home communities. This program is described in the Mobile Home Community Encroachment Surveys section of this report. This program was developed due to the frequency of encroachments in these communities.

In 2012, PSE will inspect a variety of unsatisfactory encroachments to identify issues that should be considered in prioritizing the remediation of these encroachments. This information will be used to revise reporting requirements to capture the information necessary to prioritize encroachments for remediation. Where additional information needs to be gathered to prioritize the encroachments that have already been reported, PSE will develop and implement a reinspection process to capture the additional information needed.

Mobile Home Community (MHC) Encroachment Surveys

Given the nature of mobile home communities (MHC), natural gas facilities are more likely to have encroachments occur than other areas of the system. As a result, PSE surveys each mobile home community once very three years for existing service and main encroachments as well as existing idle risers that may be at risk of future encroachments or damage when mobile homes are moved.

There are currently 167 MHCs in PSE's operating system and PSE conducted 57 MHC patrols in 2011. The results of each MHC survey are documented; and if encroachments or idle risers are found, that information is sent to GSI for prioritization and scheduling. Remediation is prioritized considering the frequency of encroachments, the number of idle risers, leak history, and current maintenance issues of related pipeline segments in each mobile home community.

Encroachments are remediated by eliminating the encroachment. This can be accomplished by either relocating or retiring the encroached facilities or relocating the object that is encroaching the pipeline. Idle risers are mitigated by retiring the service. In addition, PSE educates community owners and managers of encroachment issues to help prevent recurrence.

The following table shows the number of MHC that have been remediated by year since 2009. There are currently 24 MHC scheduled for remediation in 2012. This includes all but 20 of the MHC that had encroachments or idle risers identified during the planning for 2012.

Table 35. Number of Mobile Home Communities Remediated

Year	Number of Mobile Home Communities Remediated	Cumulative Number of Mobile Home Communities Remediated	Number of Encroachments in Mobile Home Communities Remediated	Number of Idle Risers in Mobile Home Communities Remediated
2009	47	47	551	440
2010	25	72	315	182
2011	26	98	206	100
2012 (Planned)	24	TBD	185	90

Bridge and Slide Remediation

The Bridge and Slide Remediation program ensures plans are developed and implemented to respond to threats to the pipeline identified during patrols of pipelines on bridges or in landslide areas. GOS 2575.3100 Patrolling Program specifies the frequency that patrols shall be performed. Generally patrols of pipelines on bridges and landslide areas are performed quarterly and other patrols are performed semi-annually. More frequent patrols are performed when site conditions warrant, such as during periods of heavy rainfall. These patrols identify threats due to potential corrosion, natural forces, equipment, and other outside force damage. Remediation is prioritized considering the location, impact and likelihood of pipeline failure, and severity of the issue.

Remediation may include repairing damaged pipe coating, remediating atmospheric corrosion, replacing or fixing pipe supports, and removing or relocating the pipe. In addition to prioritizing segments for remediation, PSE identifies locations that should have interim measures taken until the remediation is completed. Interim measures may include more frequent patrols, leak surveys, or valve inspection and maintenance. In 2010 there were two sites that were identified for increased leak survey until remediation was complete. Both of these locations were completed in early 2011.

The following table shows the number of sites that have been remediated per year since 2007 as well as the number planned for 2012. There are 4 additional projects that have been identified that require future remediation and are being developed in 2012.

Table 36. Number of Bridge and Slide Sites Remediated

Year	Number of Bridge and Slide Sites Remediated
2007	12
2008	14
2009	12
2010	16
2011	10
2012 (Planned)	12

Atmospheric Corrosion Inspections

PSE has identified a variety of installations that are difficult to complete atmospheric corrosion inspections using standard equipment and inspection procedures. These locations include certain pipelines on bridges, docks and wharves, and pipe on pipe supports.

Hard-to-Reach Bridges

In 2006, PSE began identifying locations where the gas mains and services were installed on bridges where access or the configuration of the bridge and pipe prevented a complete atmospheric corrosion inspection with standard equipment. Each site was assessed to determine what equipment was required to conduct a complete inspection. At the end of 2011, all but one of these locations had been inspected or replaced and is on a maintenance plan that will ensure future inspections are performed with the appropriate equipment. The one remaining bridge location is planned to be replaced in 2012.

PSE has continued to look for opportunities to conduct these inspections in the most efficient and thorough manner. This has resulted in increased use of inspection mirrors as well as inspection cameras for certain locations.

