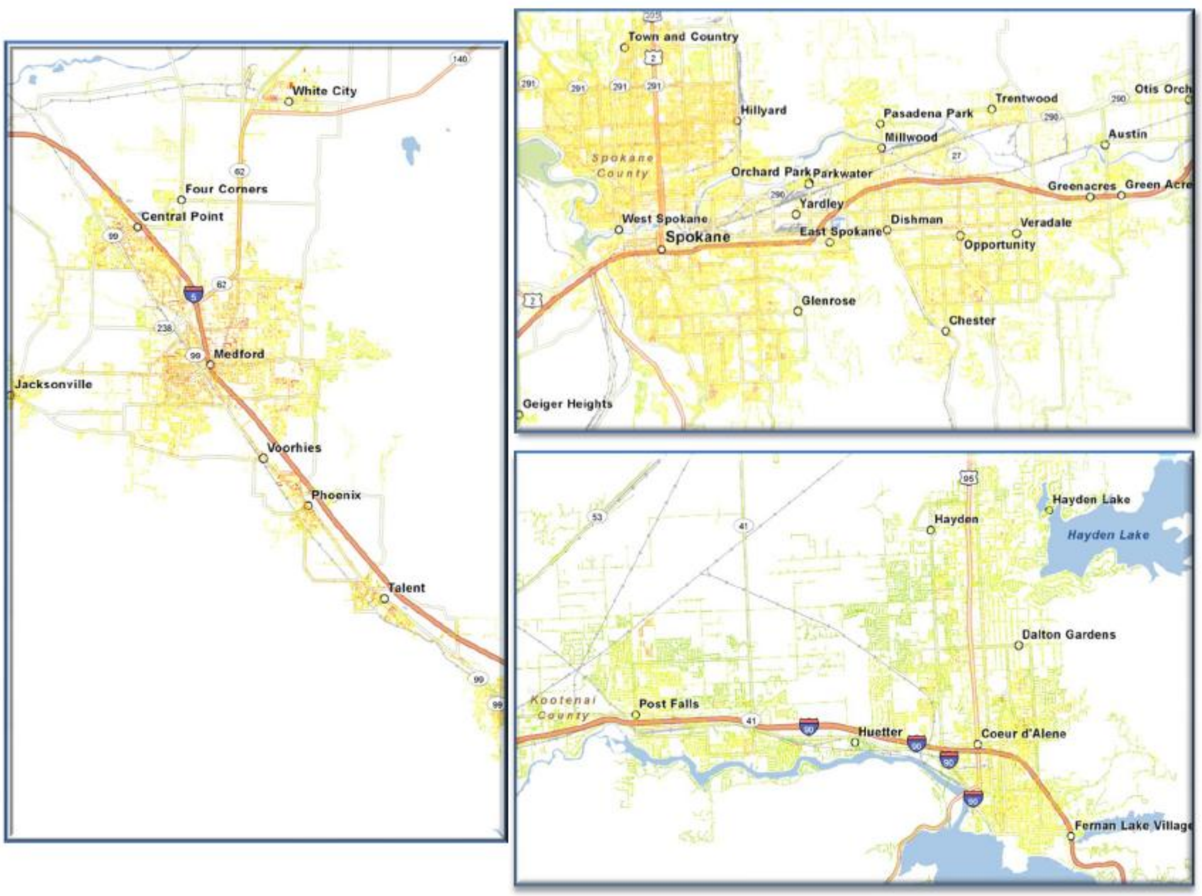
2012

AVISTA®

Gas
Distribution Integrity Management Plan



FOREWORD

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) amended the Federal Pipeline Safety Regulations on December 4, 2009 to require operators of gas distribution pipelines to develop and implement an integrity management (IM) program that includes a written integrity management plan that conforms to 49 CFR, Part 192, Subpart P.

This manual was customized by Avista Utilities from a framework developed by Structural Integrity on behalf of the Northeast Gas Association and the Southern Gas Association.

This manual is to be used in conjunction with Avista's Gas Standards Manual, Gas Emergency Service Handbook, Safety Handbook, and Public Awareness Plan. These manuals comprise Avista's Operating and Maintenance Plan as required by 49 CFR, Part 192.605, and as required by state codes.

It is imperative that all employees involved in the operations of our gas systems keep in mind that operating a safe system for our customers and fellow employees is paramount.

Responsibility for keeping this manual accurate and up-to-date is the function of Gas Engineering.

This manual is made available to the appropriate individuals through hardcopy and/or via the company intranet.

This manual shall be provided to the appropriate regulatory agency upon request or as required by state regulations.

REVISION CONTROL SHEET

Title: **Distribution Integrity Management Plan** – Original Publication Date 7/28/11

Section	Pages	Revision	Date	Comments
Overview	--	1	April 16, 2012	Make this manual available to regulatory agencies
TOC		1	April 16, 2012	Updated the Table of Contents
3	11 – 12	1	April 16, 2012	Updated the Roles and Responsibility Matrix
7	22-30	1	April 16, 2012	Enhanced the description of Avista's evaluation and risk ranking process, added several graphics and a risk ranking table.
8	33,34, 40	1	April 16, 2012	Incorporated asset management's role in analyzing life cycle costs and reliability for a recommended additional or accelerated action. Added a section on prioritizing additional or accelerated actions
10	43, 45	1	April 16, 2012	Enhanced the description of Avista's re-evaluation process.
Appendix A	A2-A32	1	April 16, 2012	Updated new information and current data in Appendix A
Appendix B	B2-B8	1	April 16, 2012	Updated tables in Appendix B and added information on SME's
Appendix C	C2-C8	1	April 16, 2012	Updated the documents and added documents on the development of the risk models that were previously referenced in Appendix C
Appendix D	D2-D7	1	April 16, 2012	Updated the Performance Measures for Leak Survey in Appendix D
Appendix E	E1-E4	1	April 16, 2012	Updated the List of Risks and Measures in Appendix E
Appendix F	F1-F9	1	April 16,2012	Updated the Performance Measures in Appendix F
Appendix G	G1-G4	1	April 16, 2012	Updated the tables in Appendix G
Appendix H	H1-H3	1	April 16, 2012	Updated the cross reference sections in Appendix H

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1 COMPANY OVERVIEW

Headquartered in **Spokane, Washington, Avista Utilities** delivers natural gas to more than **300,000** residential, commercial and industrial customers. The service territory spans across three states, **Washington, Oregon, and Idaho** and is depicted in Figure 1.1 below.

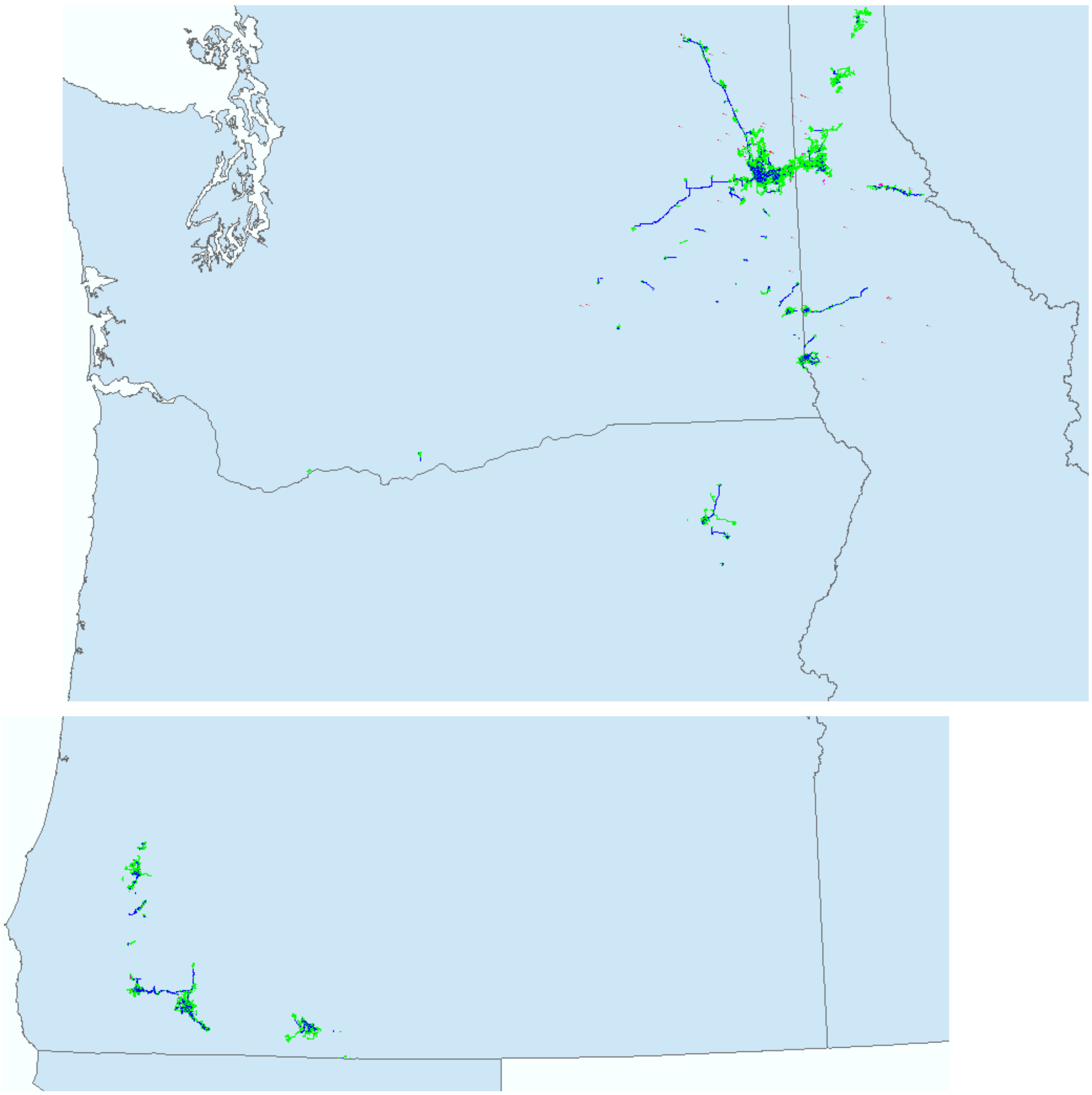

Figure 1-1 Avista's Service Territory

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2 SCOPE

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) amended the Federal Pipeline Safety Regulations on December 4, 2009 to require operators of gas distribution pipelines to develop and implement an integrity management (IM) program that includes a written integrity management plan.

The purpose of the IM program is to enhance safety by identifying and reducing gas distribution pipeline integrity risks. Operators must integrate reasonably available information about their pipelines to inform their risk decisions. The rule requires that operators identify risks to their pipelines where an incident could cause serious consequences and focus priority attention in those areas. The rule also requires that operators implement a program to provide greater assurance of the integrity of their pipeline.

The IM approach was designed to promote continuous improvement in pipeline safety by requiring operators to identify and invest in risk control measures beyond previously established regulatory requirements.

This written IM Plan addresses the IM Rule which requires operators to develop and implement an IM program that addresses the following elements:

- Knowledge
- Identify Threats
- Evaluate and Rank Risks
- Identify and Implement Measures to Address Risks
- Measure Performance, Monitor Results, and Evaluate Effectiveness
- Periodic Evaluation and Improvement
- Report results

Because of the significant diversity among distribution pipeline operators and pipelines, the requirements in the IM Rule are high-level and performance-based. The IM Rule specifies the required program elements but does not prescribe specific methods of implementation.

Tab

3 <u>PURPOSE AND OBJECTIVES</u>

The purpose of the IM program is to enhance safety by identifying and reducing gas distribution integrity risks. Managing the integrity and reliability of the gas distribution pipeline has always been a primary goal for **Avista Utilities**; with design, construction, operations and maintenance activities performed in compliance with CFR Part 192 requirements. The objective of this IM Plan is to establish the requirements to comply with the Code of Federal Regulations (CFR 49) §§ 192.1005, 192.1007, 192.1009 and 192.1011, pertaining to integrity management for gas distribution pipelines.

The IM Plan is comprised of seven elements depicted in Figure 3-1.

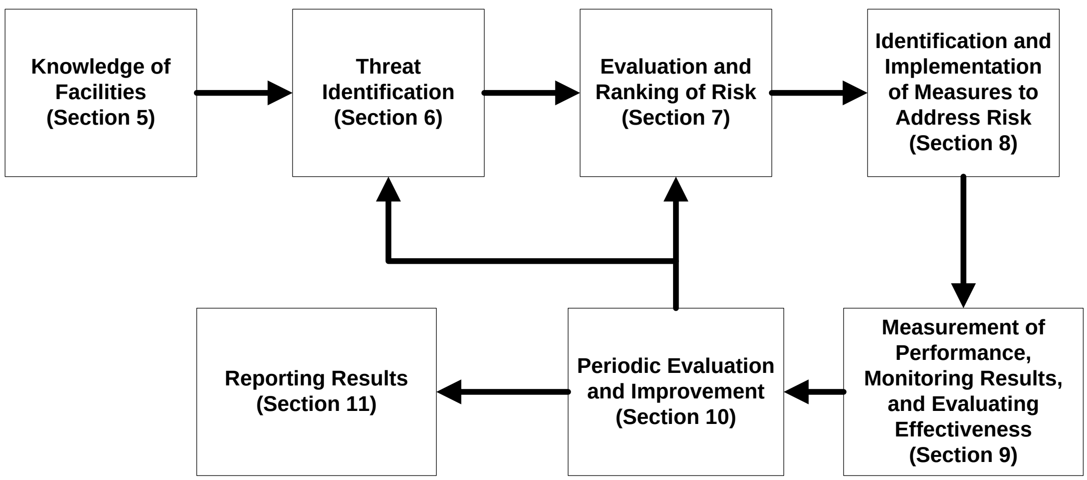


Figure 3-1 DIMP Elements

In addition to the key elements shown in Figure 3-1, the IM Plan also establishes requirements for reporting of mechanical fitting failures that resulted in a hazardous leak (Section 11.2) and maintaining records (Section 12).

All elements of this IM Plan shall be implemented by no later than August 2, 2011.

3.1.1 Organization Structure Supporting Integrity Management

Responsibility for Distribution Integrity Management in accordance with this document and applicable state and federal codes resides with Avista's Gas Engineering Department. The program manager shall be tasked with the "day to day" management of the integrity management program. The data analyst shall be tasked with the identification and maintenance of asset, maintenance and operational data used in the IM Program and associated analyses. Both the program manager and data analyst are accountable via the Gas Compliance Manager to the Chief Gas Engineer in the completion of these duties. The Chief Gas Engineer is in turn, responsible through his normal reporting channels up through the Utility President and Chief Executive Officer of Avista Corporation for proper administration of the program.

3.2 Role and Responsibility Matrix

Table 3.1-1 provides an overview that indicates the assigned positions responsible for carrying out duties and tasks associated with the distribution integrity management plan.

Table 3.1-1 IM Program Responsibility & Support Matrix

Plan Section	Role / Responsibility	Responsible Position
3.0	Overall Program Implementation and Oversight	Program Manager
5.1, 5.2, 5.3, 5.4, 5.5	Gather data for initial creation and updates to Appendix A	Program Manager
5.6	Conduct and Record SME Interviews for input into Appendix A	Program Manager
6.0	Update Threat Identification (Appendix B) as new or modified threats are known or recognized	Program Manager
6.0	Evaluate Threats applicable to the gas distribution system and complete/update Appendix B	Program Manager
7.2	Update Appendix C to document the Risk Modeling process and/or algorithms	Data Analyst
7.1	Initial gathering of data required to support Threat Identification and Risk Assessment	Program Manager
7.1	Updates to data required to support Threat Identification and Risk Assessment	Data Analyst
7.2	Perform and update threat trend evaluation	Data Analyst/Program Manager
7.2	Coordinate and document SME input for initial selection and updates to the risk factors	Program Manager
7.4	Conduct, update, and document Risk Model Validation	Data Analyst
7.2	Coordinate and document Risk Assessment & Ranking. Conduct updates.	Data Analyst
7.2	Coordinate the updates of the data acquisition from various databases used to run the risk models when additional or pertinent data becomes available that may affect the risk ranking.	Data Analyst
8.2	Ongoing management and updates to Action Plans	Program Manager
8.2	Life cycle and reliability engineering for recommendations of mitigative actions	Asset Management Engineer
9.0, 10.2	Perform periodic assessment of performance measures; identify if re-evaluation of threats and risks is required.	Program Manager

Plan Section	Role / Responsibility	Responsible Position
10.1, 10.2	Conduct and document reviews/updates to the plan	Program Manager
10.1	Conduct 5-Yr plan re-evaluation of the plan	Program Manager
10.2	As required, conduct re-evaluation of threats and risks	Program Manager/Data Analyst
11.1	Run extract titled AnnualReportExtractFile.mdb	GIS Specialist/ Data Analyst
11.1	Run standard annual report and performance measure queries against extracted data for use with the annual report and for update of performance measures if applicable	Data Analyst
11.1	Prepare and submit the annual report to PHMSA and the State Pipeline Safety Authority by no later than March 15th for the preceding calendar year's data.	Data Analyst/Program Manager
12.0	Maintain IM Program Records and Files as required by Retention Policy	Program Manager/Data Analyst

Tab

4 DEFINITIONS

The definitions provided in 49 CFR, §192.3 and §192.1001 shall apply to this IM Plan. The following additional definitions and acronyms shall also apply to this IM Plan.

COF: Consequence of Failure

D.I.R.T.: Damage Information Reporting Tool. More information on D.I.R.T. may be found at www.cga-dirt.com

DISTRIBUTION INTEGRITY MANAGEMENT PROGRAM FILES: Operator records, databases, and/or files that contain either material incorporated by reference in the Appendices of the IM Plan or outdated material that was once contained in the IM Plan Appendices but is being retained in order to comply with record keeping requirements.

DISTRIBUTION LINE: a pipeline other than a gathering or transmission line (reference §192.3)

EFV: Excess Flow Valve. An Excess Flow Valve is a safety device that is designed to shut off flow of natural gas automatically if the service line breaks.

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 (reference §192.1001)

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 (reference §192.1001)

HDPE: High Density Polyethylene

FOF: Frequency of Failure; synonymous with Likelihood of Failure

INTEGRITY MANAGEMENT PLAN (IM PLAN): a written explanation of the mechanisms or procedures the operator will use to implement its integrity management program and to ensure compliance with subpart P of 49 CFR Part 192(reference §192.1001)

INTEGRITY MANAGEMENT PROGRAM (IM PROGRAM): an overall approach used by an operator to ensure the integrity of its gas distribution system (reference §192.1001)

IM RULE: 49 CFR, Part 192, Subpart P

LDIW: Low ductile inner wall pipe, such as early vintage Aldyl A pipe manufacturer until 1972.

MAIN: a distribution line that serves as a common source of supply for more than one service line (reference §192.3)

MECHANICAL FITTING: Fittings that consist of specifically designed components including an elastomer seal and a gripping device to affect pressure sealing and/or pull-out resistance capabilities such as stab type, nut follower, & bolted type mechanical fittings.

> **Stab Type Mechanical Fitting:** Internally there are specially designed components including an elastomer seal, such as an "O" ring, and a gripping device to affect pressure sealing and pull-out resistance capabilities. Self-contained stiffeners are included in this type of fitting. With this style fitting the operator would have to prepare the pipe ends, mark the stab depth on the pipe, and stab the pip in the to the depth prescribed for the fitting being used.
>
> **Nut Follower Type Mechanical Fitting:** The components are generally a body; a threaded compression nut or a follower; an elastomer seal ring; a stiffener or an integrated stiffener for plastic pipe; and, with some, a gripping ring. Normally design concept of this type of fitting typically includes an elastomer seal in the assembly. The seal, when compressed by tightening of a threaded compression nut grips the outside of the pipe, affecting a pressure-tight seal and, in some designs, providing pull-out resistance. The inside of the pipe wall should be supported by the stiffener under the seal ring and under the gripping ring (if incorporated in the design), to prevent collapse of the pipe. A lack of this support could result in a loss of the seal affected by the seal ring or the gripping of the pipe for pull-out resistance. This fitting style is normally used in pipelines 2-inches in diameter and smaller. There are two categories of this type of joining device manufactured. One type provides a seal only, and the other provides a seal plus pipe restraint against pull-out.
>
> **Bolt Type Mechanical Fitting:** The bolt type mechanical fitting has the same components as the nut follower except instead of a threaded compression nut or follower, there is a bolt arrangement.

MDPE: Medium Density Polyethylene

NTSB: The National Transportation Safety Board

PHMSA: The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration

PIPELINE: all parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenances attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies (reference §192.3)

REGION: areas within a distribution system consisting of mains, services, and other appurtenances with similar characteristics and reasonably consistent risk. As used in Section 7 of this User Guide, the term Region applies to a geographic area within the operator's system.

RISK: A relative measure of the likelihood of a failure associated with a threat and the potential consequences of such a failure.

RISK FACTORS: Data identified to be incorporated into the risk models.

RISK MODEL: The integration of facility data, operational data, SME input, and established algorithms to estimate the relative risk associated with a gas distribution system threat.

SCG: Slow Crack Growth, piping that when subject to outside forces such as rock impingement, bending stress, and squeezing creates a slow growing crack in the wall of the pipe or fitting, usually from the inside out. Aldyl A pipe is subject to this type of failure that was manufactured prior to 1985.

SERVICE LINE: A distribution line that transports gas from a common source of supply to an individual customer, to two adjacent or adjoining residential or small commercial customers, or to multiple residential or small commercial customers served through a meter header or manifold. A service line ends at the outlet of the customer meter or at the connection to customer piping, whichever is further downstream, or at the connection to customer piping if there is no meter (reference §192.3)

SUBJECT MATTER EXPERT (SME): Persons knowledgeable about design, construction, operations, maintenance, or characteristics of a pipeline system. Designation as an SME does not necessarily require specialized education or advanced qualifications. Some SMEs may possess such expertise, but detailed knowledge of the pipeline system gained by working with it over time can also make someone an SME. SMEs may be employees, consultants, contractors, or any suitable combination of these.

SUB-THREAT: A threat type within one of the primary threat categories specified in §192.1007(b)

TICKET: A notification from the one-call notification center to the operator providing information of pending excavation activity for which the operator is to locate and mark its facilities.

WEIGHTING: A risk value assigned to a risk factor used in the risk models to provide a numerical ranking of the risks.

Tab

5 KNOWLEDGE OF FACILITIES

The objective of this section is to assemble as complete of an understanding of Avista Utilities' infrastructure as possible using reasonably available information from past and ongoing design, operations and maintenance activities. In addition, this plan will identify what additional information is needed and provide a plan for gaining that information over time through normal activities.

The information referenced in this Section shall either be placed in Appendix A or included in Appendix A by reference.

5.1 Type and Location of Records

A summary of the existing records that are utilized by Avista's IM Plan and where they are located are documented in Appendix A, Table 5.1-1. This includes, but is not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, exposed piping reports and excavation damage experience.

5.2 Overview of Past Design, Operations and Maintenance

Information that Avista has gained from past design, operations and maintenance, construction and through interviews with SME or key individuals is documented or referenced in Appendix A, Tables 5.2-1 through Tables 5.2-19.

Avista scrubbed through 5 years of leak data re-looking at how each leak failure was categorized based on how Avista would categorize leak failures currently. The results of this data was used in Table 5.2-11, Table 5.2-13 in Appendix A, Table 6.1-1 in Appendix B and Table 9.1-1 through 9.6-1

Not all fittings are mapped in Avista's GIS system an example of fittings that were not mapped prior to 2011 are service tees, elbows, tees, couplings other than dresser type, repair clamps. Installation method other than insertion was not captured prior to 2011

5.3 Characteristics of Design, Operations and Environmental Factors

Characteristics of the pipeline's design, operations and environmental factors that are necessary to assess the applicable threats and risks shall be documented, or included by reference, in Appendix A, Tables 5.2-1 through Tables 5.2-19. Environmental data used in Avista's risk models are listed below and as well as being referenced in Avista's Risk Factors and Weighting Table in Appendix C:

- System Pressures
- Known land movement areas

- Population density
- Pipelines in business districts
- Pipelines to buildings of public assembly
- Seismic data
- Flooding data
- Snow areas
- Known soil types in contact with pipeline

5.4 Additional Information Needed

Additional information needed to support the IM plan (information that is not reasonably available today) is identified in Appendix A. Plans for gaining additional information over time through normal activities conducted on the pipeline is documented, or included by reference, in Appendix A, Table 5.4-1 and Table 5.5-1. Additionally information needed for the risk models is also listed in Appendix C with the risk model factors as future enhancements.

5.5 Data Capture for New Construction and Ongoing O&M

Data is continuously collected for both construction of new facilities, reconstruction of existing facilities and ongoing operations and maintenance. Information currently collected about new pipeline installation is pipe material, diameter, installation date location of facilities with dimensions, casing/conduit, and tracer wire. Additional information to be captured in the fall of 2011 on as-built documents is installation method of pipe, backfill/padding, pipe specifications of newly installed pipe. For other materials installed the information to be captured is description of component, size, and manufacturer, part number if it is marked and it is identifiable. This information is to be captured on form N-2652 Construction Material List which is separate from the as-built drawing and spatially mapped in Avista's geographical information (GIS) system.

Information gathered from exposed pipe data for both steel and plastic includes diameter, depth, length exposed, soil type in contact with pipe. Data specific to steel, includes coating type and condition, condition of external pipe and internal pipe, pitting, pipe to soil read. Data specific to plastic, pipe material, pipe color, pipe manufacturer, manufacture data, lot number, condition of external and internal pipe, squeeze off present in exposed area, contaminated soil in exposed area. For more information on the data collection process see Avista's Gas Standards Manual, Specification 3.15 and 5.14.

Leak and failure data that is collected and utilized in the risk models is described in detail in Avista's Gas Emergency and Service Handbook, Section 2 along with Avista's Gas Standards Manual, Specification 5.11

See Avista's Gas Standards Section 5.0 Maintenance for data collection processes from the field for maintenance work and various inspections.

See Table 5.5-1 in Appendix A for a list of additional data collection projects that have been identified, the action plan and tentative schedule for completion.

Tab

6 THREAT IDENTIFICATION

The objective of this section of the plan is to identify existing and potential threats to the gas distribution pipeline. The following main categories of threats shall be considered for each gas distribution pipeline:

- Corrosion
- Natural Forces
- Excavation Damage
- Other Outside Force
- Material, Weld or Joint Failure
- Equipment Failure
- Incorrect Operation
- Other concerns that could threaten the integrity of the pipeline.

A review of information gathered for Section 5 shall be conducted to identify existing and potential threats. Threats identified as applicable to the gas distribution pipeline are documented in Appendix B, Table 6.1-1.

Any prior versions of the threat identification process and results that are no longer current shall be retained and stored in the Distribution Integrity Management Program files per the requirements of Section 12.

6.1 Identification of Existing Threats

Available leak repair, incident data, material failure reports and operational and maintenance history, and excavation damage records were used to identify existing threats to Avista's distribution system.

6.2 Potential Threats

Potential threats are those threats that are not currently evident based on failures, leaks or incident data. Some potential threats were identified by environmental data for geographical areas. Examples of these are known fault lines, flooding zones, landslides, snow affected areas and other geographical natural force data.

Other potential threats were identified using Subject Matter Experts, example is internal corrosion biological and chemical, even though there have been no failures or incidents these internal corrosion threats could potentially be a threat to Avista's steel pipelines.

Identification of future potential threats shall be accomplished by routinely monitoring information from sources that include:

- National Transportation and Safety Board (NTSB) Reports and Recommendations applicable to Pipeline Accidents. Reports may be found at: http://www.ntsb.gov/Publictn/P_Acc.htm; Recommendation Letters may be found at: http://www.ntsb.gov/recs/letters/
- Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletins: http://phmsa.dot.gov/pipeline/regs/advisory-bulletin
- Membership in a local, regional, or national gas association (e.g. American Gas Association, Northeast Gas Association, Southern Gas Association, etc.) and involvement in Association workshops and forums that share knowledge regarding distribution pipeline threats

This review shall be documented on a form similar to the one shown below and will be located in Appendix B.