Docks and Wharves Assessment

In 2011, the Maps, Records, and Technology (MRT) department performed a comprehensive review of all mains and services based on facilities in close proximity to bodies of water. Records were then reviewed to determine any facilities that may be installed on a dock or wharf. In the same year, GSI completed an inventory of candidate locations identified by MRT, developed and recorded initial inspection criteria and documentation requirements, and completed the inspection of all candidate locations.

GSI recorded the results of each inspection, the condition of the facilities, and whether special equipment or access is needed to perform a full inspection with the intent of prioritizing each location for follow-up activity. Through these efforts a total of 30 dock and wharf locations were found. In addition, as maintenance concerns were discovered, GSI assessed and scheduled these locations for remediation as required. The following tables show the status of the inspection and remediation work. Inspections and remediation will continue into 2012 with the goal of completing the inspections of the remaining locations and the remediation of the one location identified in 2011 still pending.

Table 37. Inspection Statuses of Dock and Wharf Locations

Inspection Status	Number of Dock and Wharf Locations
Confirmed Dock or Wharf	30
Full Inspection Completed without Specialized Equipment	12
Full Inspection Completed with Specialized Equipment	0
Full Inspection Pending Scheduling of Specialized Equipment	18

Table 38. Remediation Statuses of Dock and Wharf Locations

Remediation Status	Number of Dock and Wharf Locations
Identified as Requiring Remediation	2
Remediated	1
Pending Remediation	1

Pipe on Pipe Supports

As the result of an audit in 2008, PSE developed an inspection methodology for inspecting pipe at pipe supports. Using this methodology, the inspection of the pipe under the pipe support is performed by visually examining the pipe at the edges of the pipe support or fiberglass reinforced plastic (FRP) shield for evidence of corrosion. If there is no evidence of corrosion, the inspection is completed without removing the pipe support. If only rust staining (a light surface oxide) with no indication of corrosion product is found, the inspection is completed and no further action is taken prior to the next inspection as provided for in the Code of Federal Regulation (CFR) 192.479(c)(1).

If any accumulated corrosion deposits are identified, further inspection is performed to determine the extent of corrosion. The additional inspection may include removing the pipe support and conducting a direct examination of the pipe or by using non-destructive tools to determine the extent of corrosion. Based on the results of this additional inspection, a determination is made as to whether the pipe must be cleaned and coated in accordance with CFR 192.479(a) or whether experience indicates corrosion will not affect the safe operation of the pipeline before the next scheduled inspection as provided for in CFR 192.479(c).

PSE has conducted a detailed study to validate this inspection process is sound. This study has also been reviewed and validated by a consulting firm, Kiefner and Associates, Inc. (KAI), to confirm that the approach is technically sound, ensures pipe integrity, and meets the requirements of CFR 192.481 and CFR 192.479. KAI's review confirmed that any corrosion that might affect the safe operation of the pipeline will be visually identifiable by the presence of accumulated corrosion deposits without removing the pipe supports. As a result, no further inspection is required when only rust staining is present and there is no visible indication of corrosion deposits. These recommendations are reflected in the inspection processes described above.

PSE has reviewed this process as well as PSE's study and KAI's recommendations with the Washington Utilities and Transportation Commission Pipeline Safety Staff (WUTC). PSE and the WUTC are continuing discussions on this inspection methodology and whether a request needs to be made to PHMSA to confirm that this approach complies with the requirements of CFR Part 192.

Aging Valve Mitigation

High Pressure (HP) Valves

In recent years, PSE has identified an emerging threat of leakage due to corrosion and equipment failure on Rockwell Figure (Fig.) 1487 valves. These valves were installed on PSE's 12", 16" and 20" high pressure (HP) supply mains in the 1950's and 1960's. The valves have a configuration that can allow moisture to collect on the upper bonnet of the valve. Over time this leads to corrosion of the steel and leakage can occur. In addition, one of the seals in the valve dries out over time and can lead to leakage.

Leakage on these valves due to corrosion can often be temporarily mitigated by greasing the valve. However, some of the valves become corroded to the point that greasing is not able to remediate the leak and leakage due to the seal drying out is not able to be remediated by greasing. Remediation then is typically accomplished by replacement.

As a result, PSE is developing replacement projects for all Rockwell Fig. 1487 valves that have active leaks. This will facilitate timely replacement if the leak grade increases and a repair is required. In addition, PSE is working to identify locations where leaks on these valves have previously been repaired by greasing. These locations will be reviewed and where deemed appropriate, PSE will develop replacement projects for these locations as well.

Based on the data available, PSE has identified 62 Rockwell Fig. 1487 valves still active in PSE's natural gas system. Over the past few years, PSE has average one valve replacement per year. Currently, there is one valve planned for replacement in 2012.

In the first quarter of 2012, PSE identified that the Rockwell Fig. 1167 valves have a similar design as the Rockwell Fig. 1487 valves and may be subject to the same threats. PSE has identified nine locations where the available valve data indicates a Rockwell Fig. 1167 valve has been installed. PSE will perform additional investigation on these valves and determine whether a similar approach should be implemented for these valves.

Intermediate Pressure (IP) Valves

Through the Bare Steel Program and the Older STW Pipe Mitigation Program, older valves that are within the scope of the main replacement are retired with the existing main. Currently, the entire distribution system is being leak surveyed at a maximum of every 3 years providing additional mitigative measures for these valves.

Double Insulated Flange (IF) Valve Mitigation

A double insulated flanged (IF) valve is a valve that is isolated from the cathodic protection system. The risk associated with double insulated flanged valves was identified in 2000 during the Critical Bond Program. As a result, all valve bodies at accessible valves were tested and inaccessible valves were accessed and tested if the plat map showed a double insulated flanged valve starting in July of 2000 and continuing through the remainder of the Critical Bond Program. All valves identified as double insulated flanged valves during the Critical Bond Program were remediated as part of that program.

Currently, PSE tests for and remediates double insulated flanged valves when there is an opportunity to do so in conjunction with other construction or maintenance work.

In 2012, PSE plans to test and excavate 15 valves to gather information about the condition of the valve and bolts to assist in the risk assessment of these valves. PSE also plans to look for opportunities to utilize GIS in identifying potential double IF valves for additional inspection and remediation based on high consequence areas and/or high risk areas due to corrosivity of the soil. Currently, the entire distribution system is being leak surveyed at a maximum of every 3 years providing additional mitigative measures for these valves.

High Voltage Alternating Current (HVAC) Mitigation Program

The High Voltage Alternating Current (HVAC) program addresses the threat of other outside force damage due to unintentional energizing of PSE pipelines by overhead power transmission lines. When pipelines are energized by AC, leaks may result and the coating may be damaged. In addition to the integrity threats to the pipeline, pipelines with AC present worker and public safety hazards.

Beginning in 2008, PSE began identifying gas pipelines at a high risk of being subjected to induced AC voltages due to their proximity to overhead power transmission lines. These were identified by reviewing maps as well as gathering reports from field personnel of locations where they had found the pipeline energized with AC current. This research and investigation effort was largely completed in 2009 and resulted in a list of steel pipeline segments for further investigation to determine which locations should have AC current mitigative measures implemented.

To date, 9 locations have been identified for remediation. Five have been completely remediated, two have been remediated and are pending confirmation of the effectiveness of the remediation, and the remaining two locations are scheduled to be mitigated in 2012. Once these locations are mitigated, PSE will continue to review revisions to the electric or gas system in the vicinity of electric transmission lines to determine whether the revisions result in the need for AC mitigative measures.

High Pressure (HP) Main Evaluation and Assessment

Current and historical design, construction, and O&M practices have reduced the risks of the high pressure system. This is due to the fact that PSE has generally constructed and maintained its high pressure mains to standards that exceed the federal requirements for a distribution pipeline and frequently met the requirements for a transmission pipeline. While the risks are reduced due to these practices, the high pressure system remains a higher risk than the intermediate pressure system mainly due to the higher consequence if failure occurs because of the higher operating pressure and criticality of supply.

In 2011, PSE gathered additional system knowledge of the high pressure system to determine where additional mitigative measures should be considered. This included knowledge gained from TIMP that may be indicative of threats to the distribution portion of the high pressure system as well as extensive review of the high pressure pipeline in the area of the Alaskan Way Viaduct project.

Knowledge gained from TIMP indicates that most of the coating is in good condition and where holidays exist, there is not significant corrosion; i.e. the CP has been performing adequately. Exceptions to this are primarily due to the pipe being shielded from CP either due to shorted casings or non-bare casings (such as PVC or wood), coating damage within the casing due to the insulators, and valves and associated flanges and bolts that may have improperly applied coating. Remediation of main in casing includes replacing or retiring the facility, removing the casing or filling the casing with grease. As a result, in 2011 PSE identified 2 locations where high pressure pipe was in casing for planned remediation and 1 project for investigation in 2012. Additionally in 2011, PSE plans to expose 2 high pressure valves and perform inspections of the valve body, flanges, and bolts for coating and corrosion condition.