Table 6.2-1 Example Review of Potential Threat Applicable to the Gas Distribution System

Date of Review	Source 1 – PHMSA Bulletin 2 – NTSB Report 3 – NTSB Recommendation 4 – Gas Association	Threat Root Cause	Is this Threat already evaluated for in the IM Program? Y / N	Date that threat was added to program and incorporated into Risk Evaluation and Ranking (If Applicable)

Tab

7 EVALUATION AND RANKING OF RISK

7.1 <u>Objective</u>

Risk analysis is an ongoing process of understanding what factors affect the risk posed by threats to the gas distribution pipeline and where they are relatively more important than others. The primary objectives of the evaluation and ranking of gas distribution pipeline risk are:

- Consider each applicable current and potential threat
- Consider the likelihood of failure associated with each threat
- Consider the potential consequences of such a failure
- Estimate and rank the risks (i.e. determine the relative importance) posed to the pipeline
- Consider the relevance of threats in one location to other areas

7.2 <u>Risk Assessment Process</u>

The current process used for Risk Assessment (the evaluation and ranking of risk) shall be documented, or included by reference, in Appendix C.

Avista created a document entitled Risk Analysis Modeling that is located on Avista's IMP sharepoint site that provides the standards and guidelines for building the risk models.

Any prior risk assessment processes shall be retained and stored in the Distribution Integrity Management Program files.

7.3 <u>Risk Assessment</u>

Avista Utilities chose to utilize the ESRI® Arc GIS ModelBuilder environment, with the ArcGIS Spatial Analyst extension in conjunction with Avista's geographical information system (GIS) and operational and maintenance data tables (AFM) to build their spatial risk models.

7.3.1 Summary of Risk Assessment

The risk model is broken into a series of threat category models. Each threat category model represents a category of risk (threat) as defined in 49 CFR, §192.1015(b)(2) and if possible as identified in Section 6. Within each threat category model, the risks associated with that category are defined. For each defined risk, the data is processed, assigned a risk ranking score, and converted into a raster dataset with a 50-foot grid that gets overlaid on Avista's facilities in GIS.

Threat Category Model Scoring:

Risk ranking score values are assigned for each risk factor defined in a category model. Specific documentation on each threat category model and the risk factors and weightings are documented in Appendix C.

Rasters:

The raster's are completely overlaid on Avista's GIS facilities. The raster then takes the mapped distribution facilities or assets within its 50-foot grid and applies the defined risk factors and weightings that apply to those facilities based on each category model.

Total Score Model:

The Total Score model adds up the risk due to each threat category model and multiplies this by the consequences. The model currently does not assign additional weighting to any category so they are all treated equally. The model also calculates what percentage of the total risk is due to each threat category.

To determine the impact a gas system failure can have on the adjacent community, the factors for the consequence model include population density, pipeline operating pressure, located within a business district and migration of gas.

The logic in this model first combines the risk summary polygon with the consequences polygon so the data for each raster is in one polygon. It then sums up the risk for each threat category into the Risk_Total variable as follows:

Calculate Field Risk_Total

[Risk_Unknown_Pipe] + [Risk_OutsideForces]+ [Risk_IncorrectOps]+ [Risk_Material]+ [Risk_NaturalForces]+ [Risk_Corrosion]+ [Risk_Equipment]+ [Risk_Excavation]+ [Risk_JointWeld]

The final risk total score represents an SME weighted probability which is the total aggregated risk to the gas system based on the risk factors and applied weightings, see section 7.3.2 for additional information on the factors and weightings.

It then multiplies the Risk_Total (*which represents the SME weighted probability*) by the consequences for that raster as follows:

Calculate Field Total_Score:

[Consequence] * [Risk_Total]

To determine the impact a gas system failure can have on the adjacent community, the factors for the consequence model include population density, pipeline operating pressure, location within a business district and migration of gas.

The output is a risk score for each threat category; the total risk score which is an aggregate of all the threat category scores and the consequence scores; and the ratio/percentage of risk attributable to each threat category by a 50 foot geographical location as shown in Figure 7-1.

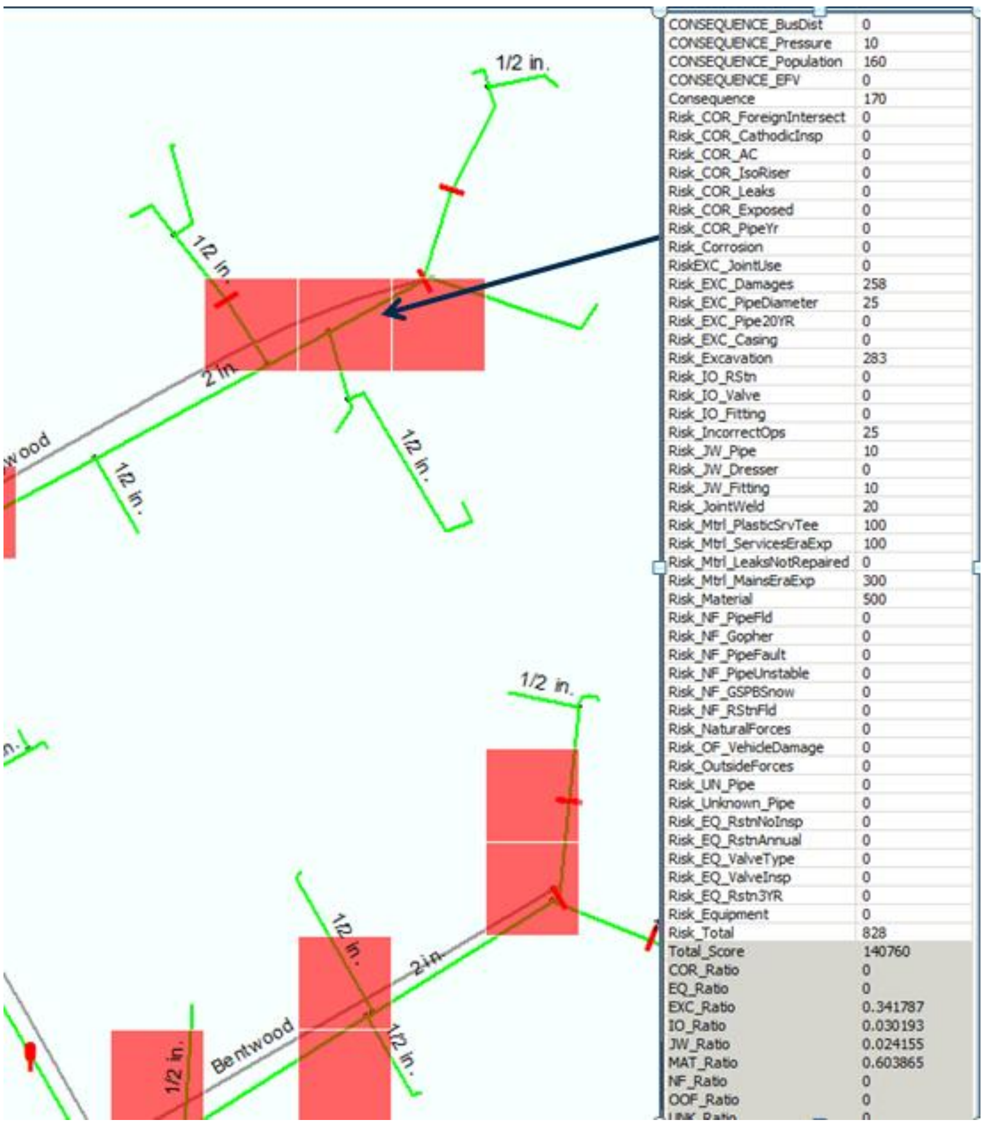


Figure 7-1 Example of a Scored Raster

7.3.2 Risk Model Factors and Weightings (SME Probability)

Avista developed an SME Probability scoring process that was assigned for each risk factor defined in a threat category model. Avista's risk factors and weightings for the process were developed based on risk factors that were developed by GL Advantica through the Gas Technology Institute. This data was only used as a starting point and modified after review by Avista's Risk Modeling Team and subject matter experts which included:

Core Team:

- Linda Burger – IM Program Manager
- Rob Cloward – GIS Analyst
- Erika (Jake) Jacobs – GIS Specialist
- Kris Busko – Asset Management Engineer
- Kevin Farrington – Data Analyst

Additional Input from:

- Bill Baker – Codes and Training Coordinator (material failures)
- Gary Douglas – Corrosion Specialist
- Jody Morehouse – Compliance Manager
- Rodney Pickett – Sr. Asset Management Engineer

Informally Operations personnel from a question and answer standpoint were included but were not directly involved in the formal process.

The current risk assessment is documented and included by reference in Appendix C. Avista's list of risk factors and weightings are listed by threat in Table 7.3-1 Risk Factors and Weightings which is located in Appendix C.

The risk total score and the consequence score were multiplied by 100 which resulted in a large score. This was to provide enough granularity to the total risk scores when reviewing.

The initial results were based on subject matter expert with a small amount of data, which resulted in a qualitative model rather than a quantitative model.

Prior risk assessment results shall be retained and stored in the Distribution Integrity Management Program files per the requirements of Section 12.

7.4 <u>Determining the Group of Highest Aggregated Scoring Rasters</u>

After the rasters were processed with the Total Score, it resulted in over 750,000 scored rasters which represented the aggregated scores of all threats/subthreats within a 50 foot geographical location. In order to determine which of these fell into the following categories of high, medium and low, Avista utilized the ESRI tool to plot the results in a bell curve to look for natural breaking points. As there none, Avista made the break for High Risk at 2 standard deviations from the mean of the curve. This resulted in the highest 26,438 scored rasters, Medium Risk resulted in approximately 350,000 and Lowest Risk resulted in approximately 450,000 scored raster sets. See Figure 7-2.

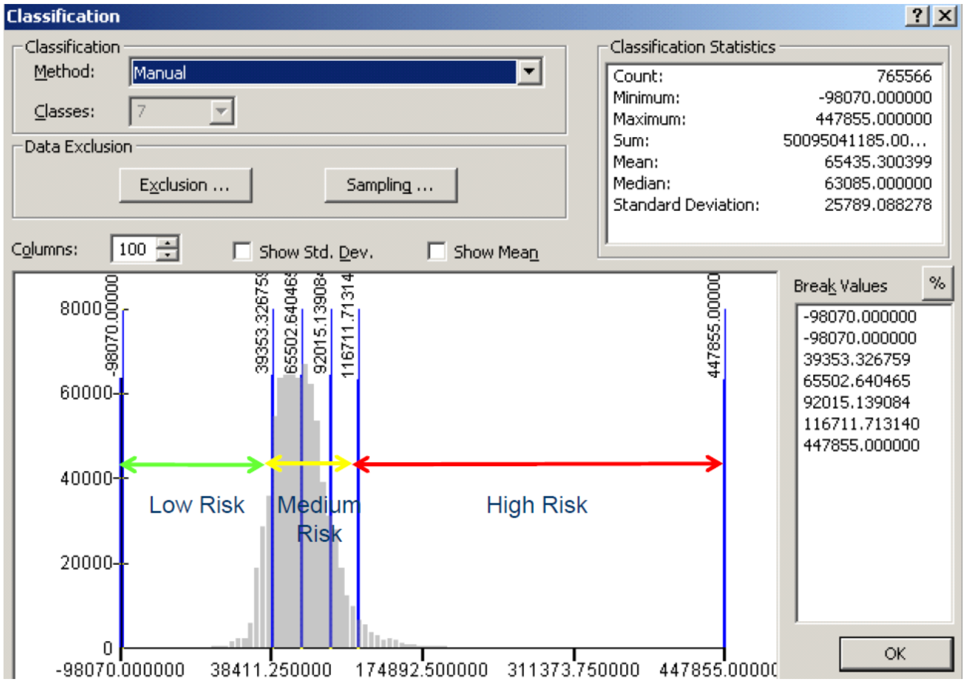


Figure 7-2 Determining Highest Scoring Aggregated Rasters by High, Med, Low Risk

Table 7.4-1 Risk Ranking of Primary Threats

Primary Threats	Scores	Ranking of Threats within the Highest Aggregated Scoring Rasters
Excavation	1526704745	1
Material	740357250	2
Unknown	616200000	3
Corrosion	281815700	4
Welds/Joints	229633150	5
Incorrect Operations	167734250	6
Nat Forces	73810850	7
Equipment	20684100	8
Other Outside Force	410250	9

Table 7.4-2 Risk Ranking of Subthreats

Sub-threat	Scores	Ranking of Sub-threats within the Highest Aggregated Scoring Rasters
Excavation Damage	1526704745	1
Unknown	616200000	2
Material Failure Pipe	613422125	3
Incorrect Operations	167734250	4
W/J Steel Weld	126951375	5
Mtrl Svc Tee & Bending Stress	126935125	6
W/J Mech Joint	81411225	7
Natural Forces Snow	59054900	8
Corrosion Isolated Risers	47216250	9
W/J PE Joints	21270550	10
Equipment Valve	19947750	11
Natural Forces Faults	12352000	12
Natural Forces Flooding Pipe	2270950	13
Corrosion External	2225605	14

Sub-threat	Scores	Ranking of Sub-threats within the Highest Aggregated Scoring Rasters
Equipment Reg Station	736350	15
Corrosion AC	430500	16
OOF Vehicle Damage	410250	17
Natural Forces Gopher	113200	18
Natural Forces Land Movement	19800	19
Corrosion Stray Current	0	20
Natural Forces Flooding Reg Sta	0	21

7.5 Validation – SME Risk Evaluation and Ranking

It is important to validate the results of risk ranking to ensure that the greatest risks are correctly identified and ensure that subsequent mitigation activity is correctly targeted. To validate the results, the core team that developed the risk factors and weightings, reviewed the results to determine if they are reasonable in comparison to historical leak repair and incident data. The determination of validity should address the following questions:

- Does the initial output of each model produce results that are reflective of what the expectation is based on the risk factors and their weightings?
    - After each model was completed the team reviewed the output to validate against the identified parameters, in several cases the parameters were adjusted based on the expectation and the knowledge of the team members in regard to historical leak repair and incident data.
- Does the overall Risk Score Ranking reflect the experience and knowledge of the subject matter experts (SME)? Example, select specific examples for SMEs to review and determine if the result produces a risk ranking that makes sense. It is expected that the risk ranking process will need to be modified based on the validation process and the risk ranking rerun.
    - The overall risk ranking score was reviewed by the core team and validated against the scrubbed historical leak repair and incident data along with the knowledge of the team members.
    - This information was compiled by district and state and was presented to each construction office during the months of September through December of 2011. The results presented were consistent with what field employees were seeing in their area.

As an additional validation, it is recommended that the risk factors and weightings be reviewed in the year 2012 to further validate and calibrate the risk models against additional failure data from year end 2011. If any changes are made based on this review, the risk models shall be run again with any new parameters that were identified. This review shall be documented along with all changes to the risk model parameters in Appendix C.

7.6 Risk Assessment Process Improvement

Risk Evaluation and Ranking is an ongoing process that responds to changes in the distribution system and continuous improvements in risk evaluation and ranking methodology. A documented review of the risk evaluation and ranking methodology shall be completed at a minimum of every 5 years to reflect changes to the distribution system. As part of this review, threats and risks shall be re-evaluated on its entire pipeline and consider the relevance of threats in one location to other areas. This review shall be documented. However, a review should be done annually to ascertain if key information has become available or enhancements to the distribution data are available that would have an impact on the current risk ranking.

7.6.1 SME Review Process of Risk Score Ranking for Improvements to the Models

A Subject Matter Expert (SME) team shall be assembled that are made up from the original risk factor and weightings development team along with key individuals to review the results of changes to the overall risk score ranking for validation based on risk assessment improvements. This team shall be appointed by the Program Manager and shall be based on their knowledge of the system and any special areas of expertise that they may contribute to the process.

This review shall be documented with the following:

- names of individuals identified to participate on the SME team along with their title, normal work location, and area of subject matter expertise
- the results of the review
- the date of the review
- identified changes

After the recommended changes have been made to the risk models, the results shall be run again, the team re-assembled and the output reviewed for validation.

Any changes within the risk models shall be documented as part of the modeling documentation with revision control as referenced or included in Appendix C.

(In 2012 it was determined that improvements and refinement of the risk models will be needed. The initial results were based on subject matter expert with a small amount of data, which resulted in a qualitative model. Since this process in all likelihood would not be able to be repeated, Avista has determined the need to take the initial process and restructure it to create a repeatable process that will eventually rely less on subject matter expert and more on quantitative data as that becomes available through Avista's data collection processes.)

Another improvement to the risk models is to be able to intersect pipe and the total score. The ESRI® Arc GIS ModelBuilder has the ability to do this; however, Avista has some overlapping vertices that cause this process to fail. This would provide a better visual than using the rasters overlaid on the facilities in GIS as shown in Figure 7-1 above. This enhancement is already documented within the Total Score Model document.

Tab

8 IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS

The objective of this section of the IM Plan is to describe existing and proposed measures to address the risks that have been evaluated and prioritized in Section 7.

8.1 Leak Management Program

The Leak Management program is established in Avista's Gas Standards Manual Specification 5.11 and Avista's Gas and Emergency Service Handbook, Section 2. The Leak Management program addresses the following elements:

- **L**ocate the leaks in the distribution system;
- **E**valuate the actual or potential hazards associated with these leaks;
- **A**ct appropriately to mitigate these hazards;
- **K**eep records; and
- **S**elf-assess to determine if additional actions are necessary to keep people and property safe.

8.1.1 Description of Existing Program

A summary of the key elements of the Leak Management Program are included in Table 8.1-1.

Table 8.1-1 Summary of Leak Management Program Elements

Leak Management Program Elements	Reference to Standard or Procedure
Qualification / training requirements for personnel conducting leak surveys and leak investigations	Gas Standards Manual, Specification 4.31
Maintenance and calibration requirements of leak survey equipment and other leak investigation equipment	Gas Standards Manual, Specification 5.11 & Specification 5.19
Established frequency of defined leak surveys	Gas Standards Manual, Specification 5.11
Criteria for leak severity classification (1, 2, 3)	Gas Standards Manual, Specification 5.11 & Gas Emergency Service Handbook, Section 2
Leak repair and monitoring timeframe	Gas Standards Manual, Specification 5.11
Leak failure cause definitions	Gas Standards Manual, Specification 5.11, Gas Emergency Service Handbook, Section 2
Records and data management procedures	Gas Standards Manual, Specification 5.11
Self-audit of leak management program	Gas Standards Manual, Specification 5.11
Performance metrics established	Appendix D & Appendix F

8.1.2 Key Performance Metrics & Analysis of Effectiveness

The Leak Management Program key performance metrics (those that establish program effectiveness) shall be documented, or included by reference, in Appendix D.

Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

8.2 <u>Other Additional or Accelerated Actions (A/A Action)</u>

The following Sections, 8.2.1 through 8.2.8, outline Additional or Accelerated Actions that are acceptable in order to reduce the risks from failure of the gas distribution pipeline by threat. This list is not all inclusive; there may be alternate action plans that are not currently identified that provide a better means of reducing the risks of failure.

8.2.1 Criteria for Determining When Additional or Accelerated Actions (A/A Actions) are Required

Once the list of high risk rasters (locations) was developed, it was reviewed to determine which threats/sub-threats were included in the list. A ratio was then created by threat/sub-threat. Initially Avista created a comparison ratio between 2009 threat leak data and 2010 threat leak data with the 2009 data being the baseline data. The ratios were compared to see if the threats/sub-threats were stable or increasing using the following criteria:

Risk Stable = within +/- 5% from established baseline
Risk Increasing = greater than 5% over established baseline
Risk Decreasing = less than 5% below established baseline

When a risk was found to be increasing, but the frequency of failure was low (LFofF) a threshold of .001(1/10th of a percent) was created and the action assigned was to continue trending this threat to see if it stabilizes or continues to increase.

This information was then used with the flow process chart in Section 10 to determine if an additional/accelerated action was required.

This information was then presented to the team that was assembled to review the results and determine if an additional or accelerated action currently exists or not. If one did not exist then one was assigned. A performance measure was selected to monitor the performance of the A/A action. Ongoing performance monitoring shall be performed as described in Section 10.

A list of the selected A/A Actions and Performance Measures selected are documented and listed in Appendix D. (A list of acceptable A/A Actions by Threat and Sub-threat are identified in this section and should be reviewed as part of this process.)

8.3 <u>Other Additional or Accelerated Actions (A/A Action)</u>

When a trend is identified, the Asset Management engineer may be asked to perform a life cycle cost and reliability study to better understand what additional or accelerated action is appropriate to take. The diagram below shows the process.

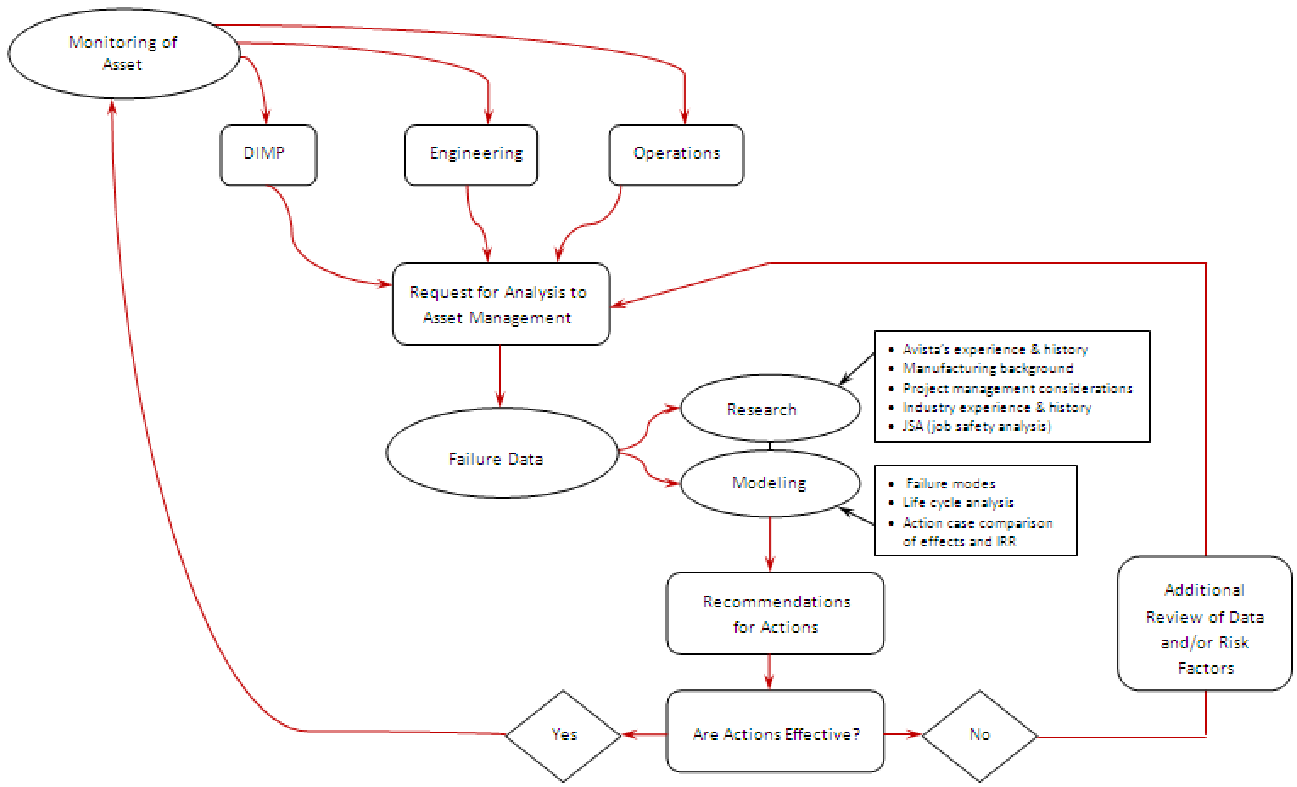


Figure 8-1 Asset Management Analysis Process

The following Sections, 8.3.1 through 8.3.8, outline Additional or Accelerated Actions that are acceptable in order to reduce the risks from failure of the gas distribution pipeline by threat. This list is not all inclusive; there may be alternate action plans that are not currently identified that provide a better means of reducing the risks of failure.

8.3.1 Corrosion

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with corrosion. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
External Corrosion Galvanic/Stray Current	Increase Leak Survey Frequency on areas of highest risk
	Implement or increase schedule of a replacement, program that prioritizes the replacement schedule based on highest risk areas/segments
	Correct cathodic protection deficiencies
	Test for and resolve DC current interference in areas located near DC transit systems, foreign utilities under CP, etc.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
	Replace sections of poorly coated pipe subject to stray current
	Install insulation joints, magnesium anodes, and/or drainage bonds
Internal Corrosion Biological/Chemical	Increase Leak Survey Frequency on areas of highest risk
	Install drips in areas of known liquid collection. Establish periodic draining and monitoring.
	Monitor and enforce gas quality standards with problematic providers.
	Increase leak survey / inspection
Atmospheric Corrosion	Increase inspection frequency on areas of highest risk
	Implement a replacement program
	Review coating materials to ensure that they are appropriate for areas susceptible to atmospheric corrosion.

8.3.2 Natural Forces

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with natural. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Seismic Activity	Patrol and leak survey immediately after any seismic event
	Identify areas subject to soil liquefaction and fault lines for targeted deployment of mitigation actions
	Design Emergency Isolation Zones and install zone shut off valves
	Install excess flow valves in areas prone to seismic activity
	Install valves, shut-offs, line rupture control valves, SCADA or other appropriate devices at fault crossings
	Re-engineer pipelines at Fault Crossings to minimize potential impact of earth movement
Earth Movement / Landslide	Patrol and/or leak survey immediately after any significant rainfall
	Identify areas subject to earth movement / landslide for targeted deployment of mitigation actions
	Install valves, excess flow valves, strain gauges or other appropriate devices in areas of susceptibility

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Flooding	Monitor flood threats and shut off gas service to impacted areas in advance of flooding
	Patrol and/or leak survey after flooding.
	Design Emergency Isolation Zones and install zone shut off valves for areas known to have high risk of flooding.
Snow/Ice	Implement customer education effort via billing inserts or other methods as outlined in Avista's public awareness program
	Educate meter reading personnel to identify problems and refer to Operations department.
	Conduct patrol of regulator stations or other critical stations after heavy snow or ice-storm.
	Install EFV in known areas that experience snow/ice issues
	Install meter shelters in known areas that experience snow/ice issues
Tree Roots	Increase leakage survey in areas with history of problems.
	Replace / relocate sections of main or service subject to abnormal stress due to known root impact
	Implement tree clearing program in pipeline right of way
	Implement public/community education effort regarding the planting of certain types of trees in proximity to gas mains and services.
Gophers	Install excess flow valves on services in areas with history of problems
	Install services in conduit/casing in gopher identified areas
	Investigate gopher/mole habits and patterns to determine what facilities are susceptible to their damage

8.3.3 Excavation Damage

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with excavation damage. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Insufficient Excavator Practices	Track dig-ins and identify problem excavators. Implement repeat offender policy with targeted education, targeted field inspections.
	Conduct pre-construction meeting or site-visits for excavation near critical or high risk facilities.
	Special patrols or job site visits for high-risk excavators or high-risk excavation practices.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
	Conduct enhanced awareness education
Locating Issues	Analyze root cause and implement corrective action.
	Monitor and track for dig-ins resulting from mismarked facilities. Analyze root cause and implement corrective action.
	Conduct sample audits of locates to monitor performance.
	Improve system map accuracy and availability
No One Call Notification	Implement customer education effort via billing inserts or other methods as outlined in Avista's public awareness program
	Conduct enhanced awareness education

8.3.4 Other Outside Force

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with other outside force. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Vehicle Damage to Aboveground Facilities	Identify and track aboveground facilities that are at risk for vehicular damage. Implement or expand program to install protection or relocate facilities.
	Relocate or protect any facility that is hit or damaged by a vehicle.
Vandalism of Critical Facilities	Ensure locks are installed on critical valves and existing gates.
	Install fences or other enclosures for high risk stations or other facilities.
	Increase visibility/lighting or other actions at critical facilities
Fire/Explosion	Ensure that a shutoff valve (riser or curb valve) exists outside the structure and is operable. Monitor and expedite repairs of these service shutoff valves.
	Verify that first responder training is adequate and frequent
	Expand the use of excess flow valves

8.3.5 Material, Weld or Joint Failure

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with material, weld/joint. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Manufacturing Defect – Steel	Increase frequency of leak surveys
	Repair or replace
	Revise material standards
	Trend manufacturing defects
Material Failures	Trend material failures
	Increase leak survey frequency on areas of high risk
	Revise material standards
	Implement or increase schedule of a replacement program that prioritizes the replacement schedule based on high risk areas/segments
Weld/Joint Failure	Trend weld or other joint failures
	Replace or repair
	Revise construction procedures
	Improve training

8.3.6 Equipment Failure

List of Additional or Accelerated Actions that are acceptable in place in order to reduce the risks associated with equipment such as valves, regulators, reliefs, stopper fittings, service tee o-rings, etc anything with internal components that can be changed out. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Equipment Failure	Replace or repair
	Increase frequency of inspection/monitoring
	Investigate if equipment is being used in inappropriate situations/locations

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
	Improve installation procedure
	Trend equipment failure
	Better standard designs

8.3.7 Incorrect Operation

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with incorrect operation. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

SUB-THREAT	ADDITIONAL OR ACCELERATED ACTIONS
Improper Install	Track failures/leaks that results from operating errors in order to identify any trends.
	Perform root cause analysis of operating errors and take corrective action.
	Review training and qualification programs and procedures for adequacy and take corrective action
	Evaluate locations where inadequate practices may have been used
	Improve training
	Perform internal inspections
Service Lines Bored thru Sewer Lines	Identify possible locations and prioritize investigation of highest risk sites.
	Educate sewer line troubleshooting companies (roto rooter) on possible gas line blockages and Avista's customers

8.3.8 Other

List of Additional or Accelerated Actions that are acceptable in order to reduce the risks associated with other causes. Prior documentation shall be retained and stored in the Distribution Integrity Management Program files.