Review of the design, construction, operation and maintenance of the high pressure pipeline in the area that will be impacted by the Alaskan Way Viaduct PI project indicated the pipeline was installed on or near materials such as timbers and tires that may insulate the facility from CP. Based on this information, additional investigation and remediation measures have been implemented on pipe that will not be impacted by the Alaskan Way Viaduct PI project but that have similar threats.

In 2012 PSE will continue to evaluate options for gaining risk knowledge and identifying areas where additional mitigative measures should be taken for the high pressure system.

Extended Utility Facilities (EUF) Program

Extended Utility Facilities (EUF) are PSE owned and operated facilities downstream of the meter. EUF's present operating and maintenance challenges because the customer typically owns the piping downstream of the meter. These challenges include customers unintentionally modifying PSE facilities, the potential confusion over operation and maintenance responsibility, and the physical location of EUF's. Starting in 2011, PSE has been working to ensure these facilities are being operated and maintained appropriately by confirming EUF locations, inspecting these facilities, and evaluating whether PSE should implement additional inspection and maintenance requirements for EUFs. Additionally, PSE will provide internal training to ensure EUF's are being addressed consistently and appropriately within the company and when communicating to the customer. PSE also expects to leverage GIS to help address challenges with identifying and maintaining EUFs.

Modified Farm Tap on a Riser

PSE is developing a pilot inspection program for modified farm taps to gain additional knowledge of the risks and appropriate mitigation strategies for these facilities. A modified farm tap is a high pressure service where the regulation from high pressure to the customer delivery pressure occurs aboveground as part of the meter set assembly. The goal of the pilot program will be to gain information that will enable us to develop a methodology for determining where Additional and Accelerated Actions should be implemented, a methodology for prioritizing implementing these additional risk reduction measures, and performance measures to determine the effectiveness of these measures at reducing the risks.

Main and Services in Wall-to-Wall Paving and Near HOS

Mains and services located in areas of wall-to-wall paving and near HOS have been identified as a higher risk due to the potential for a more significant consequence of a failure in these areas. This fact is recognized in the regulations resulting in additional leak survey of facilities in these areas. PSE has also implemented Additional and Accelerated Actions as facilities in these areas are given a higher risk score for facilities being scored in risk models. PSE plans to continue to evaluate whether there are additional risk reduction strategies that should be considered for these facilities.

Sumner Propane Distribution System

PSE has identified that Additional and Accelerated Actions should be implemented for the propane distribution system in Sumner. It is currently the only propane distribution system currently active in PSE's system. The system was initially installed in 1973 and has approximately 4 active customers. These customers are served under Rate Schedule 53. This rate schedule is intended to provide propane bridging service until it is economically feasible to extend natural gas service to the propane distribution system.

PSE has evaluated the economic feasibility of extending main to this distribution system and it consistently remains economically infeasible. As a result, PSE has decided to work with the customers off this system to convert to individual propane tanks and retire the distribution system once they are converted. The goal is to have the customers retired in the summer of 2012 and the system retired.

Wrapped Steel Main in Casing

PSE has evaluated and prioritized the segments of wrapped steel main that are shorted to the casing or installed in a non-bare steel casing. These segments have been prioritized and project development to mitigate the highest priority segments began in 2011. Many of these projects are complex and may take multiple years for the project to be ready for construction due to permits, easements, and other complex construction requirements.

Expanded Use of Excess Flow Valves

With Excavation Damage being the highest threat to the distribution system, PSE is evaluating the benefit of installing Excess Flow Valves (EFV's) beyond what the federal regulation requires. An EFV is a fitting installed in series with other pipe and components in a service line and is designed to automatically close when the gas flow through the EFV exceeds a certain volume flow rate, normally triggered by severing the pipe downstream of the EFV. The federal regulation requires that EFV's are installed on all new and replaced residential service lines except for where EFV's are not commercially available and where contaminants exist in the pipeline that may prevent the correct operation of an EFV. In addition to mitigating the threat of Excavation Damage, EFV's can also mitigate risk to services located in areas prone to landslides, flooding or other natural force damage. When the evaluation is complete it will identify where the expanded application is most appropriate taking into consideration the service location and type of customer the service serves. This evaluation is planned to be completed by late 2012.

New Moderate Risks

Based on the most recent risk analysis, the following risks have been identified as moderate risks requiring additional investigation to determine whether additional and accelerated actions need to be developed:

- Idle service risers
- Celcon service tee caps
- Electrical faults
- Lightning

These risks will be further evaluated and; if appropriate, additional and accelerated action will be developed and implemented to reduce the risks associated with these facilities and threats. Progress on the risk evaluation as well as the development and implementation of additional and accelerated actions will be reported in next Continuing Surveillance Annual Report.

Completed Programs

Isolated Facilities Program

In 2005, PSE agreed to develop the Isolated Facilities Program to identify electrically isolated steel facilities that require cathodic protection. The identification included services, mains, extended utility facilities (EUFs) and casings. After these facilities were identified, they were assessed to verify the ongoing effectiveness of the cathodic protection. Facilities that were not part of the current monitoring program were added and inspected. Facilities that lacked adequate cathodic protection were remediated by adding additional cathodic protection, replacing existing pipe with polyethylene (PE) pipe, or retiring the pipe.

By the end of 2010, PSE had completed inspection of 735,473 service risers (100% of total) and resolved 21,441 isolated facilities (99.9% of total) through service/EUF replacements, riser replacements, or the installation of anodes. One remaining project was completed in early 2011 to get to 100% completion.

Cast Iron Replacement Program

The cast iron replacement program was a 15-year program that began in 1992 and focused on replacing all cast iron pipe system wide. Cast iron was a high risk to the system because as the pipe aged it became more susceptible to leakage. As PSE completed the replacement, records were reviewed to confirm that all documented cast iron was replaced. At the end of the program in 2007, PSE had identified and replaced a total of 1,516,275 feet of cast iron. The footage replaced each year and the cumulative footage replaced over the course of the program is summarized in

Table 39.

Table 39. Cast Iron Pipe Replacement Footage

Year	Total Cast-Iron Replaced (feet)	Cumulative Replacement (feet)
1993	136,689	136,689
1994	97,933	234,622
1995	143,875	378,497
1996	117,828	496,325
1997	110,909	607,234
1998	106,185	713,419
1999	98,886	812,305
2000	92,572	904,877
2001	111,043	1,015,920
2002	95,039	1,110,959
2003	121,354	1,232,313
2004	105,079	1,337,392
2005	62,539	1,399,931
2006	79,275	1,479,206
2007	37,069	1,516,275

Critical Bond Program

PSE began the Critical Bond Program in 1996 to ensure that all cathodically protected systems had adequate test sites installed. With PSE's system consisting of more than 3,000 individual cathodic protection systems protecting approximately 4,413 miles (23,300,000 feet) of pipe and tens of thousands of services, PSE initiated and completed 100% quality assurance review of all CP systems. More than 270 impressed current systems and 3,000 galvanic systems were reviewed, which included reviewing records and field testing. At the end of the program in 2007, more than 23,000 additional test sites were identified and added to PSE's computer system to ensure that these test sites will continue to be monitored. The knowledge and skill obtained through this program ensures that future steel pipe installations are not isolated and are maintained appropriately.

Appendix C: System Performance Data

Appendix C presents detailed system performance data, the basis for the performance measures as discussed in *Part 5. Measure Performance, Monitor Results, and Evaluate Effectiveness*, including:

- 2011 Number of Hazardous Leaks Repaired, Categorized by Leak Cause
- 2011 Total Number of Leaks Repaired, Categorized by Leak Cause
- 2006-2011 Number of Excavation Damages
- 2006-2011 Number of Excavation Tickets
- 2011 Total Number of Leaks Repaired, Categorized by Material
- 2011 Number of Hazardous Leaks Repaired, Categorized by Material
- 2008-2011 Gas Emergency Reponses and Response Times
- Threat Leak Frequency by Threat Category
    - Corrosion
    - Natural Forces
    - Excavation Damage
    - Other Outside Force Damage
    - Material, Weld or Joint Failure
    - Equipment Failure
    - Incorrect Operations
    - Other