Sub-Threat	ADDITIONAL OR ACCELERATED ACTIONS
Pipeline Overbuilds	Implement program to identify, track, prioritize and resolve construction over pipelines
	Implement education as part of Public Awareness Program

8.4 Prioritization of Facilities for Additional or Accelerated Actions

When looking at how to prioritize the facilities for an additional or accelerated action there are several considerations that need to be taken into account. The first and foremost is the safety aspect. Then after safety the following considerations should be used in determining the facility prioritization:

- Customer experience
- Municipality stakeholders (permitting, pavement moritoriums, etc)
- Weather related conditions (snow areas versus non-snow areas for scheduling)
- Logistics of crews and equipment
- Work efficiency, density of area and opportunity work

Tab

9 MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATING EFFECTIVENESS

The objective of this section of the plan is to establish performance measures that shall be monitored from an established baseline in order to evaluate the effectiveness of the IM program. The performance measures detailed in Sections 9.1 through 9.6 have been established in order to monitor performance and assist in the ongoing evaluation of threats.

9.1 Number of Hazardous Leaks either Eliminated or Repaired, per §192.703(c), Categorized by Cause

The baseline and ongoing performance of the number of hazardous leaks either eliminated or repaired, per §192.703(c), categorized by cause, shall be documented, or included by reference, in Appendix F.

9.2 Number of Hazardous Leaks Eliminated or Repaired, per §192.703(c), Categorized by Material

The baseline and ongoing performance of the number of hazardous leaks either eliminated or repaired, per §192.703(c), categorized by material, shall be documented, or included by reference, in Appendix F.

9.3 Total Number of Leaks Eliminated or Repaired, Categorized by Cause

The baseline and ongoing performance of the total number of leaks either eliminated or repaired, categorized by cause, shall be documented, or included by reference, in Appendix F.

9.4 Number of Excavation Damages, Locate Tickets and Ratio of Excavation Damges per 1000 Locate Tickets

The baseline and ongoing performance of the number of excavation damages per 1000 locate tickets shall be documented, or included by reference, in Appendix F.

The baseline and ongoing performance of the number of excavation tickets received from the notification center(s) shall be documented, or included by reference, in Appendix F.

9.5 Additional Performance Measures

Any additional performance measures that are needed to evaluate the effectiveness of the IM Program in controlling an identified threat, shall be documented in Appendix F or included by reference.

9.6 Data Collection for Use with Performance Measures

The collection of data for use with performance measures shall be done by the DIMP Analyst and/or the Program Manager. The data used in the performance measures will be primarily from data gathered and tracked for use on the PHMSA annual reports in conjunction with queries from Avista's GIS mapping system and Avista's AFM database which spatially houses facility data and inspection data. Additional information may come from reports generated through other systems as necessary to provide the necessary data for tracking performance measures.

Tab

10 <u>PERIODIC EVALUATION AND IMPROVEMENT</u>

The objective of this section of the plan is to periodically re-evaluate threats and risks on the entire pipeline and periodically evaluate the effectiveness of its program.

10.1 <u>Plan Updating, Review Frequency and Documentation</u>

This written integrity management plan shall be reviewed annually and updated as required to reflect changes and improvements that have occurred in process, procedures and analysis for each element of the program, reference Table 10.1-1 in Appendix G. A complete program re-evaluation shall be completed every five years beginning in 2016. All changes to the written plan, inclusive of material from the appendices, shall be recorded on the Revision Control Sheet on page ii. However, changes to material in the appendices that is included by reference need not be recorded on the Revision Control Sheet.

Past effectiveness reviews that are no longer current shall be retained and stored in the Distribution Integrity Management Program files per the requirements of Section 12.

10.2 <u>Effectiveness Review</u>

An assessment of the performance measures described in Sections 9.1 through 9.6 shall be performed. In cases where the re-evaluation criteria specified is met or exceeded, a re-evaluation of the associated threats and risks shall be completed. If it is determined that the current Additional/Accelerated Action is not stabilizing or reducing the threat, then another Additional/Accelerated Action maybe required; however, it may take a couple of years worth of monitoring to truly determine if the Additional/Accelerated action is effective. This should be noted on the re-evaluation form titled Performance Measures that Exceeded Baseline, shown in Appendix G. This determination shall be accomplished using the process flow as outlined in 10.2.1 Re-Evaluation Criteria of Performance Measures.

10.2.1 Re-Evaluation Criteria of Additional/Accelerated Actions

A baseline should have been established for applicable threats/sub-threats. An example of a baseline measurement is a 5-year average of leaks/mile/year. (Not all performance measures will have 5 years worth of data to create a baseline, start with what is available and add to it until you reach 5 years of data.)

The criteria for re-evaluation shall be if the moving 5-year average changes as outlined below:

Risk Stable = within +/- 5% from established baseline
Risk Increasing = greater than 5% over established baseline
Risk Decreasing = less than 5% below established baseline

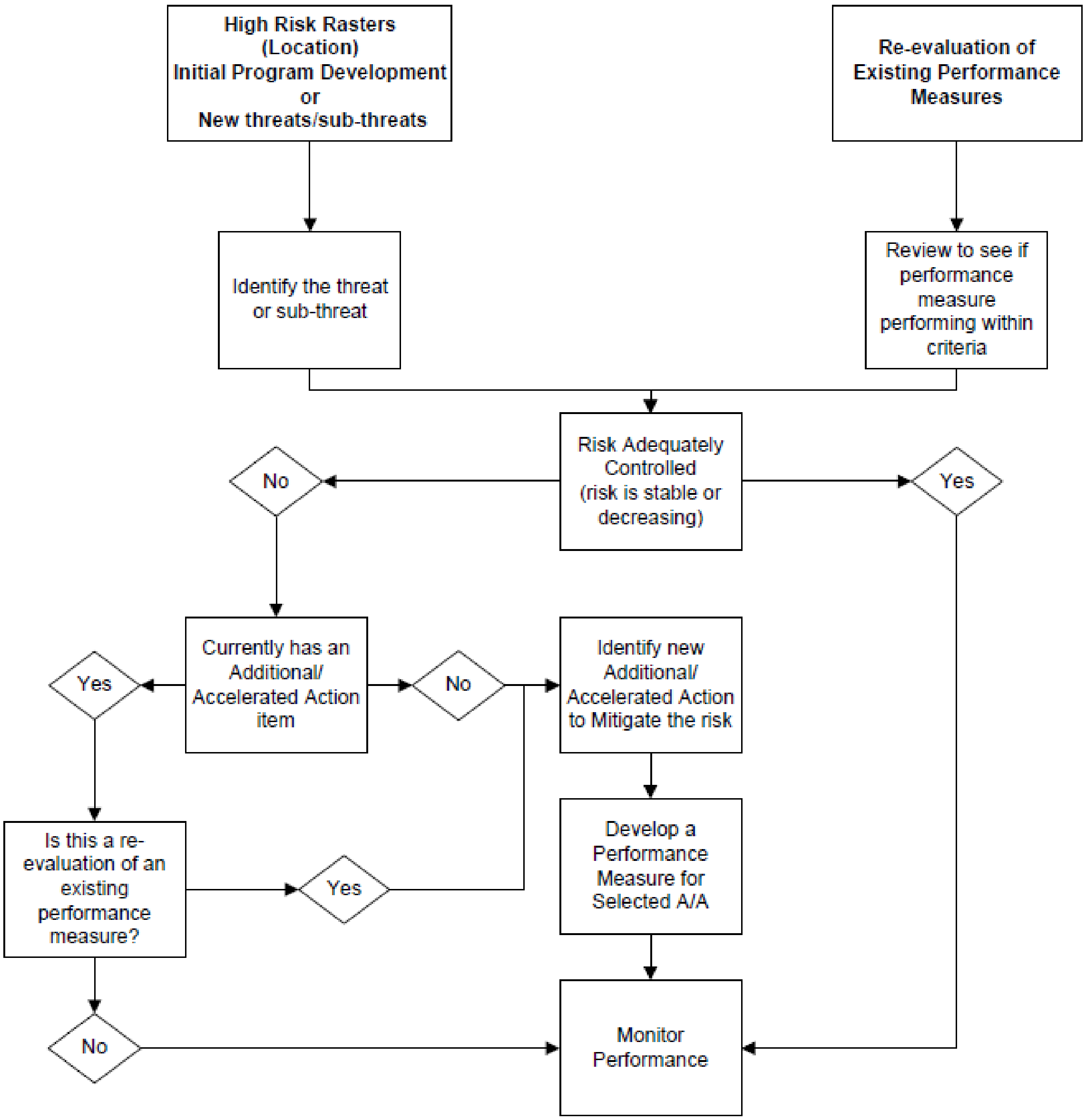


Figure 10-1 Additional/Accelerated Action Criteria Process

10.2.2 Criteria for Determining When Additional or Accelerated Actions (A/A Actions) are No Longer Required or Necessary

The following criteria shall be used to determine when an A/A Action is no longer required or necessary:

- When facilities are no longer considered high risk
- When high risk facilities have been replaced or eliminated
- When the effectiveness review shows that a threat has decreased (is more than 5% below the baseline data) for a minimum of 3 years, the A/A Action may be eliminated; however, a new performance measure shall be established and monitored. If the threat moves to the “Risk Increasing” category, and the facilities are in the high risk category, then an A/A Action shall be re-assigned and a performance measure developed and monitored.

10.2.3 Review of Performance Measures

All performance measurements shall be reviewed periodically but not to exceed a maximum of 5 years to determine that it is effective and that the right measurement is being used. If it is determined that the measurement is not effective, a new one shall be developed and applied to the threat that it is measuring and a new baseline shall be established.

The re-evaluation of threats and risks shall be documented in the form titled Performance Measures that Exceeded Baseline, Table 10.2-1 in Appendix G. The results of the re-evaluation shall be documented in Appendices B and C. The review shall also establish whether a complete program re-evaluation shall be completed in a shorter timeframe than five years; this decision shall also be documented.

10.2.4 Emerging Threats

If an emerging threat is identified in or more location it shall be evaluated for relevance to other areas. It may take a couple of years’ worth of data to determine if a threat is truly emerging.

This threat shall be reviewed to determine if it needs to be incorporated into the risk models and whether there is sufficient data to develop a risk model. If there is not sufficient data, then this shall be documented under Section 5 where additional data required and an action plan identified to collect the necessary data to incorporate this risk into the risk models. This emerging threat shall be reviewed and documented in Appendix B as a threat. When and if this threat is incorporated into the risk models, the risk model documents shall be updated.

Tab

11 REPORTING RESULTS

11.1 State & Federal Annual Reporting Requirements

The following four measures shall be reported, annually by March 15, to PHMSA on form F7100.1-1 annual report for Gas Distribution System as required by 49 CFR, §191.11:

- Number of hazardous leaks either eliminated or repaired (or total number of leaks if all leaks are repaired when found), per § 192.703(c), categorized by cause
- Number of excavation damages
- Number of excavation tickets (receipt of information by the underground facility operator from the notification center)
- Total number of leaks either eliminated or repaired, categorized by cause

The annual report which includes these five measures shall also be sent to each respective State Pipeline Safety Authority in the State (Washington, Idaho and Oregon) where the gas distribution pipeline is located. A copy of the reports shall be maintained in the Distribution Integrity Management Program files per the requirements of Section 12. Annual reporting requirements are also outlined in Avista's Gas Standards Manual, Specification 4.14 for information on additional state reporting requirements.

11.2 Mechanical Fitting Failure Reporting Requirements

Operators are required to begin collecting mechanical fitting failure information for each mechanical failure that results in a hazardous leak during the calendar year beginning January 1, 2011. Each failure shall be submitted on form F7100.1-2 Mechanical Fitting Failures. This form(s) shall be submitted to PHMSA annually by no later than March 15 for the previous year's data. (Operators are permitted to submit mechanical fitting failure report forms throughout the year.) Reporting requirements for this form are contained in 49 CFR, §192.1009 and §191.12

Information related to mechanical fitting failures must include, as available, state where failure occurred, date of failure, type of mechanical fitting, description of fitting, location in the pipeline, year installed, year manufactured (or decade), manufacturer, part/model number, lot number, other attributes, material type, apparent cause of leak, and leak location on fitting.

Report all types and all sizes of mechanical fitting failures regardless of the material composition of the fitting or the cause of the leak. The reporting requirements apply to failures in the bodies of mechanical fittings, failures in the joints between the fitting and the pipe, and when the pipe pulls out of fitting.

Tab

12 DOCUMENT AND RECORD RETENTION

The following records shall be retained in the Distribution Integrity Management Program files.

- The most current as well as prior versions of this written IM Plan
- Documents supporting Knowledge of Facilities, material supporting Appendix A of the IM Plan.
- Documents supporting threat identification, material supporting Appendix B of the IM Plan.
- Documents supporting risk evaluation and ranking, material supporting Appendix C of the IM Plan.
- Documents supporting the identification and implementation of measures to address risks, material supporting Appendix D of the IM Plan.
- Documents supporting measurement of performance, monitoring results and evaluating effectiveness, material supporting Appendix F of the IM Plan.
- Effectiveness reviews, material supporting Appendix G of the IM Plan.
- Annual Reports to PHMSA and State pipeline safety authorities
- Mechanical Fitting Failure Reports

Documentation demonstrating compliance with the requirements of 49 CFR, Part 192, Subpart P shall be retained for at least 10 years.

Tab

APPENDIX A
KNOWLEDGE OF FACILITIES

History of Avista

1. 1956 Natural Gas comes to Eastern Washington and Northern Idaho.

2. 1958 Washington Water Power Company (Avista) acquires the natural gas system from Spokane Natural Gas.

3. 1968 Washington Water Power Company (Avista) begins the use of plastic pipe (Aldyl A) in certain towns and areas as test sites.

4. 1971 Oregon begins installing plastic pipe.

5. 1973 Washington Water Power Company (Avista) plastic pipe (Aldyl A) becomes the preferred method for installation of pipe for intermediate use.

6. 1974 Washington Water Power Company (Avista) acquires the Columbia Gas system properties in Ritzville (1957), Endicott (1958), Warden (1960), Connell (1969), Goldendale (1959), Stevenson (1959)

7. 1991 Washington Water Power Company (Avista) acquires CP National properties in Roseburg, Medford, Klamath Falls, and LaGrande in Oregon and South Lake Tahoe in California. The steel system dates back to 1930.

    - The CP National system has changed owners several times prior to the acquisition by Avista (WWP). Historical records are missing.
    - Name change for CP National to WPNatural

8. 1993 Earthquake 15 miles NW of Klamath Falls, OR measuring 5.7 on the Richter scale. No damage was sustained to any of WP Natural’s facilities.

9. 1999 company name change to Avista for both Washington Water Power Company and WP Natural as the names no longer fits the company’s focus for the future.

10. 2005 Avista sells South Lake Tahoe property in California.

11. 2007 Avista converts Glendale from a propane system to natural gas.

12. 2008 Avista begins developing their DIMP program.

13. 2011 Avista begins an Aldyl A pipe replacement program and implements their DIMP program.

14. 2012 Avista switches to Polytough1 plastic pipe, a bi-modal pipe manufactured by Polypipe.

Table 5.1-1: IM Program Records Summary

Record	Record Type Database, Electronic Record, Paper Record	Extent of Missing Records	Location of Records	Key Contact	Years Reviewed
Geographic Information System (GIS) database	Spatial Database	There are some unknown pipe and install years	Avista	Randi Rich	Reviewed various information in database, initiated changes based on review
Gas Service Records	Paper Electronic	Reviewed sampling of as-builts for historical construction data from 1958 to current	Local Office & Archive, GIS	Various	Reviewed sampling of as-builts for historical construction data from 1958 to current
As-Built Construction Drawings / records	Paper Electronic	Reviewed sampling of as-builts for historical construction data from 1958 to current	Local Office, Gas Engineering, Archive, GIS	Various	Reviewed sampling of as-builts for historical construction data from 1958 to current
Leak Survey Repair Records	Paper Electronic	Reviewed back to 2006 and in some areas 2004	<prior to 2005 archived Gas Engineering Compliance Database	Mike Faulkenberry,	Reviewed back to 2006 and in some areas 2004
Trouble Order Leak Repair Records	Paper Electronic	Prior to 2005 records were archived off site leak categories changed also prior to this date	< 2006 archived off site 2006 - 2009 local office >Oct 2008 Compliance Database	Local Constr Manager Jody Morehouse	Reviewed back to 2006 (2005 in some areas)

Record	Record Type Database, Electronic Record, Paper Record	Extent of Missing Records	Location of Records	Key Contact	Years Reviewed
Gas Leak Survey Records	Paper	Reviewed back to 2005 archived prior to this year	Gas Engineering	Shawn Gallagher	Reviewed back to 2005 data input into spreadsheet for analysis
DOT/PHMSA Incident Reports	Paper	Not sure all reports were in files	Gas Engineering	Mike Faulkenberry	20 years worth of files
Other Incident Reports	Paper		Gas Engineering	Mike Faulkenberry	Early 1990's
PHMSA Annual Reports	Paper	Missing some annual reports from 1990's	Gas Engineering	Mike Faulkenberry	Reviewed 18 years worth of reports (OR back to 1970)
Cathodic Protection Maintenance Areas (Rectifier and Pipe-to-Soil inspection)	Paper Electronic	Combination of paper and electronic	Gas Engineering Compliance Database	Gary Douglas Jody Morehouse	Reviewed sampling back to 2000
CP Maintenance of Isolated Mains and Services subject to 10% annual inspection	Paper Electronic	Combination of paper and electronic	Gas Engineering Compliance Database	Gary Douglas Jody Morehouse	Reviewed back to 2003
Atmospheric Corrosion Inspection Records	Paper Electronic	No standard process of documenting inspections prior to 2007 (changed process in 2007 for all areas)	Archive, Local Office, >=2007 Gas Engineering Compliance Database	Local Construction Manager/ Shawn Gallagher Jody Morehouse	Reviewed back to 2007
Patrol Records	Paper		Archive, Local Office	Local Construction Manager	Reviewed back to 2006

Record	Record Type Database, Electronic Record, Paper Record	Extent of Missing Records	Location of Records	Key Contact	Years Reviewed
Bridge Crossing Inspection Records	Paper		Archive, Local Office	Local Construction Manager	Reviewed back to 2006
Valve Maintenance Records	Electronic	Not all areas went back to 1996	Compliance Database	Jody Morehouse	Reviewed back to 1996
Regulator Station Maintenance Records	Electronic	Some areas only went back to 2005	Compliance Database	Jody Morehouse	Back to 2004
Locate data	Paper	Limited	Archive Local Office	Local Construction Manager	Reviewed back to 2006
3rd Party Damage Data	Paper Electronic	Information captured on trouble order leak repairs see category for extent of missing records	Archive, Local Office Compliance Database	Local Construction Manager Jody Morehouse	Reviewed back to 2006 (2005 in some areas)
Material Failure Reports	Paper <2010 Access Database >=2010	Minimal information prior to 2009 on field failures, prior to this it was mostly new material issues. 2009 implemented new form, process and tracking mechanism	Gas Engineering	Bill Baker	Reviewed what was available back to early 1960's
PPDC Reports	Paper	Reviewed back to 2001	Gas Engineering	Bill Baker	Reviewed back to 2001
Exposed Pipe Reports Steel & Plastic	Steel Paper Electronic 2009	Prior to 2004 information was not on a single form but associated with multiple forms	Archive Local Office/Gas Engineering Compliance Database	Gary Douglas Jody Morehouse	Reviewed back to 2004 and random inspections in certain areas

Record	Record Type Database, Electronic Record, Paper Record	Extent of Missing Records	Location of Records	Key Contact	Years Reviewed
System Pressure Data	Electronic - GIS		Gas Engineering	David Howell	Most current
Gas Quality Contracts	Paper	1990's	Gas Supply	Eric Scott	Reviewed contracts back to 1975
Purchase Order Records	Paper/Electronic	WA/ID Limited OR - sporadic	Archive, Supply Chain Dept	Kathy Nitteberg	Some associated with project files back to 1958, pipe & fittings
SME Interview Records	Paper		Gas Engineering	Gas Engineering	N/A

In 2011 there was a temporary change in leadership in Gas Engineering, David Howell's name replaces Jody Morehouse, and David Howell's name is replaced with Jeff Webb as key contacts within Gas Engineering.

Table 5.2-1: Summary of Material Types and Mileage

Total Mile of Main at Year End 2011				
CATEGORY	Idaho	Oregon	Wash	Total
STEEL	529.24	839.24	1496.01	**2864.49**
Plastic: pre-1987 AldylA (susceptible to SCG)	132.72	250.14	342.67	**725.53**
Plastic: >= 1987 to 1991, AldylA 2406	123.1	138.26	211.39	**472.75**
Other Plastic: >= 1992	1172.6	1019.1	1289.27	**3480.97**
UNKNOWN	0	0	0	**0**
Total	**1957.66**	**2246.74**	**3339.34**	**7543.74**
Total Mile of Services at Year End 2011				
CATEGORY	**Idaho**	**Oregon**	**Wash**	**Total**
STEEL	188.65	283.07	618.91	**1090.63**
Plastic: pre-1987 AldylA (susceptible to SCG)	129.9	191.71	254.7	**576.31**
Plastic: >= 1987 to 1991, AldylA 2406	104.86	144.1	197.26	**446.22**
Other Plastic: >= 1992	816.54	774.93	1272.17	**2863.64**
UNKNOWN	1.82	51.61	5.55	**58.98**
Total	**1241.77**	**1445.42**	**2348.59**	**5035.78**
Total Number of Services at year End 2011				
CATEGORY	**Idaho**	**Oregon**	**Wash**	**Total**
STEEL	12279	18509	44121	**74909**
Plastic: pre-1987 AldylA (susceptible to SCG)	4905	7421	14152	**26478**
Plastic: >= 1987 to 1991, AldylA 2406	5806	8098	11213	**25117**
Other Plastic: >= 1992	48377	61928	75412	**185717**
UNKNOWN	92	3942	498	**4532**
Total	**71459**	**99898**	**145396**	**316753**
Total Miles Pipe (both main & services) at Year End 2011				
CATEGORY	**Idaho**	**Oregon**	**Wash**	**Total**
STEEL	717.89	1122.31	2114.92	**3955.12**
Plastic: pre-1987 AldylA (susceptible to SCG)	262.62	441.85	597.37	**1301.84**
Plastic: >= 1987 to 1991, AldylA 2406	227.96	282.36	408.65	**918.97**
Other Plastic: >= 1992	1989.14	1794.03	2561.44	**6344.61**
UNKNOWN	1.82	51.61	5.55	**58.98**
Total	**3199.43**	**3692.16**	**5687.93**	**12579.52**
Generated from GIS with install date of < 01-01-2012				