Table 40. 2011 Number of Hazardous Leaks Repaired, Categorized by Leak Cause

Cause of Leak	Mains	Services
Corrosion	16	45
Bare Steel and Wrought Iron (Protected and Unprotected)	3	11
Wrapped Steel (Protected) - 1972 and Newer	1	1
Wrapped Steel (Protected) - 1971 and Older	12	29
Atmospheric Corrosion (includes SAI)	0	4
Natural forces	5	33
Steel	2	20
Polyethylene	3	12
Other	0	1
Excavation	97	661
Other Outside Force Damage	4	31
Material, Weld or Joint Failure	56	62
Bare Steel and Wrought Iron (Protected and Unprotected)	0	6
Wrapped Steel (Protected) - 1972 and Newer	2	6
Wrapped Steel (Protected) - 1971 and Older	12	18
Polyethylene - 1986 and newer	2	16
Polyethylene - 1985 and older	40	16
Equipment Failure	34	59
Steel	22	30
Polyethylene	12	29
Incorrect Operation	7	11
Steel	2	4
Polyethylene	5	6
Other	0	1
Other	20	87
Non-Exposed - Bare Steel and Wrought Iron (Protected and Unprotected)	2	0
Non-Exposed - Wrapped Steel (Protected) - 1972 and Newer	0	1
Non-Exposed - Wrapped Steel (Protected) - 1971 and Older	0	13
Non-Exposed - Polyethylene - 1986 and newer	0	3
Non-Exposed - Polyethylene - 1985 and older	1	2
Other	17	68
Total	239	989

Table 41. 2011 Total Number of Leaks Repaired, Categorized by Leak Cause

Cause of Leak	Mains	Services
Corrosion	69	68
Bare Steel and Wrought Iron (Protected and Unprotected)	15	18
Wrapped Steel (Protected) - 1972 and Newer	4	4
Wrapped Steel (Protected) - 1971 and Older	50	41
Atmospheric Corrosion (includes SAI)	0	5
Natural forces	10	38
Steel	6	20
Polyethylene	4	17
Other	0	1
Excavation	103	668
Other Outside Force Damage	6	32
Material, Weld or Joint Failure	107	93
Bare Steel and Wrought Iron (Protected and Unprotected)	1	6
Wrapped Steel (Protected) - 1972 and Newer	6	9
Wrapped Steel (Protected) - 1971 and Older	37	33
Polyethylene - 1986 and newer	6	20
Polyethylene - 1985 and older	57	25
Equipment Failure	177	136
Steel	135	74
Polyethylene	42	61
Other		
Incorrect Operation	11	24
Steel	5	6
Polyethylene	6	17
Other	0	1
Other	107	163
Non-Exposed - Bare Steel and Wrought Iron (Protected and Unprotected)	41	3
Non-Exposed - Wrapped Steel (Protected) - 1972 and Newer	2	6
Non-Exposed - Wrapped Steel (Protected) - 1971 and Older	23	64
Non-Exposed - Polyethylene - 1986 and newer	2	3
Non-Exposed - Polyethylene - 1985 and older	1	5
Other	38	82
Total	590	1222

Table 42. Number of Excavation Damages

Year	Number of Excavation Damages
2011	850
2010	824
2009	1031
2008	1438
2007	1802
2006	1955

Table 43. Number of Excavation Tickets

Year	Number of Excavation Tickets
2011	138,028
2010	146,549
2009	162,108
2008	174,940
2007	185,479
2006	168,643

Table 44. 2011 Total Number of Leaks Repaired, Categorized by Material

Material	Mains	Services
Bare Steel and Wrought Iron (Protected and Unprotected)	69	78
Corrosion	15	23
Natural Forces	0	11
Excavation	1	3
Other Outside Force	0	10
Material, Weld or Joint Failure	1	6
Equipment Failure	5	10
Incorrect Operation	1	0
Other	46	15
Wrapped Steel (Protected) - 1972 and newer	54	52
Corrosion	4	4
Natural Forces	0	1
Excavation	3	3
Other Outside Force	0	1
Material, Weld or Joint Failure	6	9
Equipment Failure	29	19
Incorrect Operation	2	3

Other	10	12
Wrapped Steel (Protected) - 1971 and older	250	248
Corrosion	50	41
Natural Forces	6	8
Excavation	14	32
Other Outside Force	0	3
Material, Weld or Joint Failure	37	33
Equipment Failure	101	45
Incorrect Operation	2	3
Other	40	83
Polyethylene - 1986 and newer	90	590
Natural Forces	3	13
Excavation	53	464
Other Outside Force	4	15
Material, Weld or Joint Failure	6	20
Equipment Failure	15	38
Incorrect Operation	3	15
Other	6	25
Polyethylene - 1985 and older	126	244
Natural Forces	1	4
Excavation	32	164
Other Outside Force	2	1
Material, Weld or Joint Failure	57	25
Equipment Failure	27	23
Incorrect Operation	3	2
Other	4	25
Copper	0	5
Excavation	0	2
Equipment Failure	0	1
Incorrect Operation	0	1
Other	0	1
Aluminum	0	3
Natural Forces	0	1
Other Outside Force	0	2
Stainless Steel	1	2
Other	1	2
Total	590	1222

Table 45. 2011 Number of Hazardous Leaks Repaired, Categorized by Material

Material	Mains	Services
Bare Steel and Wrought Iron (Protected and Unprotected)	10	64
Corrosion	3	15
Natural Forces	0	11
Excavation	1	3
Other Outside Force	0	10
Material, Weld or Joint Failure	0	6
Equipment Failure	1	8
Incorrect Operation	1	0
Other	4	11
Wrapped Steel (Protected) - 1972 and newer	15	25
Corrosion	1	1
Natural Forces	0	1
Excavation	3	3
Other Outside Force	0	1
Material, Weld or Joint Failure	2	6
Equipment Failure	3	5
Incorrect Operation	0	2
Other	6	6
Wrapped Steel (Protected) - 1971 and older	61	132
Corrosion	12	29
Natural Forces	2	8
Excavation	9	30
Other Outside Force	0	3
Material, Weld or Joint Failure	12	18
Equipment Failure	18	17
Incorrect Operation	1	2
Other	7	25
Polyethylene - 1986 and newer	66	548
Natural Forces	3	10
Excavation	52	460
Other Outside Force	3	14
Material, Weld or Joint Failure	2	16
Equipment Failure	2	17
Incorrect Operation	3	6
Other	1	25
Polyethylene - 1985 and older	87	212
Natural Forces	0	2
Excavation	32	163
Other Outside Force	1	1
Material, Weld or Joint Failure	40	16
Equipment Failure	10	12
Incorrect Operation	2	0
Other	2	18

Copper	0	3
Excavation	0	2
Equipment Failure	0	0
Incorrect Operation	0	1
Other	0	0
Aluminum	0	3
Natural Forces	0	1
Other Outside Force	0	2
Stainless Steel	0	2
Other	0	2
Total	239	989

Table 46. Gas Emergency Responses and Response Times

Year	Number of Emergencies	Average Response Time (minutes)	Percent Responded to within 60 Minutes
2011	22806	29	96.74%
2010	20498	31	95.44%
2009	23260	33	92.40%
2008	24842	35	89.79%

Table 47. Corrosion Threat Leak Frequency

Frequency and Trend	Leak Frequency (Total Leaks/Facility Mile)							
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	Leak Ratio Increasing?
Corrosion	0.0355	0.0465	0.0266	0.0193	0.0168	0.0200	0.0258	NO

Corrosion	Number of Facilities		Number of Leak Repairs			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	3920	175330	69	66	135	0.0176	0.0376	0.0200
2010	3949	177419	53	61	114	0.0134	0.0344	0.0168
2009	3987	180567	70	63	133	0.0176	0.0349	0.0193
2008	4009	183571	79	106	185	0.0197	0.0577	0.0266
2007	4045	186655	161	167	328	0.0398	0.0895	0.0465
2006	4087	189263	110	143	253	0.0269	0.0756	0.0355

Table 48. Natural Forces Threat Leak Frequency

Frequency and Trend	Leak Frequency (Total Leaks/Facility Mile)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Natural Forces	0.0009	0.0002	0.0003	0.0022	0.0009	0.0019	0.0011	YES

Natural Forces	Number of Facilities		Number of Leak Repairs			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	12041	817440	10	38	48	0.0008	0.0465	0.0019
2010	12008	814416	9	14	23	0.0007	0.0172	0.0009
2009	11979	811733	27	27	54	0.0023	0.0333	0.0022
2008	11896	805636	2	5	7	0.0002	0.0062	0.0003
2007	11740	792353	1	3	4	0.0001	0.0038	0.0002
2006	11524	775155	0	22	22	0.0000	0.0284	0.0009

Table 49. Excavation Damage Threat Leak Frequency

Frequency and Trend	Leak Frequency (Total Leaks/Facility Mile)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Excavation Damage								
Number of Tickets	168643	185479	174940	162108	146549	138028	161421	NO
Number of Leaks	1800	1653	1356	946	716	771	1088	NO
Leaks / Ticket	0.0107	0.0089	0.0078	0.0058	0.0049	0.0056	0.0066	NO
Leaks / Facility Mile	0.0750	0.0675	0.0545	0.0378	0.0285	0.0306	0.0438	NO