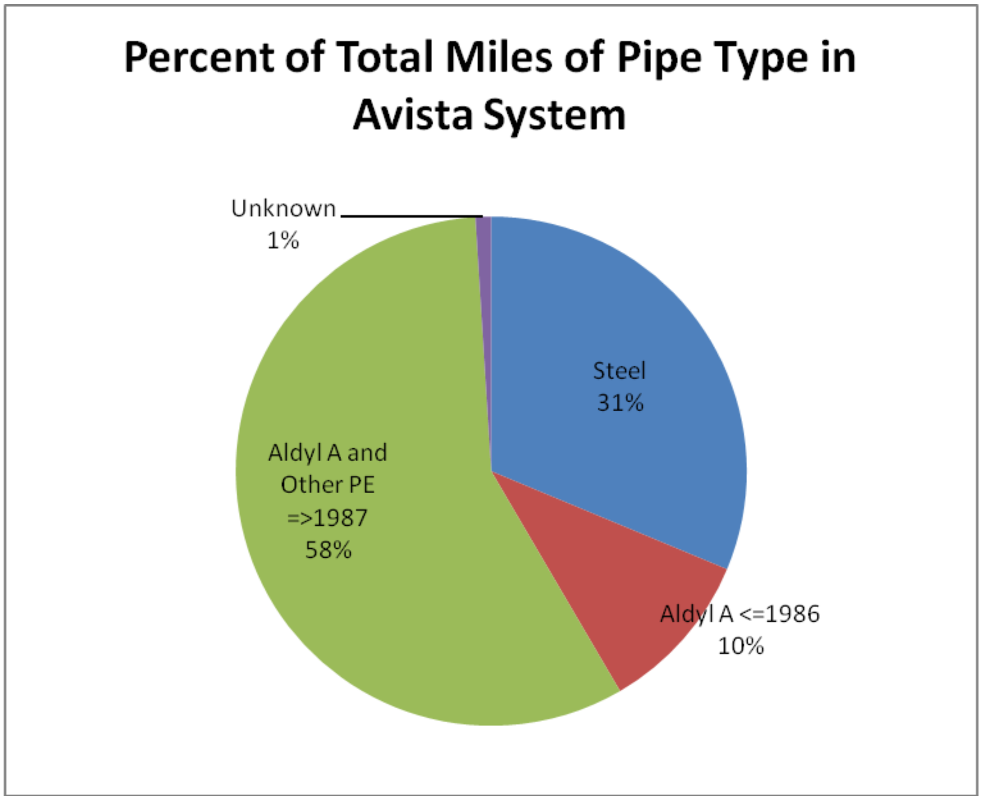


Figure A-1 Percent of Total Miles of Pipe by Type in Avista System

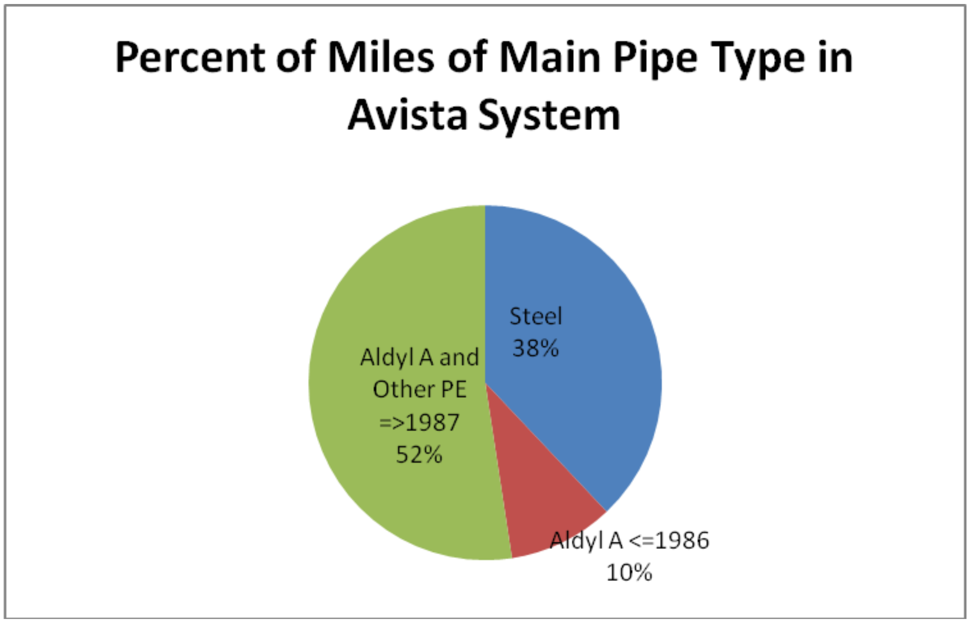


Figure A-2 Percent of Miles of Main Pipe by Type in Avista System

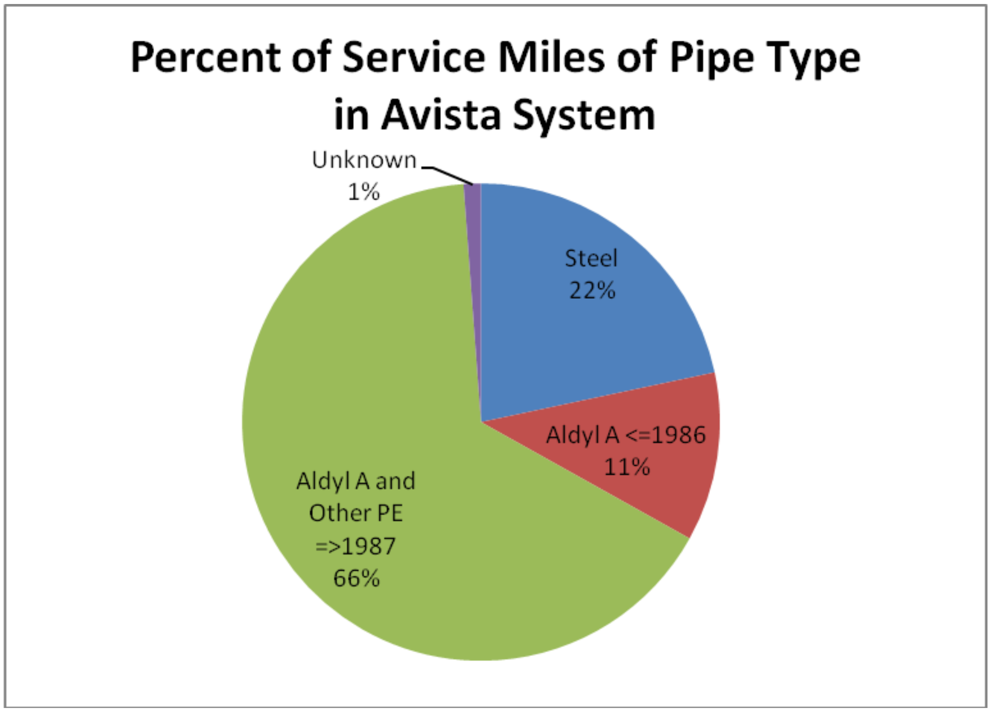


Figure A-3: Percent of Miles of Service Pipe by Type in Avista System

Table 5.2-2 Summary of Plastic Pipe Type by State

STATE	PLASTIC PIPE	START YEAR	END YEAR
OR	Aldyl A	1971	1991
OR	Plexco Yellowpipe	1992	2002
OR	Yellowstripe 8300 HDPE	1996	1997
OR	Driscoplex	2002	2011
OR	Poly Pipe Polytough1	2012	Present
WA	Aldyl A	1968	1990
WA	Phillips Driscopipe	1990	1991
WA	Plexco Yellowpipe	1992	2002
WA	Discroplex	2002	2011
WA	Poly Pipe Polytough1	2012	Present
ID	Aldyl A	1969	1990
ID	Phillips Driscopipe	1990	1991
ID	Plexco Yellowpipe	1992	2002
ID	Discroplex	2002	2012*
ID	Poly Pipe Polytough1	2012	Present

Original information gathered from available purchase order information, historical memos and letters, maps, construction standards, annual reports.

Avista has approximately 2800 feet of 6” diameter of Plexco Yellowstripe 8300 HDPE pipe in Roseburg, OR.

In 2012 Avista began using Polytough1 pipe manufactured by Poly Pipe. This pipe is bi-modal and considered a high performance plastic pipe.

*In order to use up the quantities of larger diameter Driscoplex pipe that Avista had in stock at the end of 2011, this pipe was used on a pipe relocation program in Idaho that was currently under construction at the time.

Table 5.2-3 List of Steel Pipe Specifications of Original Infrastructure for Spokane dated 1956

Infrastructure Installed by Spokane Natural Gas Co. 1956-1957			
Pipe Diameter	Wall Thickness	Grade	Longitudinal Seam Type
24"	0.25	API 5L X42	ERW
20"	0.25	API 5L X42	ERW
16"	0.25	API 5L X42	ERW
12"	0.25	API 5L X42	ERW
8"	0.188	API 5L X42	ERW
6"	0.188	API 5L X42	ERW
4"	0.188	API 5L	Lapweld
3"	0.216	Std Black	Buttweld
2"	0.154	API 5L	Continuous Weld
1"	0.133	API 5L	Continuous Weld
3/4"	0.113	API 5L	Continuous Weld

The information in this table was found an historical material inventory list dated February 26, 1957 by Fish Service Corporation who acted as Spokane Natural Gas Company's agent for the installation of the original backbone system starting in 1956.

Back in the mid-1990's the box with the original Fish Company as built drawings that this table would have related to was lost in the move when Gas Engineering was moving back into the main building from a temporary satellite office in downtown Spokane. There were many historical documents that were lost during this transition period which was from 1992 to 1996. Because these documents are missing, Avista is not sure where all this pipe relates to other than Spokane.

Table 5.2-4 Summary of Pipeline Coatings by State

STATE	PIPELINE COATINGS	START YEAR	END YEAR
OR	Bare	1940's	1950's*
OR	Coal Tar	1930	1959
OR	X-tru Coat (all diam.)	1960	2005
OR	X-tru Coat <= 1 ¼"	1960	Present
OR	FBE => 2"	2005	Present
WA	Bare	N/A	N/A
WA	Coal Tar (all sizes)	1956	1972
WA	Epoxy (<=2")	1964	1973
WA	Plastic Coating	1961	1963
WA	X-tru Coat (all diam.)	1960	2005
WA	X-tru Coat <= 1 ¼"	1960	Present
WA	FBE => 2"	2005	Present
WA	X-tru Coat (all diam.)	1960	2005
ID	Bare	N/A	N/A
ID	Coal Tar (all sizes)	1956	1972
ID	Epoxy (<=2")	1964	1973
ID	Plastic Coating	1961	1963
ID	X-tru Coat (all diam.)	1960	2005
ID	X-tru Coat <= 1 ¼"	1960	Present
ID	FBE => 2"	2005	Present
ID	X-tru Coat (all diam.)	1960	2005

Original information on the pipe coatings was gathered from exposed pipe reports, historical construction data, maps, purchase order records and knowledge of the system from cathodic protection technicians.

*A notation was found on a leak repair order on bare pipe replacement project, found neighborhood in GIS which showed abandoned bare pipe dating from the 1940's and 1950's. There maybe a small number of services that have bare pipe; however, we have 5500 services in Oregon that are of unknown pipe type and service date and are unable to determine which of these are bare at this time. Avista has a project underway to do a record research on these and other unknown pipe material segments as referenced in Appendix F.

Table 5.2-5 Summary of Cathodic Protection Systems

State	Cathodic Protection	
	Type of Protection	Number of Each Type
Idaho	GA	9
	Impressed	35
	Deep Well	15
	Horizontal Surface	19
	Vertical Surface	1
Oregon	GA	25
	Impressed	117
	Deep Well	5
	Horizontal Surface	41
	Vertical Surface	71
Washington	GA	24
	Impressed	90
	Deep Well	46
	Horizontal Surface	37
	Vertical Surface	7
Avista System	GA	58
	Impressed	242
	Deep Well	66
	Horizontal Surface	97
	Vertical Surface	79

The information in Table 5.2-4 above was compiled from Avista's GIS data for year end 2011 in regard to the different types of cathodic protection by state.

STATE	Type of Cathodic Protection	Year
OR	Galvanic	Unknown
	Oldest known rectifier – Medford	1968
ID*	Galvanic	Unknown
	Oldest known rectifier - Lewiston (most installed in early to mid 1960's)	1960
WA*	Galvanic	Unknown
	Oldest known rectifier – Spokane (most installed in mid 1960's)	1963

The data in the above table was found in an historical file on cathodic protection for Washington and Idaho in regard to rectifiers.

Table 5.2-6 Summary of Cathodic Protection History

STATE	Summary of Cathodic Protection Review	Year
OR	Original steel system	1930
OR	Oldest document found on when CP system installed in Oregon – rectifier system Assume a galvanic system prior to this	1968
OR	CP installed on original systems – galvanic	No documents to determine when installed
WA/ID	Spec S-571 Pipeline Installation requires coated pipelines with Tapecoat for wrapping joints	1959
WA/ID	CP installed on original systems	??
WA	Oldest rectifier known to be still in service	1963
OR	Avista acquires CP National	1991
All	Several revisions to CP standards on isolation of steel and gauge of wire	2001
All	Implementation of Operator Qualification program	2002
All	Hired additional cathodic protection technicians	2002-2003
All	Began taking pipe to soil reads on all exposed steel piping reports when the coating is compromised	2003 - 2004
All	Hired a CP Specialist to head up the Cathodic Protection Program	2003
All	CP techs acquire NACE certifications	2003-2005
All	Began re-evaluation of all CP systems for additional test stations and restructuring of cathodic zones	2003 - current
All	Standard for removing or barreling dresser fittings on steel piping	2007

The information in Table 5.2-5 was found from historical standards, interviews with Cathodic Protection Technicians, review of historical documents, past inspection records, and information contained in Avista's GIS system.

Table 5.2-7: Summary of Construction Practices - System wide

Construction Type	Year first deployed	Year Ceased
Replacement via Insertion of Plastic	1968	Currently using
Replacement via insertion and pipe bursting/splitting	2007	Project Specific
Joint Trench with other utilities	Early 1980's	Currently in use
Unguided Bore – soil displacement (moling)	1987	Currently in use
Unguided Bore – Ram	Unknown	Unknown
Guided Directional Bore / Drill	2000	Currently in use
Guided Directional Bore / Drill Special Projects	1993	Currently in use
Blasting	<1958	Project Specific
Plowing	1968	Currently in use
Keyhole Technology	December 2010	Currently in use (only in Spokane, WA)
Construction Process Type	**Year first deployed**	**Year Ceased**
Melt-on Service Tees by Hand	1968	Late 1980's
Sidewinder Equipment for Melt On Service Tees	Late 1980's	2005
Line Tamer for Large Diameter 4" => Coiled Plastic Pipe	1997	Current
Electrofusion Process	Early 1990's	Current
Socket Fusion Process	1968	2005
Bolt-on Service Tees with Stab Outlet	2005	Current
Mechanical stab connections to the place of socket fusion	2005	Current

The information on construction types and construction process types was based on historical standards review, historical construction documents and interviews with Randy Chandler, Spokane Construction Manager and Bob Larson, CP Tech. Randy has previously worked in all three states and is familiar with the construction practices in those states. Bob Larson originally worked for many years on a contract crew for Avista before coming to work directly for Avista on a construction crew and progressing to a Cathodic Protection Technician. He was also familiar with past construction practices.

The Keyhole Technology information was provided by Dan Gigler, General Foreman for the Spokane Construction Area on 3/12/12. Currently the Keyhole Technology is only being used in the Spokane Construction Area. Avista anticipates that this construction technology will be used in other areas. It has received favorable approval by the Spokane area municipalities in regard to minimal structural invasiveness of new asphalt.

Table 5.2-8 Numbers of Emergency Valves in System - 2011

Number of Emergency Valves in System - 2011			
State	PE	Steel	Total
Idaho	479	413	892
Oregon	1016	937	1953
Washington	627	1170	1797
Avista System	2122	2520	4642

Table 5.2-9 Numbers of Secondary Valves in System – 2011

Number of Secondary Valves in System - 2011			
State	PE	Steel	Total
Idaho	567	804	1371
Oregon	1075	1897	2972
Washington	861	2462	3323
Avista System	2503	5163	7666

Table 5.2-10 Valves by Material and Type of Valve by State - 2011

STATE	PLASTIC VALVES				STEEL VALVES				
	Ball	Plug	Unknown	Total	Ball	Plug	Gate	Unknown	Total
Idaho	22	1019	5	1046	92	703	83	339	1217
Oregon	159	1923	9	2091	161	2169	55	449	2834
Washington	194	1093	201	1488	114	2551	282	685	3632
System	375	4035	215	4625	367	5423	420	1473	7683

Table 5.2-10 Number of Regulator Stations and Farms Taps in System - 2011

State	Regulator Stations	Single Service Farm Taps	Total
Idaho	158	201	359
Oregon	243	209	452
Washington	476	333	809
Avista System	877	743	1620

Table 5.2-12 Type of Fittings in System by State and Era

Fittings	IDAHO	OREGON	WASHINGTON
Service Tees/High Volume Tees			
Continental Stl svc tee with compression outlet 1/2", 3/4"	1969 to present	Unknown	1969 to present
Aldyl A Svc Tees - w/black cap fusion 2306	1968 - 1984	1971 - Unk	1968 - 1984
Continental Svc Tee PVC - white bolt-on by stab eliminator	N/A	1980's - 1991	1976 to 1979*
Aldyl A Svc Tees - w/oversize cap fusion 2406	1984 - 1990	Unknown	1984 - 1990
Amp fit service tees (in Oregon)	N/A	Unknown	N/A
Central Plastics Svc Tees fusion 2406 (orange & yellow)	1990 - 2005	1991 - 2005	1990 - 2005
Central Plastics Plexco Svc Tees Electro 2406	1994? - 2002	1994? - 2002	1994? - 2002
Continental Service Tee PA 3408 black Bolt-on Eliminator stab outlet	2005 - present	2005 - present	2005 - present
Continental Service Tee PA 3408 black Bolt-on Eliminator w/ EFV stab outlet	2008 - present	2008 - present	2008 - present
Frailen Svc Tees Electro black w/yellow cap PE2406	2002 - present	2002 - present	2002 - present
Mueller Autoperf tee H-18101 - svc tee 3/4 Steel		1970 - Unk	
Mueller H-17500 No-Blo svc tee ¾” thru 2”	1959 - Unk	Unknown	1959 - Unk
Mueller Autoperf tee H-18103 - svc tee 3/4 x 1 1/4 Steel		1970 - Unk	
Cont Ind Punch tee 1/2" socket weld 3/4 1302-09-0712 Steel	N/A	1970 - Unk	N/A

Fittings	IDAHO	OREGON	WASHINGTON
Cont Ind Punch tee 1/2" socket weld 3/4 x x 1 1/4 1302-09-0713 Steel	N/A	1970 - Unk	N/A
Mueller Autosafe Autoperf with gas-phuse H-18208 - farm taps Steel	N/A	1970 - Unk	N/A
Kerotest Aldyl A Tee Electrof Repair Kit	2011	2011	2011
**Properties acquired from Columbia Gas in 1974 used on PVC pipe- replaced over the years*			
Excess Flow Valves			
RW Lyall Stick 475 Model B 3/4"**	1998 - 2007	1998 - 2007	1998 - 2007
Lyco Model C, Lyco Model D 3/4"	2008 - present	2008 - present	2008 - present
EFV in outlet of Continental Svc Tees	2008 - present	2008 - present	2008 - present
*** Limited Use - Roseburg mostly*			
Mechanical Couplings			
Perfection Permasert	1972? - 2005	1978 - 2005	1972? - 2005
Ampfit		1980's	
Continental PVC white stab coupling		1980's	1979
Continental PA 3408 black stab coupling	2005 - present	2005 - present	2005 - present
Dresser coupling style 90	Unknown	1971 - Unk	Unknown
Dresser coupling style 39, ins. one end 2"-6"	Unknown	Unknown	1957 - Unk
Dresser coupling style 711	Unknown	1986 - Unk	Unknown

Table 5.2-13 Hazardous Leaks for 2011 by State and Leak Cause

Cause of Leak	Avista System 2011 Hazardous Leaks	Idaho 2011 Hazardous Leaks	Oregon 2011 Hazardous Leaks	Washington 2011 Hazardous Leaks
Corrosion	11	0	5	6
Excavation	447	103	170	174
Other Outside Force	64	15	16	33
Operations	26	5	8	13
Natural Forces	15	4	2	9
Equipment Failure	28	6	6	16
Material	23	5	8	10
Weld/Joint	25	1	16	8
Other	72	3	19	50
Total Leaks	**711**	**142**	**250**	**319**

Table 5.2-14 Hazardous Leaks for 2011 by Material by State

AVISTA SYSTEM Material Category	No of Grade 1 Leaks 2011	Miles of Pipe or # of Facilities	Leaks Per Mile or # of Facility
Steel	65	3955.12	0.016
Other PE	347	7263.28	0.048
Aldyl A (SCG)	132	1301.84	0.101
Other	1	58.98	0.017
Aboveground Facilities	166	320741	0.001
IDAHO Material Category	**No of Grade 1 Leaks 2011**	**Miles of Pipe or # of Facilities**	**Leaks Per Mile or # of Facility**
Steel	7	717.89	0.010
Other PE	84	2217.1	0.038
Aldyl A (SCG)	26	262.62	0.099
Other	0	1.82	0.000
Aboveground Facilities	25	75394	0.000
OREGON Material Category	**No of Grade 1 Leaks 2011**	**Miles of Pipe or # of Facilities**	**Leaks Per Mile or # of Facility**
Steel	36	1122.31	0.032
Other PE	121	2076.39	0.058
Aldyl A (SCG)	50	441.85	0.113
Other	1	51.61	0.019
Aboveground Facilities	42	96186	0.000
WASHINGTON Material Category	**No of Grade 1 Leaks 2011**	**Miles of Pipe or # of Facilities**	**Leaks Per Mile or # of Facility**
Steel	22	2114.92	0.010
Other PE	142	2970.09	0.048
Aldyl A (SCG)	56	597.37	0.094
Other	0	5.55	0.000
Aboveground Facilities	99	149161	0.001

Table 5.2-15: Reportable/Significant Gas Incidents Summary by Year – Avista System

Year	Number of Incidents	# of Fatalities	# of Injuries	Property Damage
2011	1	0	0	1
2010	2	0	0	2
2009	3	3	0	2
2008	3	0	1	2
2007	0	0	0	0
2006	1	0	0	1
2005	1	0	1	1
2004	1	0	0	1
2003	1	0	1	0
2002	0	0	0	0
2001	0	0	0	0
2000	0	0	0	0
1999	0	0	0	0
1998	1	0	0	1
1997	0	0	0	0
1996	0	0	0	0
1995	1	0	0	1
1994	0	0	0	0
1993	1	0	0	1
1992	1	0	0	1
1991	1	0	2	0
Total	18	3	5	14
5-Year Average 2007-2011	1.8	0.6	0.2	1.4
10-Year Average 2002-2011	2.6	0.6	0.6	2
20-Year Average 1992 -2011	0.85	0.15	0.15	0.7

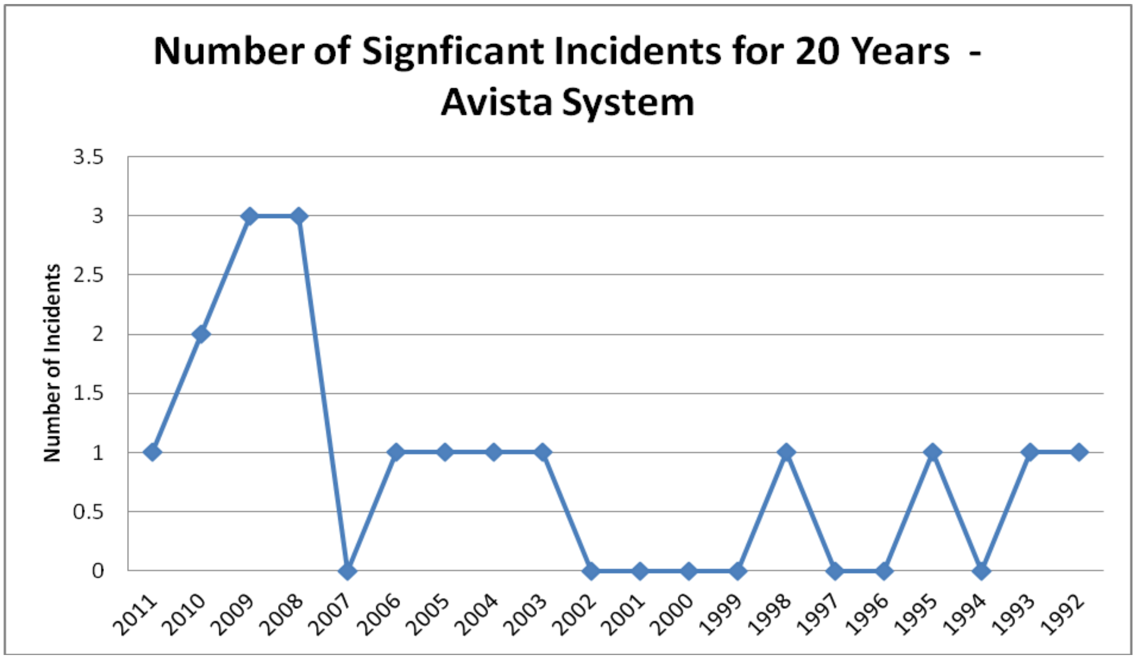


Figure A4 – Number of Significant Incidents for 20 Years – Avista System

As you can see by the chart in Figure 1, the number of significant incidents in Avista's system has increased in the last 10 years. The chart in Figure 2 shows the number of significant incidents by failure cause.

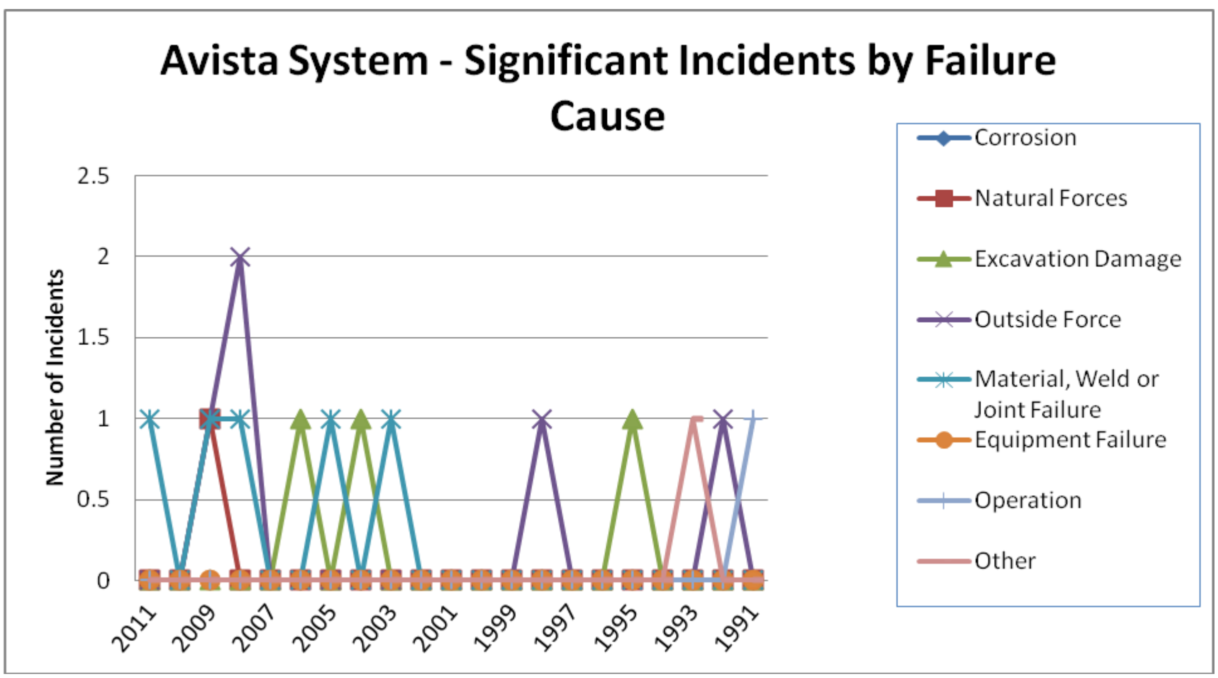


Figure A5 – Avista System - Significant Incidents by Failure Cause

Summary of Significant Incidents:

- 2011: Material Failure, Aldyl A service pipe cracked at out of PE service tee - WA
- 2011: Other Outside Force, vehicular damage to a district regulator station - ID
- 2010: Other Outside Force, structure fire, natural gas not cause of fire - OR
- 2009: Other Outside Force, vehicular damage to steel service on bridge - OR
- 2009: Welds/Joints, PE mechanical joint failed due to poor installation method - ID
- 2009: Natural Forces, snow and ice, migration, ignition of gas - ID
- 2008: Material Failure, Aldyl A main pipe, rock impingement - WA
- 2008: Other Outside Force (actually Natural Forces) snow and ice, migration, ignition of gas - ID
- 2008: Other Outside Force, structure fire, cause unknown – ID
- 2005: Material Failure, Aldyl A main pipe cracked, bending stress - WA
- 2006: Excavation Damage, contractor, gas ignition, no locates – OR
- 2004: Excavation Damage, railroad contractor hit 8" HP – WA
- 2003: Incorrect Operations, company employee injured while performing stopping operation – OR
- 1998: Other Outside Force, structure fire, cause was determined as suspicious unknown – ID
- 1995: Excavation Damage, previous damage to steel line – OR
- 1993: Other, fire customer equipment failure – ID
- 1992: Other Outside Force, vehicular damage to district regulator station – OR
- 1991: Incorrect Operations, company employee injury due to static electricity - ID

Table 5.2-16 Reportable/Significant Gas Incidents Summary by Year – Oregon

Year	Number of Incidents	# of Fatalities	# of Injuries	Property Damage
2011	0	0	0	0
2010	1	0	0	1
2009	1	3	0	0
2008	0	0	0	0
2007	0	0	0	0
2006	1	0	0	1
2005	0	0	0	0
2004	0	0	0	0
2003	1	0	1	0
2002	0	0	0	0
2001	0	0	0	0
2000	0	0	0	0
1999	0	0	0	0
1998	0	0	0	0
1997	0	0	0	0
1996	0	0	0	0
1995	1	0	0	1
1994	0	0	0	0
1993	0	0	0	0
1992	1	0	0	1
1991	0	0	0	0
Total	**6**	**3**	**1**	**4**
5 Year Average 2007-2011	0.4	0.6	0	0.2
10 Year Average 2002-2011	0.4	0.3	0.1	0.2
20 Year Average 1992-2011	0.3	0.15	0.05	0.2

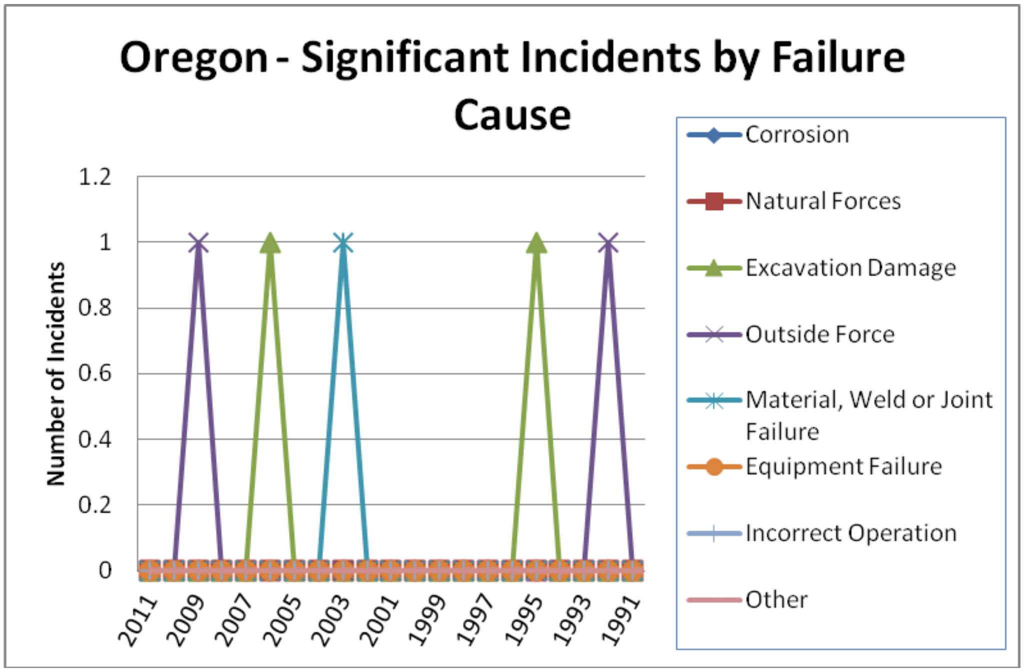


Figure A6 – Oregon - Significant Incidents by Failure Cause

Table 5.2-17 Reportable/Significant Gas Incidents Summary by Year – Washington

Year	Number of Incidents	# of Fatalities	# of Injuries	Property Damage
2011	1	0	0	1
2010	0	0	0	0
2009	0	0	0	0
2008	1	0	1	0
2007	0	0	0	0
2006	0	0	0	0
2005	1	0	1	1
2004	1	0	0	1
2003	0	0	0	0
2002	0	0	0	0
2001	0	0	0	0
2000	0	0	0	0
1999	0	0	0	0
1998	0	0	0	0
1997	0	0	0	0
1996	0	0	0	0
1995	0	0	0	0
1994	0	0	0	0
1993	0	0	0	0
1992	0	0	0	0
1991	0	0	0	0
Total	**4**	**0**	**2**	**3**
5 Year Average 2007-2011	0.4	0	0.2	0.2
10 Year Average 2002-2011	0.4	0	0.2	0.3
20 Year Average 1992-2011	0.2	0	0.1	0.15

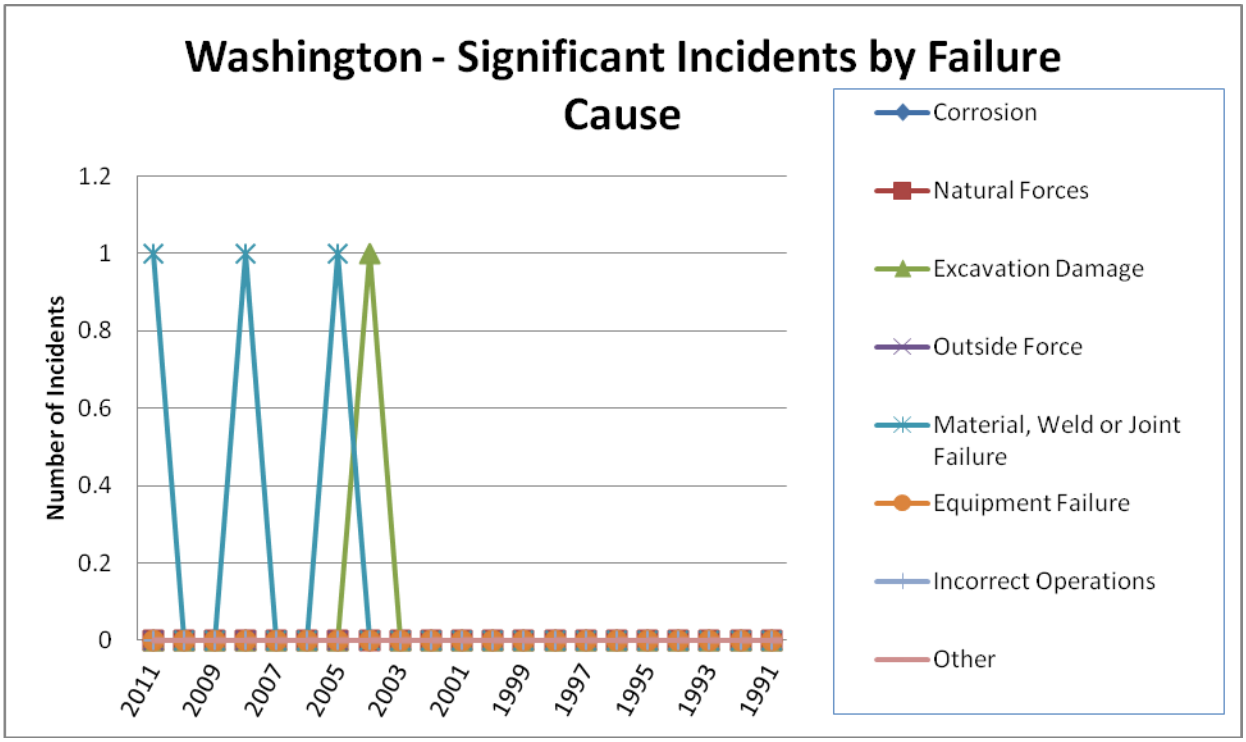


Figure A7 – Washington - Significant Incidents by Failure Cause

Table 5.2-18 Reportable/Significant Gas Incidents Summary by Year – Idaho

Year	Number of Incidents	# of Fatalities	# of Injuries	Property Damage
2011	0	0	0	0
2010	1	0	0	1
2009	2	0	0	2
2008	2	0	0	2
2007	0	0	0	0
2006	0	0	0	0
2005	0	0	0	0
2004	0	0	0	0
2003	0	0	0	0
2002	0	0	0	0
2001	0	0	0	0
2000	0	0	0	0
1999	0	0	0	0
1998	1	0	0	1
1997	0	0	0	0
1996	0	0	0	0
1995	0	0	0	0
1994	0	0	0	0
1993	1	0	0	1
1992	0	0	0	0
1991	1	0	2	0
Total	8	**0**	**2**	**7**
5- Year Average 2007-2011	1	0	0	1
10- Year Average 2002-2011	0.5	0	0	0.5
20- Year Average 1992-2011	0.35	0	0	0.35

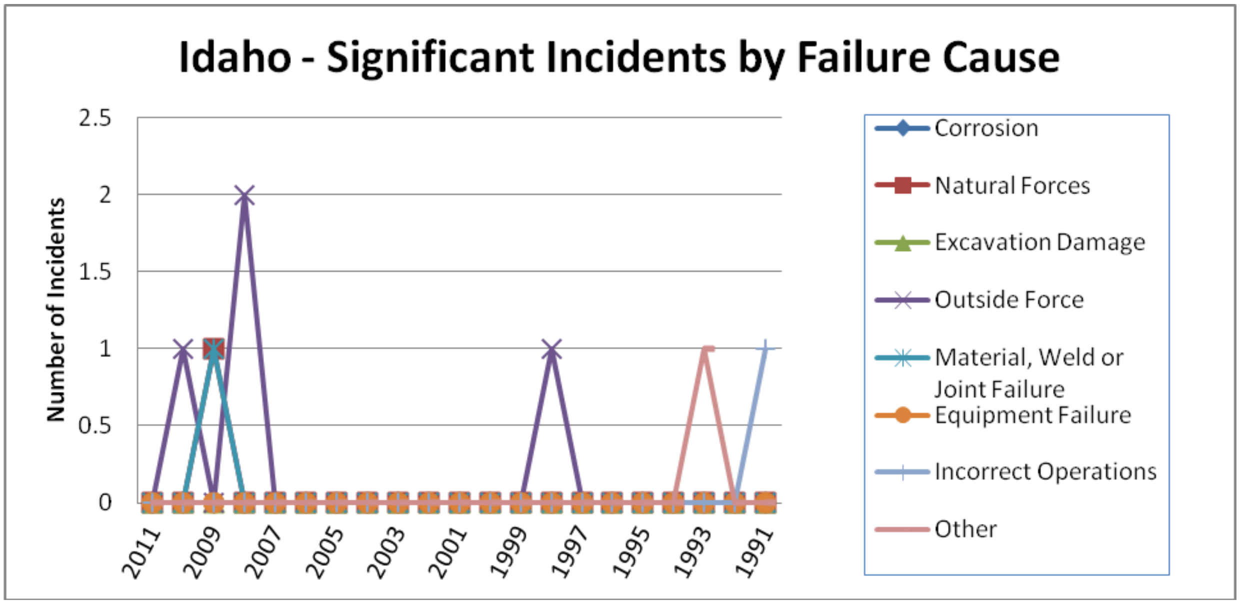


Figure A8 – Idaho - Significant Incidents by Failure Cause

Table 5.4-1 Identification of Additional Information Needed for IM Program

Area of incomplete records or Knowledge	Can it be acquired over time through normal activities? Y / N	Does Action Plan Exist? Y / N
Create sub categories for the Leak Failure Causes in the mobile application	No	Not Currently
Impermeable surfaces & other data (pavement, land growth, rivers, building footprints)	No	Yes
Develop a process to collect information on where meter protection exists as part of the AC inspection program	Yes	Yes
Develop a repeatable process to determine the probability of failure based on quantitative data, rather than the SME probability process that was originally developed.	No	Yes

Table 5.5-1 Action Plans to Enhance Knowledge

Action Plans to Enhance Knowledge			
Action Plan Scope	**Schedule**	**Completion Date**	**Department**
Data collection process for spatially mapping exposed steel pipe in AFM	2009	2009	Gas Engineering
Data collection process for gathering and spatially mapping exposed plastic pipe information from the field in AFM	2009	2009	Gas Engineering
Enhance the excavation damage data from the field based on the CGA – DIRT data collection form in AFM	2010	May 2010	Gas Engineering
Enhance the data collected and develop an electronic data collection process for leak survey leaks similar to trouble leaks and spatially map in AFM	2010	May 2010 Implemented in December 2010	Gas Engineering
Develop a process to collect data on new pipe installation methods, and pipeline characteristics	August 2011	Sept 2011 (roll out began 4th quarter)	Gas Engineering
Develop a process to collect data from the field on both newly installed components and components exposed during normal activities	August 2011	Sept 2011 (roll out began 4th quarter)	Gas Engineering
Develop a data collection process for bridge crossing inspections that are spatially tied to mapping in AFM	May 2011	In progress	Gas Engineering
Improved material failure analysis process and database for tracking	October 2010	March 2012	Gas Engineering
Impermeable surfaces software (road structures, driveways, buildings, etc)	June 2012	In progress	GIS Technical Services
Create a sub category list from the main Leak Failure Cause List in AFM so that this data can be used to break the data into identified subthreats that we cannot currently break out of the Primary threats.	Nov 2011	Nov 30, 2011	Gas Engineering
Develop a process to collect information on where meter protection exists as part of the AC inspection program	March 2012	--	GIS Technical Services

Tab

APPENDIX B
THREAT IDENTIFICATION

Table 6.1-1: Threats Applicable to Avista's Gas Distribution System

THREAT CATEGORIES		TOTAL SYS LEAKS 5 Yrs	TOTAL ID LEAKS 5 Yrs	TOTAL OR LEAKS 5 Yrs	TOTAL WA LEAKS 5 Yrs	Threat Applicable?
Corrosion:		**166**	**14**	**85**	**67**	Yes
Corrosion - External Galvanic		122	6	67	49	Yes
Corrosion - Atmospheric	Leaks	42	7	17	18	Yes
	Found Corrosion Only*	646	29	161	456	
Corrosion - Stray Current		2	1	1	0	Yes
Excavation		**3587**	**621**	**1526**	**1440**	Yes
Other Outside Force:		530	126	166	238	Yes
OOF - Vehicle		279	70	95	114	Yes
OOF - Vandalism		54	12	9	33	Yes
OOF - Fire		11	1	5	5	Yes
OOF - Misc One-Offs		183	42	57	84	Yes
OOF - Electrical Arc/Fault		2	0	0	2	Yes
OOF - Internal Static		1	1	0	0	Yes
Operations:		**262**	**54**	**88**	**120**	Yes
Operations - Improper Install		222	54	86	82	Yes
Operations - Sewer Laterals		4	0	2	2	Yes
Natural Forces:		**406**	**140**	**72**	**194**	Yes
Natural Forces - Snow and Ice		247	114	31	102	Yes
Natural Forces - Wind		5	1	1	3	Yes
Natural Forces - Gopher		135	23	33	79	Yes
Natural Forces - Earthquake		0	0	0	0	Yes
Natural Forces - Flooding		0	0	0	0	Yes
Natural Forces - Landslide		1	1	0	0	Yes
Natural Forces - Lightening		1	0	0	1	Yes
Natural Forces - Trees and roots		13	1	7	5	Yes
Natural Forces - Other Animals		4	0	0	4	Yes
Equipment Failure:		**2352**	**429**	**1195**	**728**	Yes
Material:		**313**	**57**	**77**	**179**	Yes
Material Failure - LDIW/SCG		84	8	11	65	Yes
Manuf Defects - Steel		15	3	1	11	Yes
Manuf Defects - Aldyl A Svc Tees <=1986		112	29	10	73	Yes

THREAT CATEGORIES	TOTAL SYS LEAKS 5 Yrs	TOTAL ID LEAKS 5 Yrs	TOTAL OR LEAKS 5 Yrs	TOTAL WA LEAKS 5 Yrs	Threat Applicable?
Manuf Defects - Other Svc Tees & Caps >=1987	27	1	18	8	Yes
Manufacture Defects - Equipment	57	12	26	19	Yes
Manuf Defects Other PE Failures	18	4	11	3	Yes
Weld/Joint:	**616**	**34**	**413**	**169**	Yes
Weld/Joint - PE Joints	99	7	61	31	Yes
Weld/Joint - Steel Welds	314	18	209	87	Yes
Weld/Joint - Mechanical Ftgs	147	8	99	40	Yes
Weld/Joint - Thd Fittings	56	1	44	11	Yes
Other:	**11776**	**2313**	**4903**	**4560**	Yes
Other - Unknown	250	21	185	44	Yes
Other - Misc	236	19	164	53	Yes
Other - Loose/Needs Grease (Gr 1 Leaks)	176	16	53	107	Yes
Other - Loose/Needs Grease Non-Hazardous	10452	2201	4099	4152	Yes
Overbuilds*	2335	1092	876	367	Yes

*Based on most current survey results.

Subthreats identified within the Primary Threat Categories may not be able to be broken out of the Primary Threat Category at this time as there is no specific data to break it out from the primary threat.

List of Internal and External Subject Matter Experts

Industry Subject Matter Expert on Aldyl A Pipe

Dr. Gene Palermo, President of Palermo Plastics Pipe Consulting was hired to provide a recommended protocol for Avista Assessment of Aldyl “A” and Other MDPE Pipes. Dr. Palermo provided Avista with a document on his recommended protocol for Aldyl A Pipe on March 4, 2011.

Dr. Gene Palermo received a BS degree in Chemistry from St. Thomas College in St. Paul, MN in 1969 and a Ph.D. in Analytical Chemistry from Michigan State University in 1973.
Dr. Palermo has been in the plastic piping industry for over 35 years. He worked for the DuPont Company from 1976 to 1995 in the Aldyl “A” polyethylene pipe business for natural gas distribution. Other credentials are listed in the above referenced document.

The information within this report was used to develop the Aldyl “A” portion of Avista’s Material Failure model.

Company Subject Matter Expert – General Distribution Knowledge and Historical Information – WA/ID

Linda Burger has worked for Avista Utilities since 1983. Most of those years were spent working in various positions on the natural gas side of the business which included facility design, load study analysis, gas standards maintenance and development, gas compliance and most currently gas integrity management. Linda is considered a subject matter expert on the history of Avista’s natural gas system and the types of records and information maintained by Avista in regard to their natural gas system.

Company Subject Matter Expert - General Distribution Knowledge and Historical Information – WA/ID/OR

Jody Morehouse has worked for Avista Utilities since 1989 with various positions in the gas business. She has worked as a gas engineer and as a gas operations supervisor. More recently, she has held various managerial positions for Avista in various technical areas including cathodic protection, gas planning, facility design, gas measurement, leak survey, gas emergency response, GIS, pressure control, and gas compliance.

Company Subject Matter Expert – Material Failures, Incident Investigations and Service Work – All Areas

Bill Baker has been in the natural gas business since 1970. His background experience involves construction crew work, gas and electric service related work. Bill has been involved in building codes for 30 years with different jurisdictions. Bill was Avista’s material specialist up until 2011. Bill now does field evaluations for quality assurance. Bill is also a certified fire investigator and has been involved in incident investigations on carbon monoxide poisonings, fires, and explosions. Bill has worked at Avista Utilities since 2000. Prior to that, he worked for PG&E and Suburban Propane.

Company Subject Matter Expert – General Distribution Knowledge and Asset Reliability

Kris Busko has worked for Avista Utilities since 2004. Kris has had several positions within the natural gas side of the business, including distribution design, compliance, and most recently as a natural gas asset management engineer. In Asset Management, Kris has had the opportunity to perform in-depth study of various sub-threats to Avista's distribution system and has performed reliability and life cycle analyses for several facility types. Kris is a mechanical engineer and holds a professional engineer's license in the state of Washington.

Company Subject Matter Expert – Geographical Information System and Avista's Facility Management (AFM) Database

Erika Jacobs has worked for Avista Utilities since 2007, 3 as a contractor and 2 as a company employee. She has worked with GIS the entire time and is currently a GIS Analyst. She participated in the conversion of the gas model from paper to GIS and has worked with nearly all the gas compliance activities in AFM related to GIS.

Company Subject Matter Expert – Geographical Information System

Robert Cloward has worked with Avista's digital GIS data for 14 years, utilizing ESRI GIS technology and has a total GIS expertise of 16 years. Robert holds a BS in Computer Information Systems (CIS), a GIS Certificate, and is registered as a GIS professional (GISP) with the GIS Certification Institute. As a Senior GIS analyst, Robert develops, maintains, and supports, GIS based electric and gas facility; develops tools for and performs engineering, environmental, and spatial analysis; conducts research and develops working prototype applications for proof of concepts for GIS related projects utilizing latest available software and hardware technologies compatible with company enterprise systems.

Company Subject Matter Expert - Corrosion Control

Gary Douglas has been working in the field of cathodic protection since 1993. He holds a Level 4 NACE certification as a Cathodic Protection Specialist and is a Level 1 Coatings Inspector. Gary also has a senior corrosion technologist certification, a 2 year degree in electronic technician AAS and a telecommunications mastered electronics certification. Gary has worked for Avista Utilities since 2003.

DIMP Subject Matter Expert Interview Form

SME Name	Current Job Title Role	Yrs Experience	Comment(s) re: Qualification & Experience
Gary Douglas	Foreman - CP		Nace Certified

Written record

Gary and I discussed corrosion threats to Avista's gas pipeline systems.

Existing Threats = External Corrosion - Galvanic
" " - Stray Current
Atmos Corrosion

*Potential threats = Internal - Biological
Internal - Chemical

* No known failures due to internal corrosion

Describe nature of information (First Hand witness or direct experience vs. Second Hand)

information is both first hand/direct experience and second hand thru his corrosion techs

Date:	12/29/10
Interviewer Name:	Linda Burger
Interviewer Title:	Gas Integrity Management specialist
Signature of Interviewer	Linda Burger

Potential Threat Review Documentation

Date of Review	Source PHMSA Bulletin NTSB Report NTSB Recommendation Gas Association	Threat Root Cause	Is this Threat already evaluated for in the IM Program? Y / N	Date threat incorporated into Risk Evaluation (If Applicable)
As part of developm ent of plan	• PHMSA ADB-08-03 • PHMSA ADB-11-02	Natural Forces - Abnormal Snow and Ice Buildup	Yes	Prior to Aug 2, 2011
As part of developm ent of plan	PHMSA ADB-08-02	Joint Failures - Mechanical Couplings	Yes	Prior to Aug 2, 2011
As part of developm ent of plan	• PHMSA ADB-07-02 • PHMSA ADB-07-02 • PHMSA ADB-99-02 • PHMSA ADB-99-01	Material Failure - Premature Brittle Like Cracking of Aldyl A pipe (no Century pipe in system)	Yes	Prior to Aug 2, 2011
As part of developm ent of plan	PHMSA ADB-08-04	Installation of EFV	N/A	N/A
As part of developm ent of plan	PHMSA ADB-10-03	Weld Failure - Girth Weld Quality on X70 & >= 20" diameter (Avista has no pipe that meets this criteria)	N/A	N/A
As part of developm ent of plan	PHMSA ADB-09-01	Variable Yield and Tensile Strength in X70 or greater pipe diameter (Avista has no pipe that meets this criteria)	N/A	N/A
As part of developm ent of plan	PHMSA ADB-10-08	Public Awareness – Emergency Preparedness Communications	N/A	N/A
As part of developm ent of plan	PHMSA ADB-09-03	Incorrect Operations – Improper Installation	Yes	Prior to Aug 2, 2011
7/27/11	PHSMA ADB-11-0177	Damage by Flooding Natural Forces – Flooding	Yes	Prior to Aug 2, 2011
9/1/11	PHSMA ADB-11-05	Potential for Damage to Pipeline Facilities Caused by the Passage of Hurricanes	N/A	N/A

Date of Review	Source PHMSA Bulletin NTSB Report NTSB Recommendation Gas Association	Threat Root Cause	Is this Threat already evaluated for in the IM Program? Y / N	Date threat incorporated into Risk Evaluation (If Applicable)
4/2/12	PHMSA ADB-12-03	Driscopipe 8000 HDPE Pipe Material Degradation – Small Diameter Pipe	N/A	N/A
4/2/12	PHMSA ADB–2012–05	Cast Iron Pipe - conduct a comprehensive review of their cast iron distribution pipelines	N/A	N/A

Tab

APPENDIX C
EVALUATION AND RANKING OF RISK

Table 7.3-1 Risk Factors and Weightings

Weightings: High Risk: 1 to 4
Medium Risk (or contributing factor): .25 to .9
Low Risk (or contributing factor): .1 to .24
No Risk: 0
Reduced Risk: -.1 to -.9

Model	Data Type	Factor	Weighting	Source
Material Failure – Plastic Pipe • **LDIW Aldyl A Pipe** • **Slow Crack Growth** • **Aldyl A Service Tees** • **Bending Stress**	LDIW Pipe Manufacturer	DuPont Aldyl A prior to 1973 (install <=1973) & Plastic Unknown install year on => 1 1/4" diameter pipe (change to original) Century PE 1970 to 1974 PE 3306 (Swanson, Orangeburg, Yardley	3.0 x 100 (300) 3.0 x 100 (300) 3.0 x 100 (300)	Avista SME*
	Slow Crack Growth and Environmental Stress Cracking	If Manufacture year was 1974 to 1984 (install year >=1974 and <1987) & Unknown Install Year If Manufacture year was after 1986 (install year of ≥1987)	1.0 x 100 (100) 0	GTI/Avista SME*
	Squeeze Off Present	Yes < 1987 install year (clarification)	1.0 x 100 (100)	Avista SME*
	Soil in Contact with Pipe	Rocky < 1987 install year (clarification	.5 x 100 (50)	Avista SME*
	Aldyl A Service Tees	If Manufacture year was 1984 or earlier (install year < 1987 for main and < 1987 for service) at network junction (clarification)	1.0 x 100 (100)	Avista SME
	Bending Stress (External Loading/Settlement)	Steel main to plastic service on < 1987 install year at network junction (change to original)	.5 x 100 (50) Change to original	Avista SME*
	Repair Method	All repairs and null (except for replacement)	.5 x 100 (50)	Avista SME

Avista SME Effect of Weightings:
SME Factor weight of “0” has no impact on the risk
SME Factor weight of LESS than “0” will DECREASE the risk
SME Factor weight of GREATER than “0” will INCREASE the risk
Multiple all risk factors by 100
*Based on data and information from Palermo Plastics Pipe Consulting

Validated model on 6/21/11 made slight modification to parameters
Change to Material Failures Plastic model factors and weightings on 8/15/11

Model	Data Type	Factor	Weighting	Source
Material Failures Steel Pipe	Repair Method	All repairs and null (except for replacement)	.5 x 100 (50)	Avista SME
	ERW Pipe	< =1975 >1975	.5 x 100 (50) 0	Avista SME
Avista SME Effect of Weightings: SME Factor weight of “0” has no impact on the risk SME Factor weight of LESS than “0” will DECREASE the risk SME Factor weight of GREATER than “0” will INCREASE the risk Multiple all risk factors by 100				

Validated model on 6/21/11

Model	Data Type	Factor	Weighting	Source
Weld/Joint Failures	PE Joints Training & Diameter	>1998 6” coil experiencing higher failure rate < 2002 install date poor training & qualification process and >4” – stick < 2002 install date poor training & qualification process and <3” – coiled > 2002 install date OQ program implementation and 6” pipe > 2002 install date OQ program implementation	.3 x 100 (30) .2 x 100 (20) .1 x 100 (10) .1 x 100 (10) 0	Avista SME
	Steel Weld Joining Procedures	Pre-1971 install date (pre federal regulations) 1971 - 2000 install date (welding procedures) Post-2000 install date (improved welding procedures)	.5 x 100 (50) .25 x 100 (25) 0	GTI/Avista SME
	Mechanical Couplings Steel	Dresser Fittings – Un-barreled (Cat 2) Dresser Fittings – Barreled	.35 x 100 (35) 0	GTI/Avista SME
	Mechanical Couplings PE	Mechanical fittings on services (majority of plastic mech fittings are on services)	.1 x 100 (10)	GTI/Avista SME
Avista SME Effect of Weightings: SME Factor weight of “0” has no impact on the risk SME Factor weight of LESS than “0” will DECREASE the risk SME Factor weight of GREATER than “0” will INCREASE the risk Multiple all risk factors by 100				

Validated model on 6/28/11 made slight modification

Model	Data Type	Factor	Weighting	Source
Other Outside Force for Vehicular Damage and Vandalism For Meter Sets and Regulator Stations	Vehicle Protective Barriers and previous failures	AC M=’X’ AND Resolved AND OOF AC M= ‘X’ AND Not Resolved AND OOF AC M<>’X’ AND OOF AC M=’X’ AND Resolved AC M= ‘X’ AND Not Resolved	-.10 x 100 (-10) .5 x 100 (50) .75 x 100 (75) -.25 x 100 (-25) .25 x 100 (25)	Avista SME
Avista SME Effect of Weightings: SME Factor weight of “0” has no impact on the risk SME Factor weight of LESS than “0” will DECREASE the risk SME Factor weight of GREATER than “0” will INCREASE the risk Multiple all risk factors by 100				

Model validated on 7/5/11 – made slight modifications and reran model for validation

Future enhancements:

Site Security at Regulator Stations	Telemetry present No security		Avista SME/GTI
Vehicle Traffic Density	Low potential for accident Medium potential for accident High potential for accident Null		GTI Jason Ren working on this type of data as part of impermeable surfaces
Protective Barriers from Unwanted Intruders	Excellent Barriers Adequate Barriers Inadequate Barriers No Barriers		GTI Don’t capture info for this risk factor for either reg stations or meter sets

Model	Data Type	Factor	Weighting	Source
Equipment Failure of Meter Sets, Regulator Stations, Valves	Reg Sta Maintenance	Annual (CG, DR, IM, MM) 3 years (FT, OT) None	0 .25 x 100 (25) .5 x 100 (50)	Avista SME
	Valve Maintenance	Annual Secondary None	0 .25 x 100 (25) .5 x 100 (50)	Avista SME
	Type of Valve	PE plug valve Steel Plug Valve Steel Gate Valve & Ball valve Unknown or Null or Check Valve	0 .25 x 100 (25) 0 .25 x 100 (25)	Avista SME
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

Validated model on 6/28/11

Future Enhancement

Valve Failure Reason	Will not turn Key adapter failure		Avista SME
Reg Sta Regulator Overpressured	Yes No (As found pressure exceed MAOP) Need to look at what if multiple regs with different pressures in station		Avista SME Do we collect this type of data?