Excavation Damage	Quantity			Number of Leaks Repaired			Frequency of Failure	
	Miles Main	# Services	Number of Tickets	Mains	Services	Total	Total Leaks / Ticket	Total Leaks/Facility Mile
2011	12041	817440	138028	103	668	771	0.0056	0.0306
2010	12008	814416	146549	84	632	716	0.0049	0.0285
2009	11979	811733	162108	120	826	946	0.0058	0.0378
2008	11896	805636	174940	202	1154	1356	0.0078	0.0545
2007	11740	792353	185479	251	1402	1653	0.0089	0.0675
2006	11524	775155	168643	268	1532	1800	0.0107	0.0750

Table 50. Other Outside Force Damage Threat Leak Frequency

Frequency and Trend	Leak Frequency (Total Leaks/Facility Mile)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Outside Force Damage	0.0000	0.0001	0.0011	0.0011	0.0025	0.0015	0.0013	YES

Other Outside Force Damage	Number of Facilities		Number of Repaired Leaks			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	12041	817440	6	32	38	0.0005	0.0039	0.0015
2010	12008	814416	0	64	64	0.0000	0.0079	0.0025
2009	11979	811733	10	18	28	0.0008	0.0022	0.0011
2008	11896	805636	6	21	27	0.0005	0.0026	0.0011
2007	11740	792353	0	2	2	0.0000	0.0003	0.0001
2006	11524	775155	1	0	1	0.0001	0.0000	0.0000

Table 51. Material or Welds Failure Threat Leak Frequency

Frequency and Trend	Leak Frequency (Total Leaks/Facility Mile)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Material or Weld Failure	0.0063	0.0076	0.0058	0.0070	0.0084	0.0079	0.0073	YES

Material or Welds Failure	Number of Facilities		Number of Repaired Leaks			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	12041	817440	107	93	200	0.0089	0.0114	0.0079
2010	12008	814416	130	82	212	0.0108	0.0101	0.0084
2009	11979	811733	113	62	175	0.0094	0.0076	0.0070
2008	11896	805636	96	48	144	0.0081	0.0060	0.0058
2007	11740	792353	125	61	186	0.0106	0.0077	0.0076
2006	11524	775155	121	31	152	0.0105	0.0040	0.0063

Table 52. Equipment Failure Threat Leak Frequency

Frequency and Trend	Leak Frequency (Total Leaks/Facility Mile)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Equipment Failure	0.0029	0.0220	0.0160	0.0056	0.0092	0.0124	0.0130	NO

Equipment Failure	Number of Facilities		Number of Repaired Leaks			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	12041	817440	177	136	313	0.0147	0.0166	0.0124
2010	12008	814416	152	78	230	0.0127	0.0096	0.0092
2009	11979	811733	86	54	140	0.0072	0.0067	0.0056
2008	11896	805636	197	201	398	0.0166	0.0249	0.0160
2007	11740	792353	317	221	538	0.0270	0.0279	0.0220
2006	11524	775155	47	23	70	0.0041	0.0030	0.0029

Table 53. Incorrect Operation Threat Leak Frequency

Frequency and Trend	Leak Ratio (Mains and Services)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Incorrect Operation	0.0001	0.0000	0.0002	0.0012	0.0022	0.0014	0.0010	NO

Incorrect Operation	Number of Facilities		Number of Repaired Leaks			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	12041	817440	11	24	35	0.0009	0.0029	0.0014
2010	12008	814416	21	34	55	0.0017	0.0042	0.0022
2009	11979	811733	20	10	30	0.0017	0.0012	0.0012
2008	11896	805636	2	3	5	0.0002	0.0004	0.0002
2007	11740	792353	0	1	1	0.0000	0.0001	0.0000
2006	11524	775155	0	2	2	0.0000	0.0003	0.0001

Table 54. Other Threat Leak Frequency

Frequency and Trend	Leak Ratio (Mains and Services)							Leak Ratio Increasing?
Threat / Sub-Threat	2006	2007	2008	2009	2010	2011	5-Year Ave	
Other Threat	0.0292	0.0113	0.0103	0.0224	0.0124	0.0107	0.0134	NO

Other	Number of Facilities		Number of Repaired Leaks			Frequency of Failure		
	Miles Main	# Services	Mains	Services	Mains and Services	Main Leaks/Mile	Service Leaks/100	Total Leaks/Facility Mile
2011	12041	817440	107	163	270	0.0089	0.0199	0.0107
2010	12008	814416	138	174	312	0.0115	0.0214	0.0124
2009	11979	811733	240	322	562	0.0200	0.0397	0.0224
2008	11896	805636	143	112	255	0.0120	0.0139	0.0103
2007	11740	792353	142	135	277	0.0121	0.0170	0.0113
2006	11524	775155	312	390	702	0.0271	0.0503	0.0292