Model	Data Type	Factor	Weighting	Source
Incorrect Operations	Training Program for OQ and Change in Procedure/Standards Format	Install year <2001 Install year = 2001 Install year >=2002	.25 x 100 (25) 0 -.25 x 100 (-25)	Avista SME
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

Validated model on 6/28/11

Future Enhancement

Employee and Contractor Training Effectiveness	Good Fair Poor, Needs Improvement		Avista SME

Model	Data Type	Factor	Weighting	Source
Excavation Damage All Pipelines	Plastic Installation Date	Most current 20 years are higher risk for damage based on Avista's failure data	.1 x 100 (10)	Avista SME
	Diameter	Plastic Service (pipe size <1.25) Plastic Main (pipe size >=1.25) Steel Service (pipe size <1.25) Steel Main (pipe size >=1.25) *Plastic services are more at risk than steel and plastic main is more at risk than steel*	.5 x 100 (50) .25 x 100 (25) . 2 x 100 (20) .1 x 100 (10)	Avista SME
	# of damages per 1000 tickets	OR = 10.45 WA = 9.58 ID = 5.24 *Current national average 3.7* divide Avista's ratio by state by this national average and apply to all pipelines*	2.82 x 100 (282) 2.58 x 100 (258) 1.41 x 100 (1.41)	Avista SME
	Pipe in Casing & Conduit	Yes	-.25 x 100 (-25)	GTI/Avista SME
	Joint Utility Ditch	Yes	.5 x 100 (50)	Avista SME
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

*number provided by PHMSA

Validated model on 6/21/11

Model	Data Type	Factor	Weighting	Source
Natural Forces Pipelines and Regulator Stations And Meter Sets	Seismic Event and Geological Faults	Pipelines within 500 feet of a geological fault in a seismic zone that is not active (Southern Oregon, Southwest WA)	.1 x 100 (10)	GTI/Avista SME
	Flooding – Pipelines*	Pipelines mains located in a designated flood zone Not located in a designated flood zone	.1 x 100 (10) 0	GTI/Avista SME
	Flooding – reg stations*	Reg Sta in vault and located in a designated flood zone Reg Sta located in a designated flood zone Reg Sta not located in designated flood zone	.5 x 100 (50) .35 x 100 (35) 0	GTI/Avista SME
	Land Instability	Previous failure from ground movement in the area No previous failure from ground movement in the area	. 2 x 100 (20) 0	GTI/Avista SME
	Land Instability - Monitoring	Is monitoring required – yes Is monitoring required – no	.3 x 100 (30) 0	GTI/Avista SME
	Gophers	Plastic pipe 500 ft radius of a failure (gophers/moles) *Leak failure cause of Natural Forces on belowground (reduced parameters after validation review)*	. 2 x 100 (20)	Avista SME
	Snow and Ice on Meter Sets	Non-snow area Snow area *(based on Nat Forces to aboveground facilities)*	0 . 2 x 100 (20)	Avista SME
	Snow and Ice on Meter Sets	Meter set located inside or in shelter (reduces risk) Meter set located in snow and ice area	-. 2 x 100 (-20) . 2 x 100 (20)	Avista SME
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

Validated model on 6/30/11 – modification of parameters made based on review

Model	Data Type	Factor	Weighting	Source
Corrosion • **External Galvanic** • **External Stray** • **Atmos-pheric**	Soil Type for Corrosivity	Clay Loam Rocky Sand	.3 x 100 (30) . 2 x 100 (20) .1 x 100 (10) 0	Avista SME
	Previous Failure	Yes	.1 x 100 (10)	Avista SME
	Type of CP	Impressed Current Galvanic	0 .1 x 100 (10)	Avista SME
	Critical Bond present	Yes No	.1 x 100 (10) 0	Avista SME
	Coating Type	Coal Tar or Unknown (<=1972) Other (Epoxy, Xtru, FBE) (>1972)	.1 x 100 (10) -.65 x 100 (-65)	Avista SME/GTI
	Coating Condition	Good Fair Poor	0 .1 x 100 (10) .5 x 100 (50)	Avista SME
	CP on piping systems and inadequate designs of rectifier systems	<1958 install year WA & ID; <1968 OR >=1958 to 2002 WA & ID; >=1968 to 2002 OR ≥2003 (all states)	1 x 100 (100) .1 x 100 (10) 0	Avista SME
	CP Test Potentials and Exposed Pipe Reads	Good (≥.850vdc) Poor (<.850 vdc)	-.20 x 100 (-20) .1 x 100 (10)	GTI
	Isolated Steel Riser	Yes (in survey: <=1991 Plastic or >.75" Plastic) No	.25 x 100 (25) 0	
	Stray Current	Known foreign pipe crossing AVA steel	. 1 x 100 (10)	Avista SME
	Atmospheric	AC corroded AC corroded and resolved	.1 x 100 (10) 0	
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

Model Validated on 7/12/11

Future enhancement:

Stray Current	Known underground storage tanks with CP within certain distance from pipelines. (In process of acquiring this data won't have for first run of model)		Avista SME We are
Stray Current	Foreign Rectifiers within 1000 feet of pipeline (in process of acquiring wont have for first run of model)		Avista SME

Model	Data Type	Factor	Weighting	Source
Unknown Material	Unknown Material	Pipe material that is unknown	4.0 x 100 (400)	Avista SME
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

Created new model for unknown material 8/15/11

Model	Data Type	Factor	Weighting	Source
Consequences	Gas Migration	0-50 ft Pipe within 50 ft of service points which are up against a building	.25 x 100 (25)	Avista SME
	Gas Ignition Pressure	1-60 psig 61-250 psig 251-500 psig >500 psig	.1 x 100 (10) .2 x 100 (20) .3 x 100 (30) .4 x 100 (40)	Avista SME
	Excess Flow Valves	Present in service (reduces the risk)	-.90 x 100 (-90)	GTI
	High Occupancy	Business District/Buildings of Public Assembly *(used in conjunction with census data)*	.5 x 100 (50)	Avista SME
	Population Density *(census household data per sq. mile)*	0 >=1 to <100 >=100 to <500 >=500 to <1000 >=1000 to <2000 >=2000 to <5000 >=5000	0 1.1 x 100 (110) 1.2 x 100 (120) 1.3 x 100 (130) 1.4 x 100 (140) 1.5 x 100 (150) 1.6 x 100 (160)	ESRI/Avista SME
Avista SME Effect of Weightings: SME Factor weight of "0" has no impact on the risk SME Factor weight of LESS than "0" will DECREASE the risk SME Factor weight of GREATER than "0" will INCREASE the risk Multiple all risk factors by 100				

Validated model 7/12/11

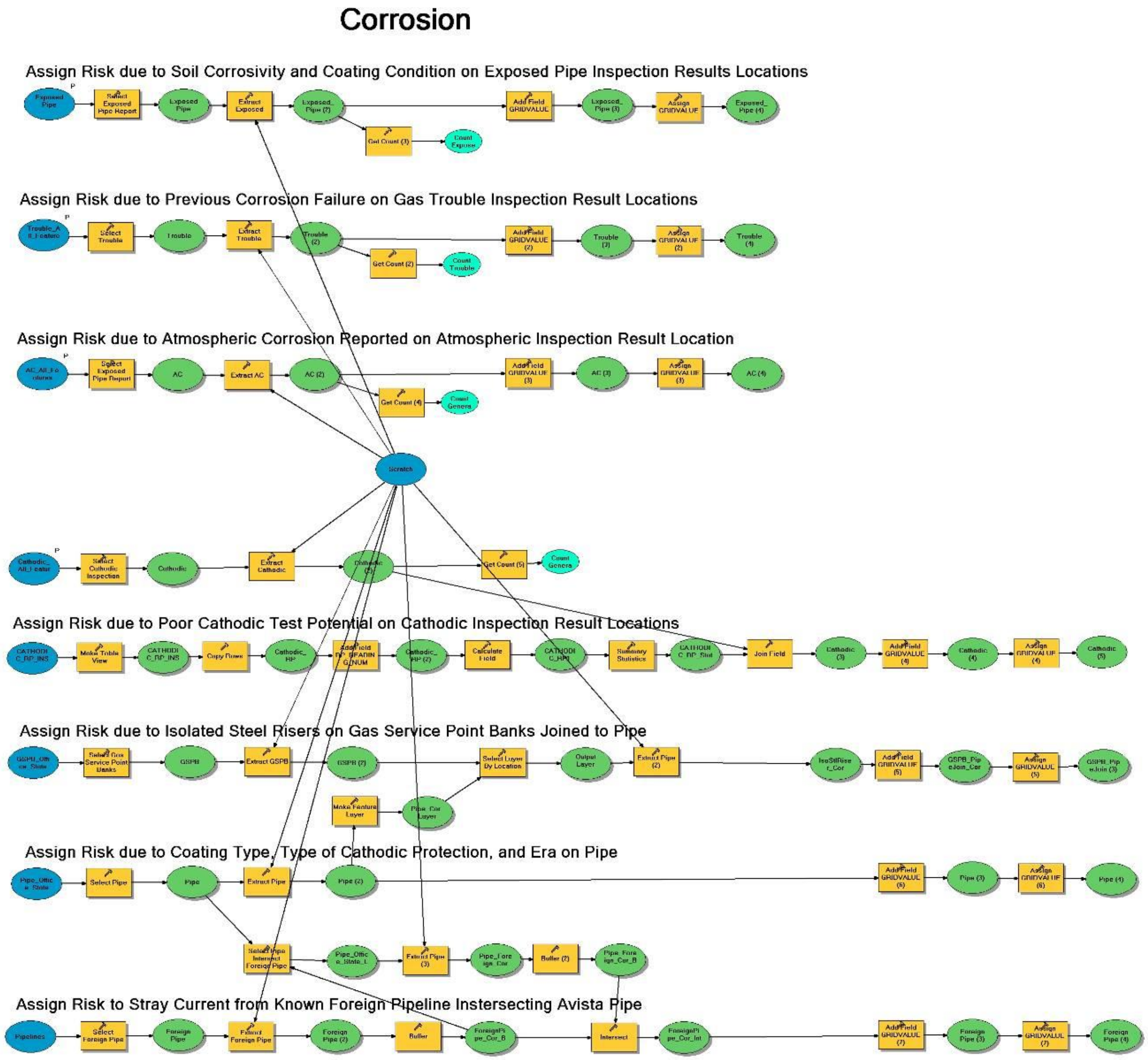
Future Enhancement:

Gas Ingress Cover	Concrete, Frozen, etc Open (Grass, Dirt, etc) Working on impermeable data Jason Ren may have for 2012 Aboveground versus Belowground		GTI No data for this factor

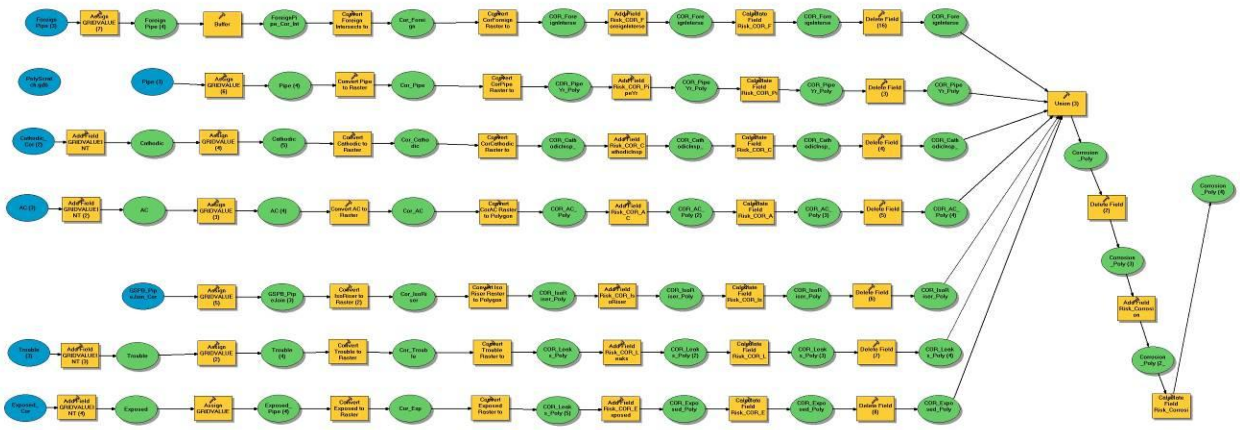
Future Enhancements – means we don't currently have the ability to model this factor:

1. *We either don't currently have the data*
2. *We are in the process of acquiring the data*
3. *It was too complicated to originally model and will take some additional time and effort to determine how to incorporate into the model*

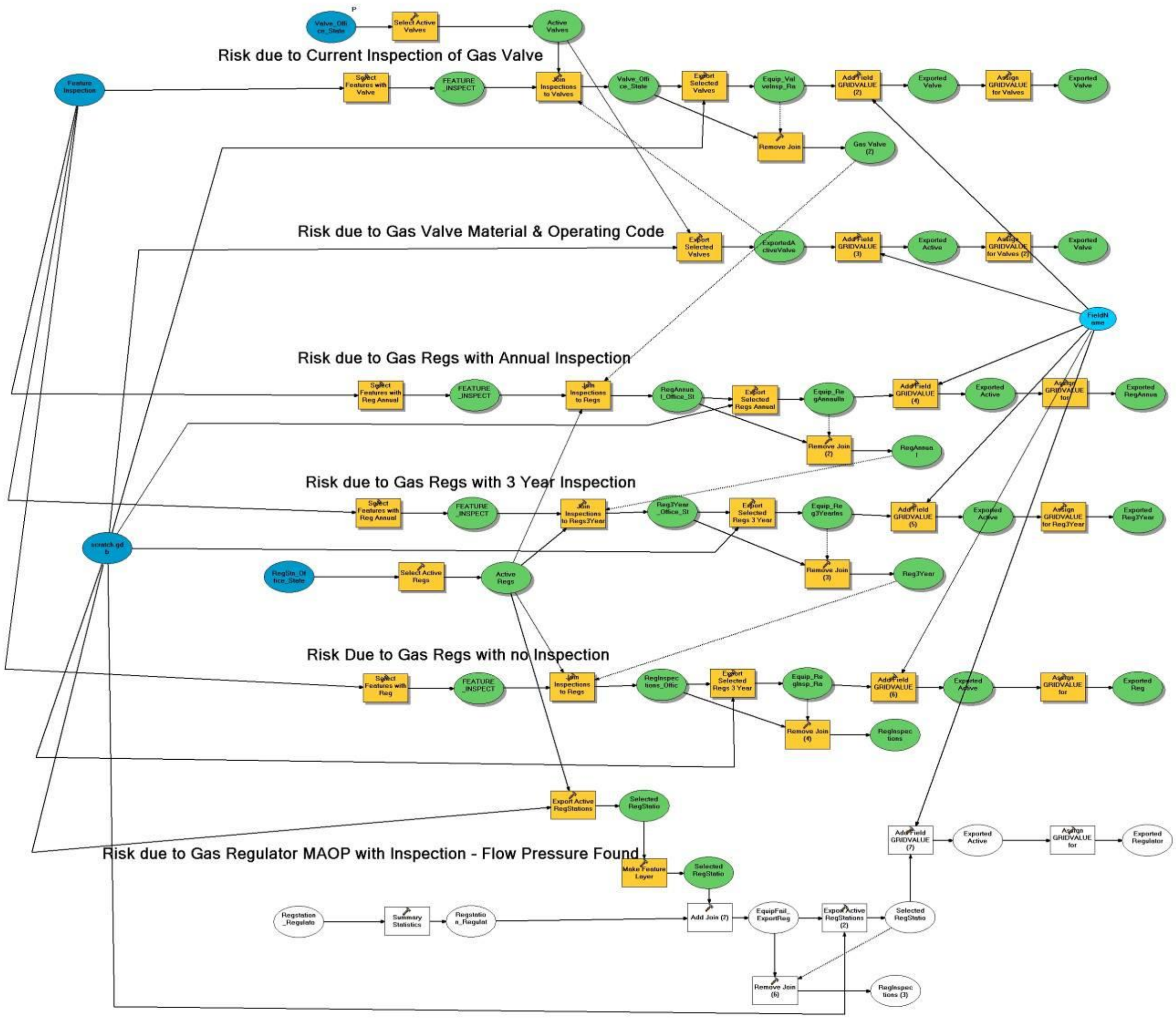
Below are diagrams of the risk models, the documentation behind the diagrams is electronically available on Avista's DIMP drive, C01m319.



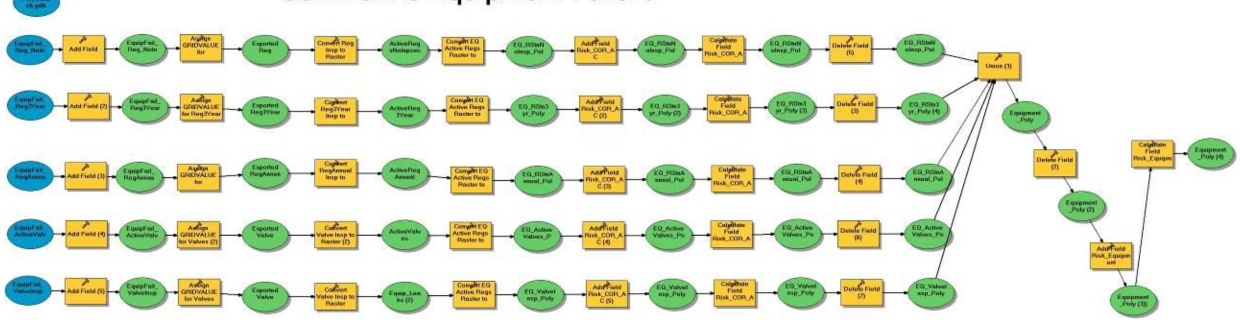
Summarize Corrosion



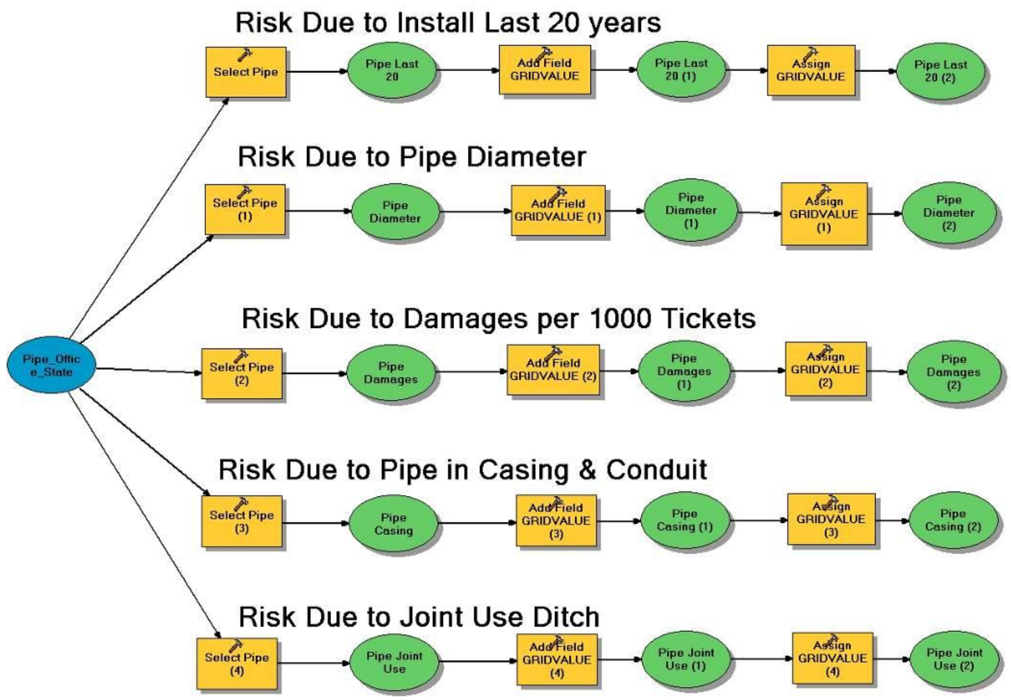
Equipment Failure

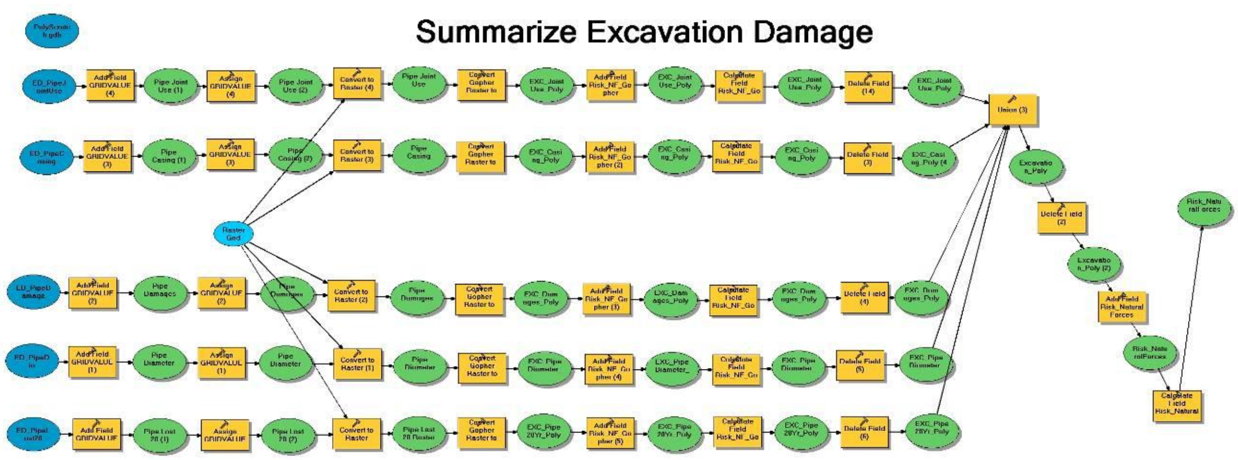


Summarize Equipment Failure

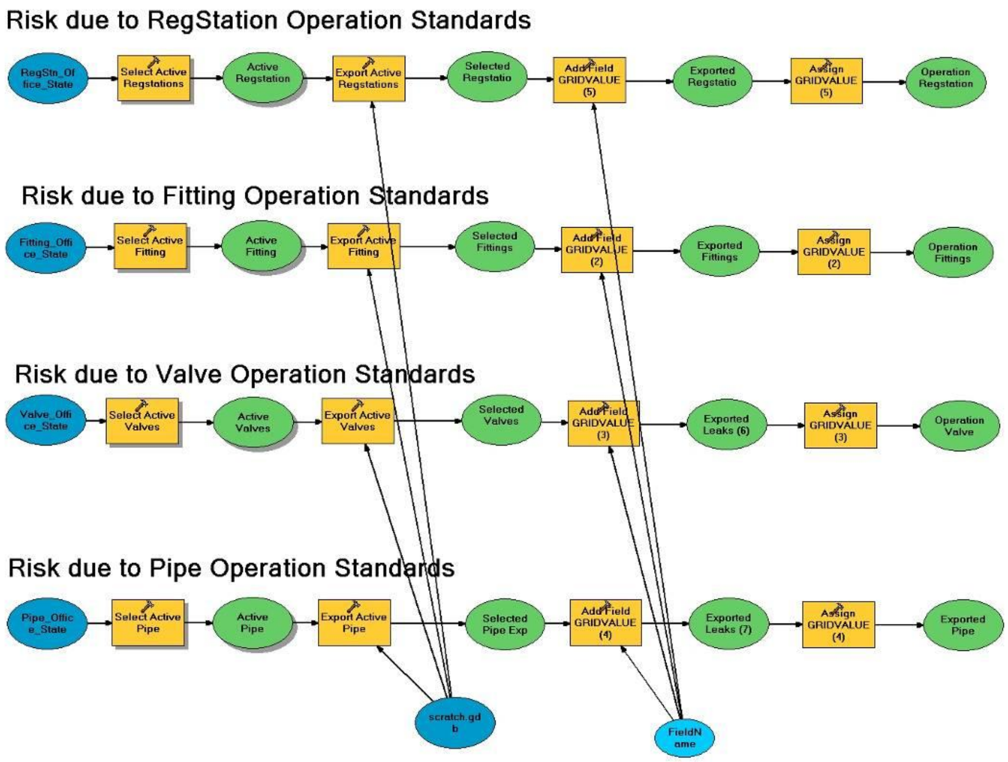


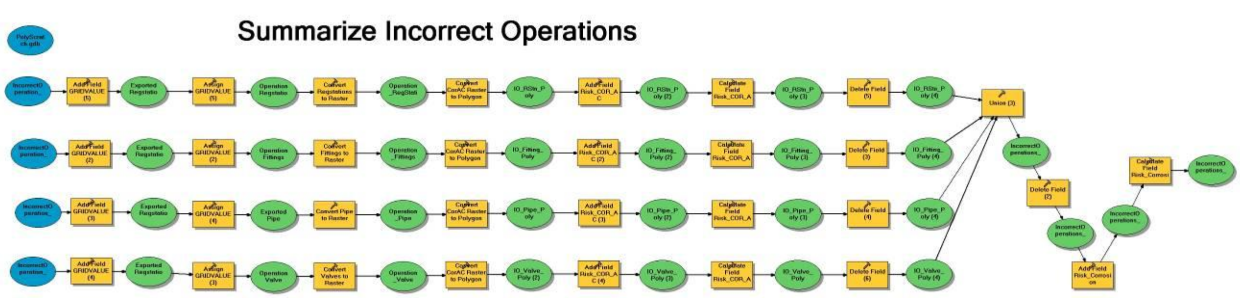
Excavation Damage



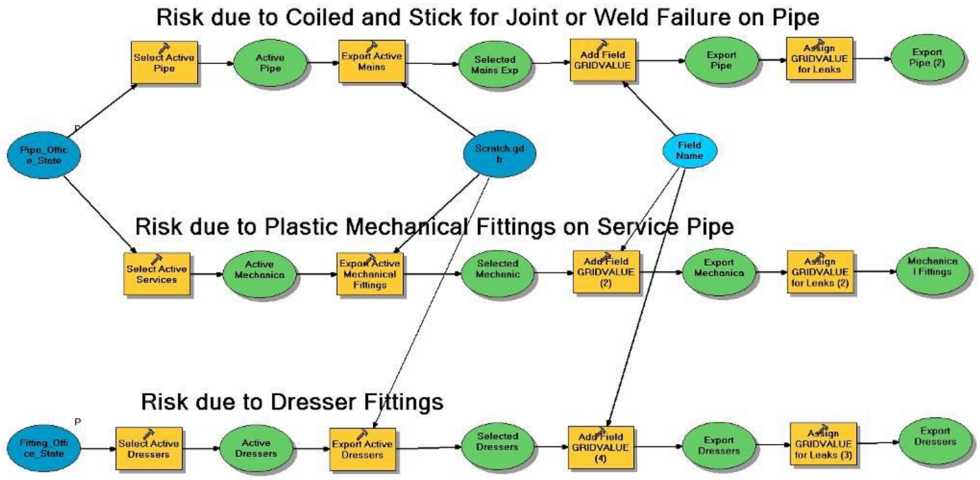


Incorrect Operation

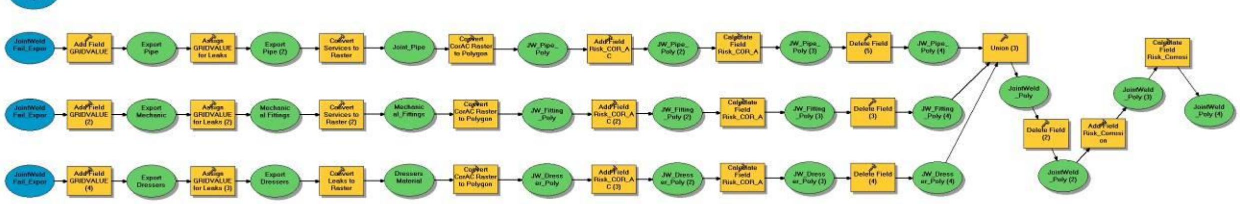




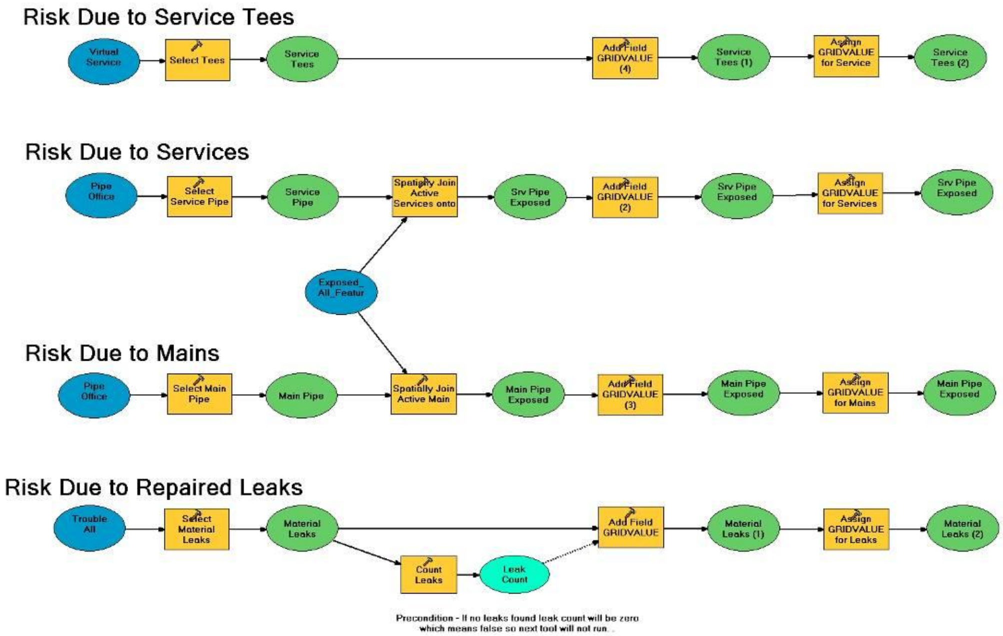
Joint or Weld Failure



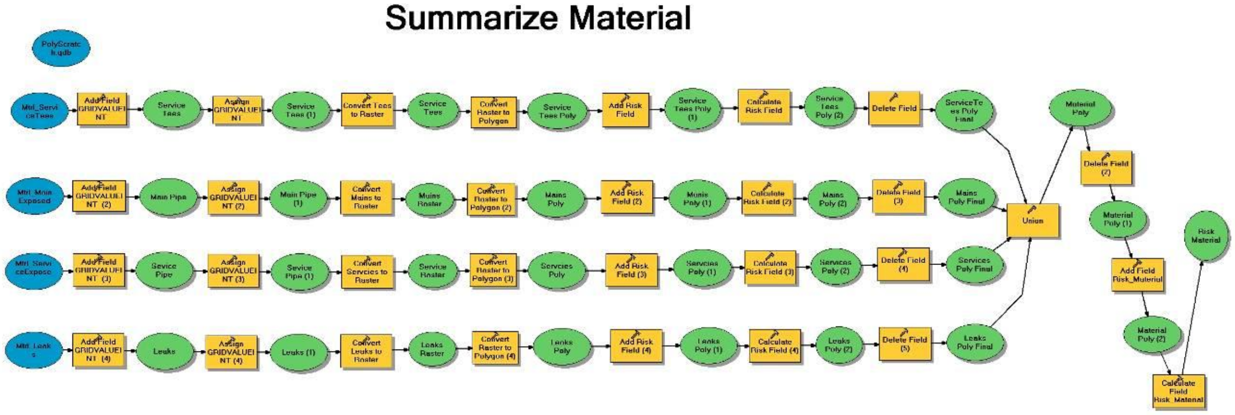
Summarize Joint Weld



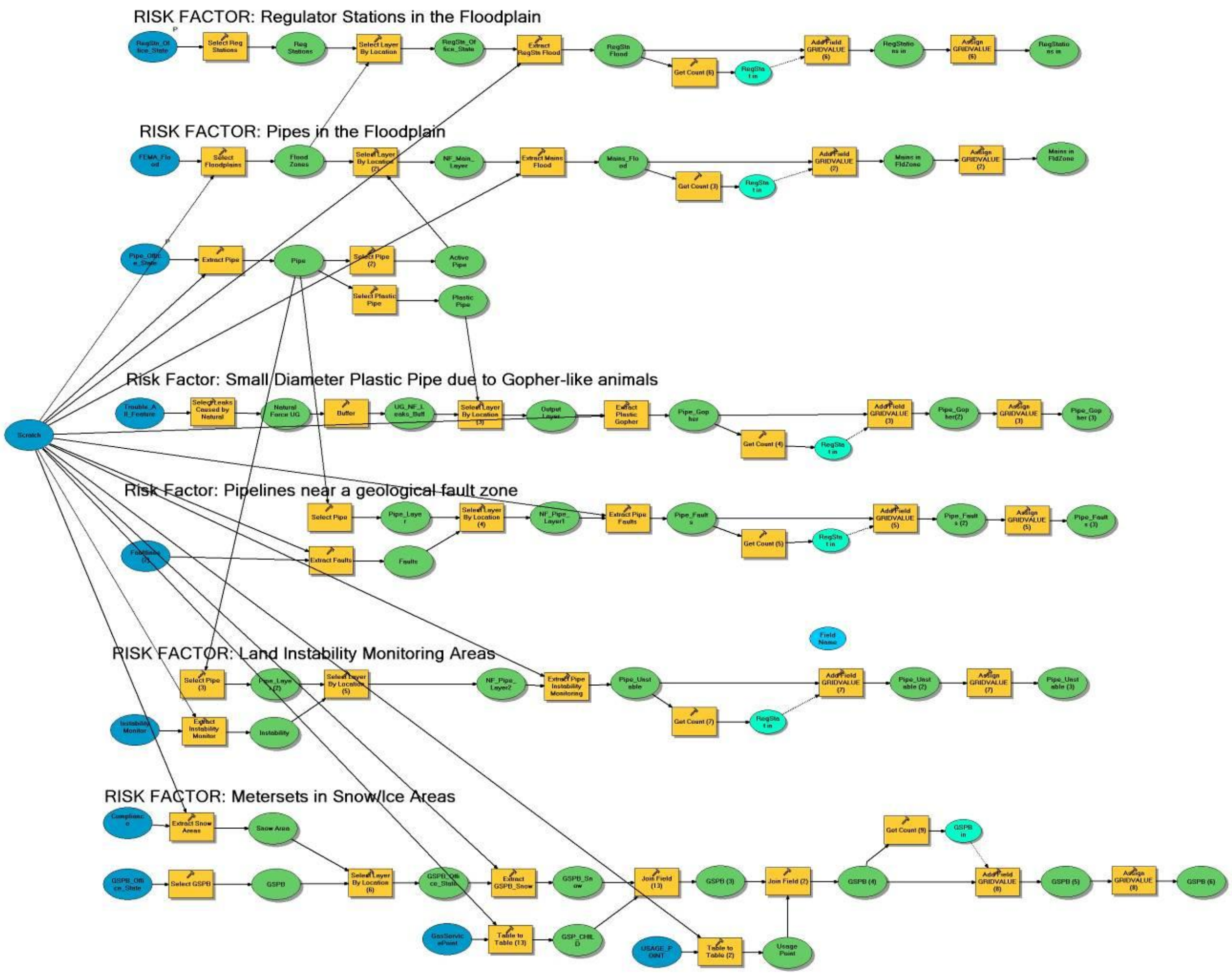
MATERIAL



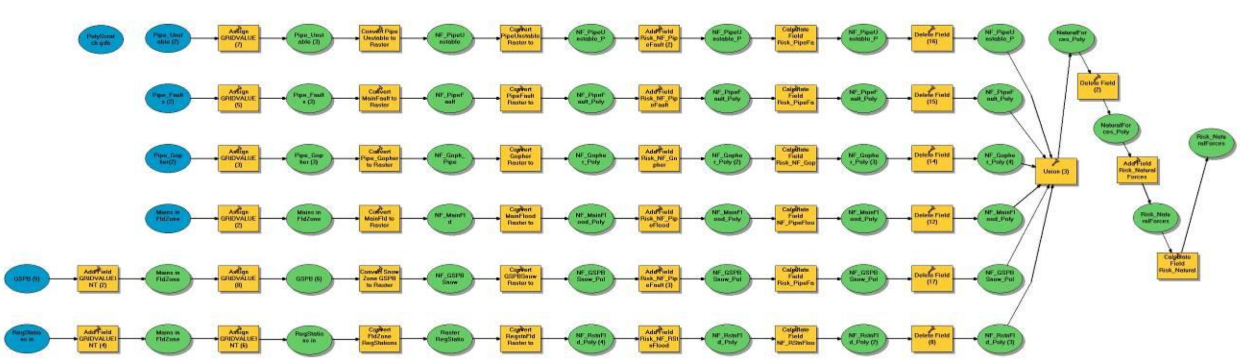
Summarize Material



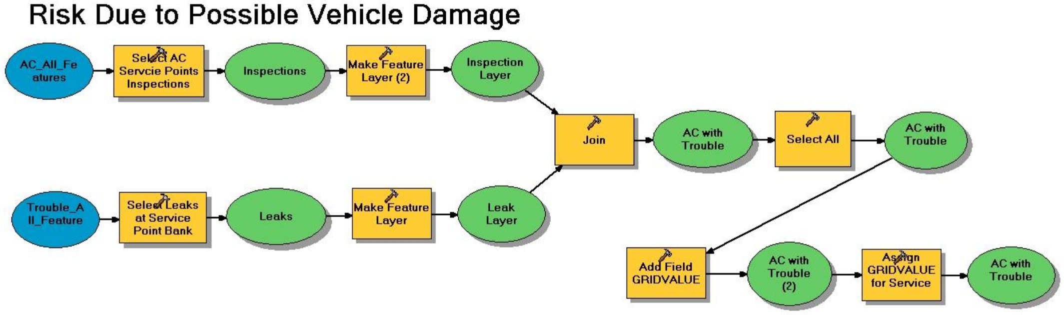
Natural Forces



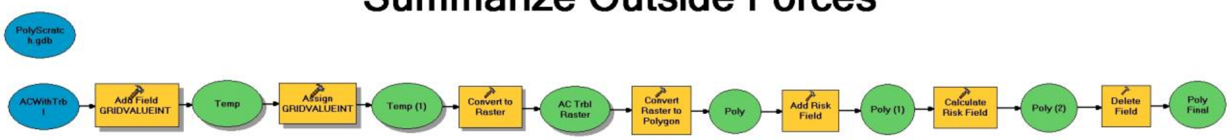
Summarize Natural Forces



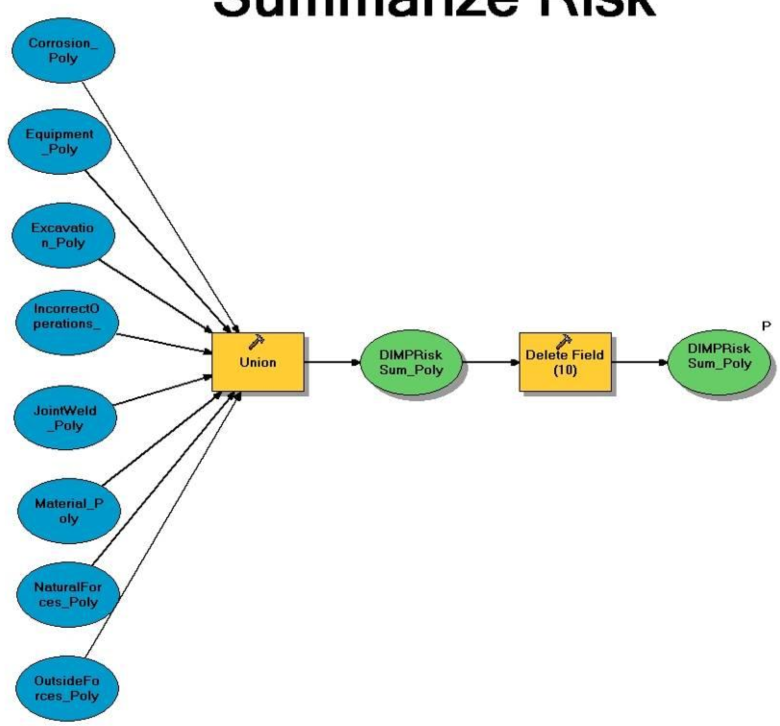
Outside Forces



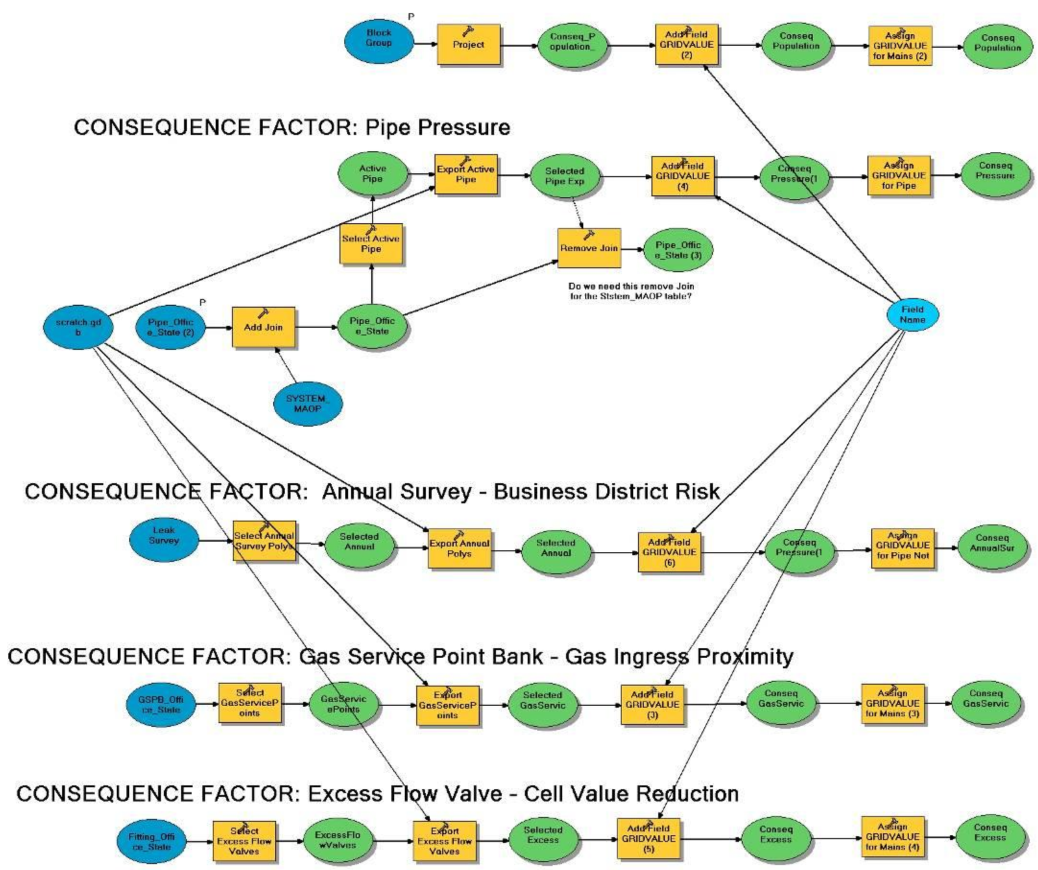
Summarize Outside Forces



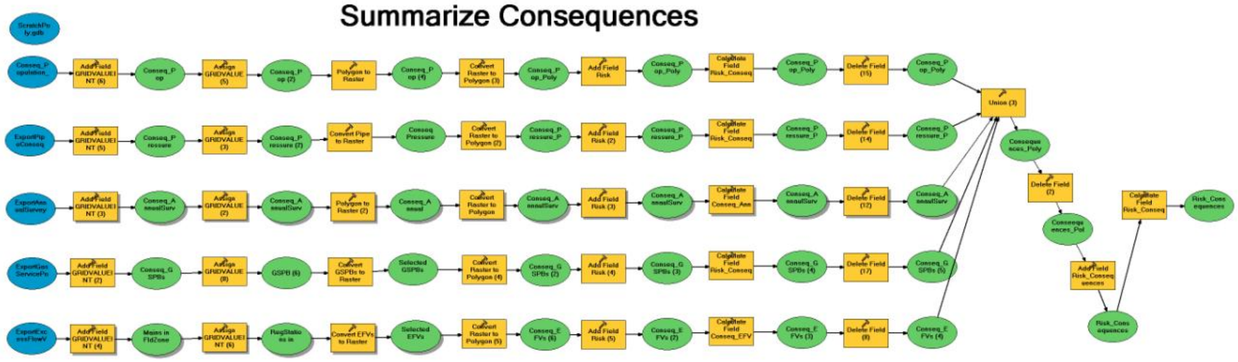
Summarize Risk



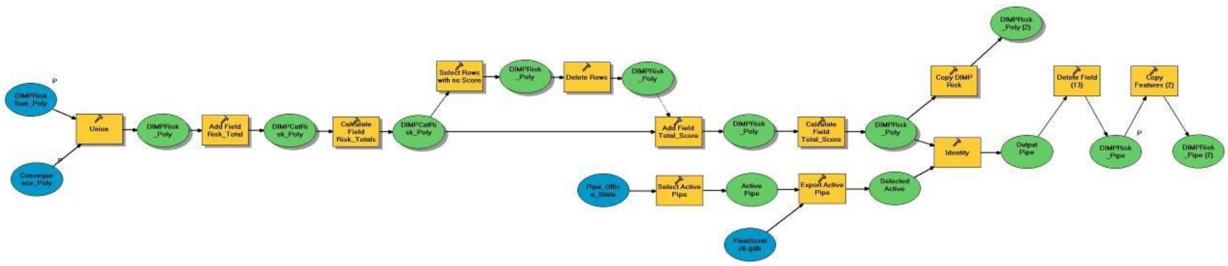
Consequences



Summarize Consequences



Total Score Unweighted



Unweighted means no additional SME weightings were applied outside the assigned risk factors and weightings

Category Corrosion

AVISTA® Utilities

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Change Management

1. Make sure changes are being tracked in this document (go to the Review ribbon and click on Track Changes). This will allow changes to be tracked and reviewed.
2. Add brief description of change to the top of the list.
3. Changes should only be accepted by someone in gas compliance.

Date	Who	Change Description
1/3/2012	Kevin F	Merged all material documents into this document and copied relevant material from model.
1/5/2012	Jake J	Edits for clarification

Overview

The corrosion risk model assigns risk to those factors that are related to corrosion. Some of the factors included in the model include soil corrosiveness, pipe coating condition, previous corrosion failures, atmospheric corrosion, poor cathodic tests, isolated steel risers, type of cathodic protection, era of pipe and stray current.

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Name	Description	Type
Pipe_Office_State	Feature class in Parameters.gdb containing all pipe.	Input
Exposed Pipe	Exposed pipe reports.	Input
Trouble_All_Features	Gas trouble inspection results. Table in Parameters.gdb	Input
AC_All_Features	Atmospheric corrosion inspection results. Table in Parameters.gdb	Input
Cathodic_all_features	Cathodic inspection results – the inspection event. Table in Parameters.gdb	Input
Cathodic_RP_Inspection_rslt	Cathodic read point inspection results – the actual read values. Table is sdeprod/efmd_cathodic_read_point.	Input
GSPB_office_state	Gas service point bank (meter location) Feature class in Parameters.gdb	Input
Pipelines	Foreign pipelines data obtained from transmission companies and loaded into: SDEADMIN.OtherFacilityDataset\SDEADMIN.Pipelines	Input
Exposed_Corr		Output
Ac_corr		Output
Trouble_corr		Output
Cathodic_corr		Output
IsolatedRiser_corr		Output
Pipe_corr		Output
Foreign_pipe_corr		Output

Assumptions

Risk due to Soil Corrosiveness and Coating Condition

Assign risk if the soil type in contact with the pipe as reported on an exposed pipe inspection is more corrosive, and also assign risk if there was not a good coating bond rating reported on an exposed pipe.

Variables:

Select Exposed Pipe Report

Select reports that are not plastic only and whose corresponding feature has not been deleted.

("DELETED_FLAG" <> 'X' OR "DELETED_FLAG" IS NULL) AND "INSPECTION_DATE" < date '2011-01-01 00:00:00' AND "INSPECTION_TYPE" <> 'CPP'

Assign Gridvalue

```
Static CalcValue as variant
Dim Score as Double

IF [SOIL_TYPE_CONTACT_PIPE] = 1 Then
  Score = 0
ElseIf [SOIL_TYPE_CONTACT_PIPE] = 2 Then
  Score = .2
ElseIf [SOIL_TYPE_CONTACT_PIPE] = 3 Then
  Score = .3
ElseIf [SOIL_TYPE_CONTACT_PIPE] = 4 Then
  Score = .1
ElseIf [SOIL_TYPE_CONTACT_PIPE] & "" = "" Then
  Score = .1
Else
  Score = 0
End If

IF [COATING_BOND_RATING] = 1 Then
  Score = Score + 0
ElseIf [COATING_BOND_RATING] = 2 Then
  Score = Score + .1
ElseIf [COATING_BOND_RATING] = 3 Then
  Score = Score + .5
Else
  Score = Score + 0
End If

CalcValue = Score
```

Risk Due to Previous Corrosion Failure

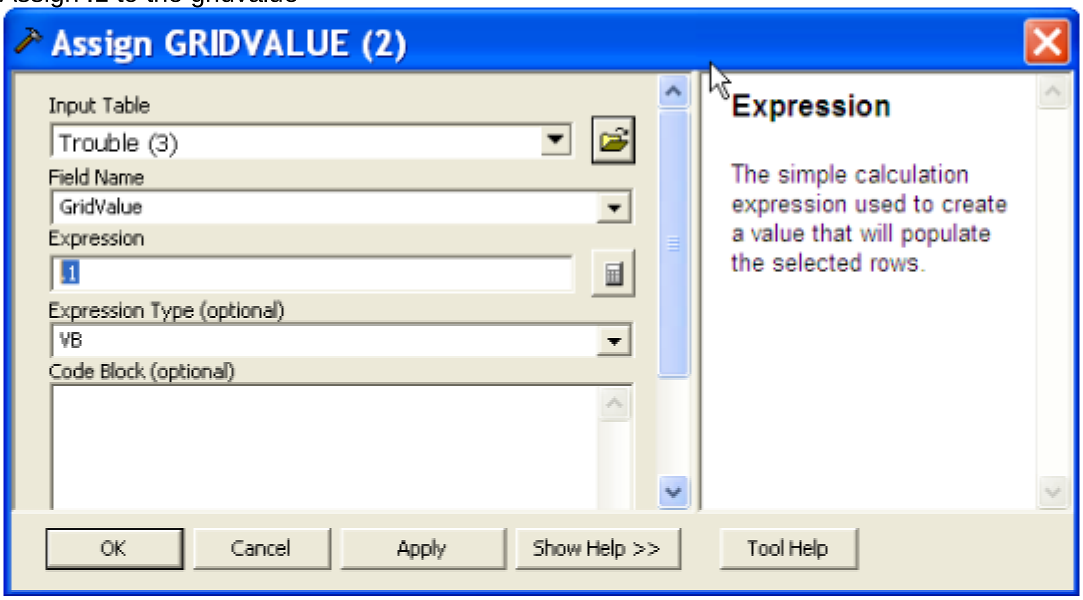
If there was a previous leak due to corrosion we assign more risk at the point of the leak.

Select Trouble

("DELETED_FLAG" <> 'X' OR "DELETED_FLAG" IS NULL) AND "INSPECTION_DATE" < date '2011-01-01 00:00:00' AND "FAILURECAUSECODE" = 1

Assign Gridvalue

Assign .1 to the gridvalue



Risk Due to Reported Atmospheric Corrosion

If corrosion was reported on an atmospheric corrosion inspection then assign more risk unless the issue was resolved.

Variables:
CORRODED_FLAG = 'Y' means corrosion was found during inspection

Select Atmospheric Corrosion Inspection Location

("DELETED_FLAG" <> 'X' OR "DELETED_FLAG" IS NULL) AND "INSPECTION_DATE" >= date '2008-01-01 00:00:00' AND "INSPECTION_DATE" < date '2011-01-01 00:00:00' AND "CORRODED_FLAG" = 'Y'

Assign Gridvalue

```
Static CalcValue as variant
Dim Score as Double

IF [ISSUE_RESOLVED_FLAG] = "Y" Then
  Score = 0
Else
 Score = 1
End If
```

CalcValue = Score

Risk Due to Poor Cathodic Test Potential

Look at the cathodic test reads taken during the test year by cathodic techs on their normal surveys and assign risk if the location experienced any low reads, defined as > -.85 VDC.

Select Cathodic Inspection

Create an extract of cathodic inspection results for certain types. These are joined back to the maximum cathodic read points.

("DELETED_FLAG" <> 'X' OR "DELETED_FLAG" IS NULL) AND "INSPECTION_DATE" >= date '2010-01-01 00:00:00' AND "INSPECTION_DATE" < date '2011-01-01 00:00:00' AND "INSPECTION_TYPE" IN ('CAA', 'CAG', 'CAL', 'CAS', 'CEM', 'CCB')

Make Table View

Extract pipe to soil cathodic inspection reads so that the maximum read can be determined. Any read that is recorded by a CP tech during normal surveys will be used, unless it is taken at a rectifier.
("DELETED_FLAG" <> 'X' OR "DELETED_FLAG" IS NULL) AND "INSPECTION_DATE" >= date '2010-01-01 00:00:00' AND "INSPECTION_DATE" < date '2011-01-01 00:00:00' AND "READ_POINT_CATEGORY" <> 'RECT' AND "READ_POINT_READING" IS NOT NULL

Convert Read Point from text to float

The cathodic read point is stored as a text field, so a new field, RP_Reading_Num is added and then converted to a float using python

```
def CalcValue(RPNum):
 try:
  return  float(RPNum)
 except:
  return -9999
```

Summary Statistics

Find the Max value of all the cathodic reads taken at a particular location throughout the year.

Assign Gridvalue

If the max value is <= -.85, then we know that all reads taken at the location are good. Also assign some risk if the location is a known critical bond.

```
Static CalcValue as variant
Dim Score as Double

IF [MAX_RP_READING_NUM] < -.85 Then
  Score = -.2
Elseif [MAX_RP_READING_NUM] >= -.85 Then
  Score = 1
Else
 Score = 0
End If
```

```
IF [INSPECTION_TYPE] = "CCB" Then
 Score = Score + .1
Else
 Score = Score + 0
End If

CalcValue = Score
```

Risk Due to Isolated Steel Risers

Using the gas service point bank data joined to pipe, find all risers that are fed by plastic pipe installed before 1992 or where the service pipe is larger than ¾". These have been determined to be the most likely candidates for steel risers.

Select Pipe

This includes Steel pipe because this select is also being used in the Foreign Pipeline strand of the model. The Assign Gridvalue only assigns risk on Plastic.

```
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01' and
"MATERIALCODE" IN ( 'PL', 'ST')
```

Assign Gridvalue

```
Static CalcValue as variant
Dim Score as Double

IF [SIZENUMBER] > .75 AND [MATERIALCODE] <> "ST" Then
  Score = .25
ElseIf YEAR( [INSTALLDATE] ) <= 1991 AND [MATERIALCODE] <> "ST" Then
  Score = .25
Else
  Score = 0
End If

CalcValue = Score
```

Risk Due to Coating Type and ERA of pipe

Find steel pipes that were installed before CP was used (varies by area) and assign additional risk. Also assign a small amount of risk for pipes installed before the current Avista CP program was in place. Additionally, assign some risk if the pipe is in a galvanic system and adjust the risk for coating type using 1972 as the indicator for coal tar.

Select Pipe

```
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01' and
"MATERIALCODE" IN ( 'PL', 'ST')
```

Assign Gridvalue

```
Static CalcValue as variant
Dim Score as Double

IF [MATERIALCODE] <> "PL" Then
 Select Case [STATE_ABBR]
  Case "OR"
   IF YEAR( [INSTALLDATE])  < 1968 Then
    Score = 1
   ElseIf YEAR( [INSTALLDATE])  <= 2002 Then
    Score = .1
   Else
    Score = 0
   End If

  Case "WA", "ID"
   IF YEAR( [INSTALLDATE])  < 1958 Then
     Score = 1
   ElseIf YEAR( [INSTALLDATE])  <= 2002 Then
    Score = .1
   Else
    Score = 0
   End If

  Case Else

 End Select

 IF [CathodicType] = "GALV" Then
   Score = Score +  .1

  Else
   Score = Score + 0

 End If

 IF YEAR( [INSTALLDATE])  <=1972 Then
    Score = Score + .1

 Else
    Score = Score + -.65
 End If

End If

CalcValue = Score
```

Risk Due to Stray Current

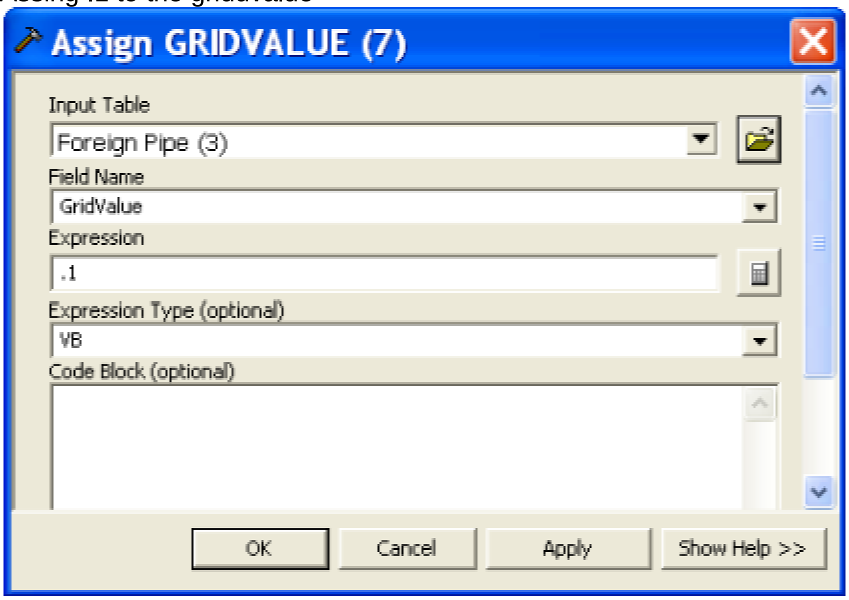
Assign additional risk if there is any foreign pipe within one foot of Avista pipe.

Select Foreign Pipe

"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01' and "MATERIALCODE" IN ('PL', 'ST')

Assign Gridvalue

Assing .1 to the griddvalue



Future Improvements:

Should Casings be included when looking for places with low cathodic reads? Is there a concern with the casing read except in reference to the 100mV separation needed with the Pipe?
Also, off reads are going to start to be taken in 2011 and will be heavily used in 2012. Will this method still be useful?

Want to split out the different risks that are currently sandwiched in one “Assign Grid Value” so they can be seen separately. For example, coating and type of protection and era of pipe.

Appendix

Code Table Values:

INSPECTION_TYPE

EFMD_INSPECTION_TYPE	
INSPECTION_TYPE	INSPECTION_TYPE_NAME
CAA	Cathodic Annual
CAR	Cathodic Rectifier

EFMD_INSPECTION_TYPE	
INSPECTION_TYPE	**INSPECTION_TYPE_NAME**
CCB	Cathodic Critical Bond
CEP	Exposed Steel Piping
CZF	Isolated Steel Survey Follow-up
CZJ	Riser Replacement Job
CAG	Isolated Main >= 100 ft
CAS	Cathodic Casing
CAL	Cathodic Isol Main < 100 ft & Isol Svcs
CEM	End Of Main
CPP	Exposed Plastic Piping
CSP	Exposed Steel/Plastic Piping
CZL	Isolated Steel Survey Monitor
CZS	Isolated Steel Survey

SOIL_TYPE_CONTACT_PIPE

EFMD_EXPOSED_PIPE_SOIL_TYPE		
SOIL_TYPE	**SOIL_TYPE_DESC**	
1	Sand	
2	Loam	
3	Clay/Bentonite	
4	Rocky (Obsolete - Do Not Use)	Used in 2010
5	Concrete/Grout	
6	Control Density Fill (CDF)	
7	Other	
8	Rocky (smaller 3/4")	Not used in 2010
9	Rocky (larger 3/4")	Not used in 2010

MATERIALCODE

- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

Category Equipment Failure

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REGULATOR STATION IS A POINT FEATURE CLASS WHICH REFERENCES A TABLE TO INDICATE THE INSPECTION INTERVAL OF A REGULATOR. THE INSPECTION INTERVAL OF A GAS VALVE HAS A DIRECT IMPACT ON THE RISK OF FAILURE. 6
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3. Changes should only be accepted by someone in gas compliance.

Date	Who	Ver	Change Description
01/08/2011	Robert Cloward	.4	Merged all equipment failure documents into this document.
4/4/2012	Linda Burger	.5	Linda Burger added some additional information in the Future Enhancements area to this document.

Overview

Equipment failure is defined as the risk of system failure due to an improperly functioning, operable gas system component.

Risk factors are those factors identified by the utility as indicators of the likelihood of system failure due to equipment failure. For the category Equipment Failure, examples of risk factors are

- Risk of gas valve failure, as indicated by uninspected valves
- Risk of gas valve failure, as indicated by valve operation and material code
- Risk of Regulator failure, as indicated by Regulator annual inspection
- Risk of Regulator failure, as indicated by Regulator 3 year inspections (single service farm taps)
- Risk of Regulator failure, as indicated by uninspected Regulators

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

Type	Name	Description
Input	Valve_Office_State	Valve feature class in parameters.gdb
Input	RegStn_Office_State	Regulator stations feature class in parameters.gdb
Input	Feature_Inspection_Type	Leak data for each feature
Output	EquipFail_ValveInsp_Raw	Intermediate data (Risk of a valve based on inspection)
Output	EquipFail_Active_Valves	Intermediate data (Risk of valve by operation and material code)
Output	EquipFail_RegAnnual_Insp_Raw	Intermediate data (Risk of a Reg for an annual inspection)
Output	EquipFail_Reg3Year_Insp_Raw	Intermediate data (Risk of a Reg for a 3 year inspection)
Output	EquipFail_Reg_NoInsp_Raw	Intermediate data (Risk of a Reg for no inspection)

Assumptions

Risk Due to Valves

Valves is a point feature class which references a table to indicate the inspection interval of a valve. The inspection interval of a gas Valve has a direct impact on the risk of failure.

Select Active Valves

8-2-2011
"INSERVICEFLAG" = 1 And InstallDate < date '2011-01-01'

Select Features with Valve Inspection Cycles

8-2-2011
"FEATURE_TYPE_ID" = 602 AND "INSPECTION_TYPE" = 'VAM'

Assign Gridvalue for Valves

8-2-2011
```
Static CalcValue as variant
Dim Score as Double
Select Case [USAGECODE]
  Case "S", "C"
    If  [FEATURE_INSPECTION_TYPE_Tabl_TARGET_INSPECTION_DATE] & "" = "" Then
       Score = .5
    Else
       Score = .25
    End If
  Case Else
    If  [FEATURE_INSPECTION_TYPE_Tabl_TARGET_INSPECTION_DATE] & "" = "" Then
       Score = .5
    Else
       Score = 0
    End If
End Select

CalcValue = Score
```

Risk Due to Material and Operation Code

Valves is a point feature class which has an attribute defining the type of material and operating code from which the gas valve point is constructed. The Material and Operating Code of a gas Valve have a direct impact on the risk of failure of a Gas Valve.

Select Active Valves

8-2-2011
"INSERVICEFLAG" = 1 And "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Valve Material & Operation Code

8-2-2011
```
Static CalcValue as variant
Dim Score as Double
Select Case [MATERIALCLASSIFICATION]
  Case "PL"
       Score = 0
  Case "ST"
       If [OPERATINGTYPECODE]  = "PG" Then
          Score = .25
       ElseIf [OPERATINGTYPECODE]  = "GA" Then
          Score = 0
       ElseIf [OPERATINGTYPECODE]  = "BA" Then
          Score = 0
       ElseIf [OPERATINGTYPECODE]  = "CK" Then
          Score = .25
```

```
        Else
           Score = .25
        End If
  Case Else
     Score = .25
End Select

CalcValue = Score
```

Risk Due to Regs Annual Inspections

Regulator Station is a point feature class which references a table to indicate the inspection interval of a Regulator Station. The inspection interval of a gas Regulator Station has a direct impact on the risk of failure.

Select Active Regstations

8-2-2011
"INSERVICEFLAG" = 1 And "INSTALLDATE" < date '2011-01-01'

Select Features with Reg Annual Inspection Cycles

8-2-2011
"FEATURE_TYPE_ID" = 601 AND "INSPECTION_TYPE" = 'RES'

Assign Gridvalue for Regstations

8-2-2011
Expression = 0

Risk Due to Regs 3 Year Inspections

Regulator Station is a point feature class which references a table to indicate the inspection interval of a Farm Tap (single service). The inspection interval of a gas Farm Tap (single service) has a direct impact on the risk of failure.

Select Active Regstations

8-2-2011
"INSERVICEFLAG" = 1 And "INSTALLDATE" < date '2011-01-01'

Select Features with Reg 3 Year Inspection Cycles

8-2-2011
"FEATURE_TYPE_ID" = 601 AND "INSPECTION_TYPE" = 'RS3'

Assign Gridvalue for Regstations

8-2-2011

```
Static CalcValue as variant
Dim Score as Double
Select Case [TYPECODE]
  Case "OD"
```

```
        Score = 0
    Case Else
        Score = .1
End Select

CalcValue = Score
```

Risk Due to Regs No Inspections

Regulator Station is a point feature class which references a table to indicate the inspection interval of a Regulator Station. The inspection interval of a gas Regulator Station has a direct impact on the risk of failure.

Select Active Regstations

8-2-2011

```
"INSERVICEFLAG" = 1  And  "INSTALLDATE" < date '2011-01-01'
```

Select Features with Reg No Inspection Cycles

8-2-2011

```
"FEATURE_TYPE_ID" = 601 AND "INSPECTION_TYPE" IN ( 'RES', 'RS3')
```

Assign Gridvalue for Regstations

8-2-2011

```
Static CalcValue as variant
Dim Score as Double
Select Case [TYPECODE]
   Case "OD"
        Score = 0
    Case Else
        Score = .5
End Select

CalcValue = Score
```

Future Improvements:

Risk due to Gas Regulator MAOP with Inspection - Flow Pressure Found. Need to expand to service regulators, service valves and meters. Need to apply leaks data to facilities.

Appendix

Code Table Values:

MATERIALCODE

- PL = Plastic
- ST = Steel

UN = Unknown
UK = Unknown

UACLASSODE

MH – Main high pressure
MI – Main intermediate pressure
SI – Service intermediate pressure
SH – Service high pressure

TRANSMISSIONFLAG

1 – Pipe is transmission
0 – Pipe is not transmission

Category Excavation Damage

AVISTA® Utilities

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Change Management

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2. Add brief a description of the change to the top of the list.
3. Changes should only be approved by someone in gas compliance.

Date	Who	Ver	Change Description
8/15/2011	Kevin F	.1	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents from 2010 where merged into this document and updated with the latest changes and risk factors.
01/17/2012	Jake J	.2	Corrected some descriptions of risk values and minor edits for clarification.

Overview

At Avista, excavation damage causes more leaks than any other threat category. This model assigns risk of excavation damage for the following factors:

- Pipe installed in the last 20 years
- Pipe diameter
- Damages per 1000 tickets
- Casing and conduit
- Joint use ditch.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Type	Name	Description
Input	Pipe_Office_State	Feature class found in Parameters.gdb containing all pipe segments.
Output	Pipe Last 20	Pipe installed in last 20 years. Intermediate data used as input to summary model.
Output	Pipe Diameter	Intermediate data used as input to summary model.
Output	Pipe Damages	Intermediate data used as input to summary model.
Output	Pipe casing	Intermediate data used as input to summary model.
Output	Pipe Joint Use	Intermediate data used as input to summary model.

Assumptions

Risk Due to Pipe Installed in Last 20 Years

If pipe was installed during the last 20 years we assume there is risk due to excavation damage. Past experience has shown that there is more excavation due to new construction or changes that need to be made after the pipe is installed.

Variables:

Select Pipe

"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and ("INSTALLDATE" > date '1990-12-31' and "INSTALLDATE" < date '2011-01-01')

Assign Gridvalue

```
Static CalcValue As Double
Dim Score As Double

Score = .1

CalcValue = Score
```

Risk Due to Pipe Diameter

Based on locations of previously reported leaks and on the fact that plastic pipe more easily leaks when contacted by outside digging, we assign higher risk to service pipe and to plastic pipe.

Select Pipe

"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01'

Assign Gridvalue

```
Static CalcValue As Double
Dim Score As Double

If [SIZENUMBER] < 1.25  Then
   If [MATERIALCODE] = "PL" Then
      Score = 0.5
   ElseIf [MATERIALCODE] = "ST" Then
      Score = 0.2
   Else
      Score = 0.5
   End If
Else
   If [MATERIALCODE] = "PL" Then
      Score =  .25
   ElseIf [MATERIALCODE] = "ST" Then
      Score = 0.1
   Else
      Score = .25
   End If
End If

CalcValue = Score
```

Risk Due to Damages per 1000 Tickets

Some states have a higher number of damages per 1000 one call tickets so additional risk is assigned.

Select Pipe

"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01'

Assign Gridvalue

```
Static CalcValue As Double
Dim Score As Double

If [STATE_ABBR] = "OR" Then
   Score = 2.82
ElseIf [STATE_ABBR] = "WA" Then
   Score = 2.58
ElseIf [STATE_ABBR] = "ID" Then
   Score = 1.41
Else
   Score = 2.82
End If

CalcValue = Score
```

Risk Due to Pipe in Casing and Conduit

If pipe is enclosed in casing or conduit, it is assigned a negative risk because it is protected from excavation damage.

Select Pipe

("DOTCASINGFLAG" = 1 or "CASINGDETAILFLAG" = 1) and "INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01'

Assign Gridvalue

```
Static CalcValue As Double
Dim Score As Double

Score = -.25

CalcValue = Score
```

Risk Due to Joint Use Ditch

If the ditch is joint use then more risk is assigned since there are multiple facilities in the ditch and possibly multiple companies maintaining the facilities.

Select Pipe

"JOINTUSEFLAG" = 1 and "INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01'

Assign Gridvalue

Static CalcValue As Double
Dim Score As Double

Score = .5

CalcValue = Score

Future Improvements:

- We need to make sure that above ground pipe is not included.
- Refine the risk measured by damages per 1000 locates so that it is not only on a state-wide level.

Appendix

Code Table Values:

INSERVICEFLAG = 1 means the pipe is being used.

TRANSMISSIONFLAG
  1 – Pipe is transmission
  0 – Pipe is not transmission

DOTCASINGFLAG

MATERIALCODE
  PL = Plastic
  ST = Steel
  UN = Unknown
  UK = Unknown

Incorrect Operation

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Date	Who	Ver	Change Description
8/19/2011	Robert Cloward	1.0	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents form 2010 where merged into this document and updated with the latest changes and risk factors.. Unknown pipe was also removed from select tool.
1/9/2011	Robert Cloward	.2	Document cleanup and verification.

Overview

Incorrect operation is defined as the risk of system failure due to a human action resulting in a change in the standard state of operation. This change in state of operation results in failure of the gas system.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

Type	Name	Description
Input	Pipe_Office_State	Feature class found in Parameters.gdb containing all pipe segments.
Input	Fitting_Office_State	Feature class found in Parameters.gdb containing all gas pipe fittings.
Input	Valve_Office_State	Feature class found in Parameters.gdb containing all valves.
Input	RegStn_Office_State	Feature class found in Parameters.gdb containing all regulator stations..
Output	IncorrectOperation_ExportPipe	Intermediate data used as input to summary model.
Output	IncorrectOperation_ExportFitting	Intermediate data used as input to summary model.
Output	IncorrectOperation_ExportValves	Intermediate data used as input to summary model.
Output	IncorrectOperation_ExportRegstations	Intermediate data used as input to summary model.

Assumptions

Risk Due to RegStation Operation Standards

Regulator Stations are a point feature class which has an attribute defining the install date from which the gas Regulator Station was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active RegStations

8-2-2011
"INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for RegStations

8-2-2011
Static CalcValue as variant

Dim Score as Double
If Year([InstallDate]) < 2001 Then

```
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Risk Due to Fitting Operation Standards

Fittings are a point feature class which has an attribute defining the install date from which the gas Fitting was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active Fittings

8-2-2011
"INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Fittings

8-2-2011

```
Static CalcValue as variant

Dim Score as Double
If Year([InstallDate]) < 2001 Then
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Risk Due to Valve Operation Standards

Valves are a point feature class which has an attribute defining the install date from which the gas Valve was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active Valves

8-2-2011
"INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Valves

8-2-2011

```
Static CalcValue as variant
```

```
Dim Score as Double
If Year([InstallDate]) < 2001 Then
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Risk Due to Pipe Operation Standards

Pipes are a line feature class which has an attribute defining the install date from which the gas Pipe was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active Pipe

8-19-2011
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 AND "MATERIALCODE" NOT IN ('UK', 'UN') and "INSTALLDATE" < date '2011-01-01'

8-2-2011
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Pipe

8-2-2011

```
Static CalcValue as variant

Dim Score as Double
If Year([InstallDate]) < 2001 Then
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Future Improvements

1. Email from Linda on 4/12/2012 - Rename risk_cor_ac to risk_io_pipe in model. Also, Linda wants us to look at this since its scoring came out quite a bit above the frequency of failure.

Appendix

Code Table Values:

MATERIALCODE

- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

UACLASSODE

- MH – Main high pressure
- MI – Main intermediate pressure
- SI – Service intermediate pressure
- SH – Service high pressure

TRANSMISSIONFLAG

- 1 – Pipe is transmission
- 0 – Pipe is not transmission

Incorrect Operation

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ASSIGN GRIDVALUE FOR FITTINGS ... 5

RISK DUE TO VALVE OPERATION STANDARDS ... 5

SELECT ACTIVE VALVES ... 5
ASSIGN GRIDVALUE FOR VALVES ... 5

RISK DUE TO PIPE OPERATION STANDARDS ... 6

SELECT ACTIVE PIPE ... 6
ASSIGN GRIDVALUE FOR PIPE ... 6

FUTURE IMPROVEMENTS ... 6

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1/9/2011	Robert Cloward	.2	Document cleanup and verification.

Overview

Incorrect operation is defined as the risk of system failure due to a human action resulting in a change in the standard state of operation. This change in state of operation results in failure of the gas system.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

Type	Name	Description
Input	Pipe_Office_State	Feature class found in Parameters.gdb containing all pipe segments.
Input	Fitting_Office_State	Feature class found in Parameters.gdb containing all gas pipe fittings.
Input	Valve_Office_State	Feature class found in Parameters.gdb containing all valves.
Input	RegStn_Office_State	Feature class found in Parameters.gdb containing all regulator stations..
Output	IncorrectOperation_ExportPipe	Intermediate data used as input to summary model.
Output	IncorrectOperation_ExportFitting	Intermediate data used as input to summary model.
Output	IncorrectOperation_ExportValves	Intermediate data used as input to summary model.
Output	IncorrectOperation_ExportRegstations	Intermediate data used as input to summary model.

Assumptions

Risk Due to RegStation Operation Standards

Regulator Stations are a point feature class which has an attribute defining the install date from which the gas Regulator Station was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active RegStations

8-2-2011
"INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for RegStations

8-2-2011
Static CalcValue as variant

Dim Score as Double
If Year([InstallDate]) < 2001 Then

```
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Risk Due to Fitting Operation Standards

Fittings are a point feature class which has an attribute defining the install date from which the gas Fitting was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active Fittings

8-2-2011
"INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Fittings

8-2-2011

```
Static CalcValue as variant

Dim Score as Double
If Year([InstallDate]) < 2001 Then
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Risk Due to Valve Operation Standards

Valves are a point feature class which has an attribute defining the install date from which the gas Valve was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active Valves

8-2-2011
"INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Valves

8-2-2011

```
Static CalcValue as variant
```

```
Dim Score as Double
If Year([InstallDate]) < 2001 Then
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Risk Due to Pipe Operation Standards

Pipes are a line feature class which has an attribute defining the install date from which the gas Pipe was installed. The risk due to install date is reflective of Avista's one going effort of improving training and standards.

Select Active Pipe

8-19-2011

```
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 AND "MATERIALCODE" NOT IN ('UK', 'UN')  and
"INSTALLDATE" < date '2011-01-01'
```

8-2-2011

```
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and  "INSTALLDATE" < date '2011-01-01'
```

Assign Gridvalue for Pipe

8-2-2011

```
Static CalcValue as variant

Dim Score as Double
If Year([InstallDate]) < 2001 Then
  Score = .25
Elseif Year([InstallDate]) >= 2001 and Year([InstallDate]) < 2002 Then
  Score = 0
Elseif Year([InstallDate]) >= 2002 Then
  Score = -.25
Else
  Score = .25
End If

CalcValue =Score
```

Future Improvements

1. Email from Linda on 4/12/2012 - Rename risk_cor_ac to risk_io_pipe in model. Also, Linda wants us to look at this since its scoring came out quite a bit above the frequency of failure.

Appendix

Code Table Values:

MATERIALCODE
- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

UACLASSODE
- MH – Main high pressure
- MI – Main intermediate pressure
- SI – Service intermediate pressure
- SH – Service high pressure

TRANSMISSIONFLAG
- 1 – Pipe is transmission
- 0 – Pipe is not transmission

Category Joint Weld

AVISTA Utilities

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Change Management

1. Make sure changes are being tracked in this document (go to the Review ribbon and click on Track Changes). This will allow changes to be tracked and reviewed.
2. Add brief description of change.
3. Changes shall be approved by someone in gas compliance.

Date	Who	Ver	Change Description
8/19/2011	Robert Cloward	.1 .2	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents form 2010 where merged into this document and updated with the latest changes and risk factors. Unknown pipe was removed from model.
1-10-2012	Robert Cloward	.3	Document cleanup and verification.
4/4/2012	Linda Burger	.4	Minor document cleanup.

Overview

The joint or weld risk model is used to calculate the risk due to joint or weld failures including Dresser Fittings, Service Pipe, and Main Pipe.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

Type	Name	Description
Input	Pipe_Office_State	Feature class found in Parameters.gdb containing all pipe segments.
Input	Fitting_Office_State	Feature class found in Parameters.gdb containing all pipe fittings.
Output	JointWeldFail_ExportPipe	Intermediate data used as input to summary model.
Output	JointWeldFail_ExportServicesMechanicalFittings	Intermediate data used as input to summary model.
Output	JointWeldFail_ExportDressers	Intermediate data used as input to summary model.

Assumptions

Risk Due to Service Pipe

Services are a line feature class which has an attribute defining the type of material, install date, and size from which the gas pipe segment is constructed. The data in this model was configured for did not have a populated "Coating Type" attribute. Therefore DIMP has compiled a vintage table to determine in finer detail the Material and Coating Type if required in the model.

Select Service Pipe

8-19-2011
"MATERIALCODE" = 'PL' and "SIZENUMBER" <= .75 and "INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 AND "MATERIALCODE" NOT IN ('UK', 'UN') and "INSTALLDATE" < date '2011-01-01'

8-2-2011
"MATERIALCODE" = 'PL' and "SIZENUMBER" <= .75 and "INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Service Pipe

8-2-2011
Expression Value = .1

Risk Due to Coiled and Stick for Joint or Weld Failure on Pipe

Pipes are a line feature class which has an attribute defining the type of material, install date, and size from which the gas pipe segment is constructed. The Material and Coating Type of a gas pipe have a direct impact on the risk of failure of a Gas Main segment. The data in this model was configured for did not have a populated "Coating Type" attribute. Therefore we have compiled a vintage table to determine in finer detail the Material and Coating Type if required in the model.

Select Main Pipe

8-19-2011
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 AND "MATERIALCODE" NOT IN ('UK', 'UN') and "INSTALLDATE" < date '2011-01-01'

8-2-2011
"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Main Pipe

8-2-2011

```
Static CalcValue As Variant
Dim Score As Double
Select Case [MaterialCode]
   Case "PL"
      If Year([InstallDate]) >= 1998 and Year([InstallDate]) <= 2010 and [SizeNumber] = 6 Then
         Score = .3
      ElseIf Year([InstallDate]) < 2002 and Year([InstallDate]) > 1930  Then
         If [SizeNumber] >= 4 Then
            Score = .2
        ElseIf [SizeNumber] < 4 and [SizeNumber] > 0 Then
            Score = .1
        Else
            Score = .2
        End If
      ElseIf Year([InstallDate]) >= 2002 Then
        Score = 0
      Else
        Score = .2
      End If
   Case "ST"
      If Year([InstallDate]) < 1971 and Year([InstallDate]) > 1930 Then
         Score = .5
      ElseIf Year([InstallDate]) >= 1971 and Year([InstallDate]) <= 2000 Then
         Score = .25
      ElseIf Year([InstallDate]) > 2000 Then
         Score = 0
      Else
         Score = .5
      End If
   Case Else
      Score = .5
```

End Select

CalcValue =Score

Risk Due to Dresser Fittings

Dresser Fittings are a point feature class which has an attribute indicating if a dresser fitting has been barreled. Majority of Avista's plastic mechanical fittings are on Services.

Select Dresser Fittings

8-2-2011
"INSERVICEFLAG" = 1 and "TYPECODE" IN ('BD', 'DP', 'DR') and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Dresser Fittings

8-2-2011

```
Static CalcValue as variant
Dim Score as Double
If [BarreledFlag] = 0 Then
        Score = .35
ElseIf [BarreledFlag] = 1 Then
        Score = 0
End If

CalcValue = Score
```

Future Improvements

Appendix

Code Table Values:

MATERIALCODE
- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

UACLASSODE
- MH – Main high pressure
- MI – Main intermediate pressure
- SI – Service intermediate pressure
- SH – Service high pressure

TRANSMISSIONFLAG

1 – Pipe is transmission
0 – Pipe is not transmission

Category Material

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Change Management

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2. Add brief description of change to the list.
3. Changes should only be approved by someone in gas compliance.

Date	Who	Ver	Change Description
8/15/2011	Kevin Farrington	.1	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents from 2010 where merged into this document and updated with the latest changes and risk factors.
01/17/2012	Jake J	.2	Minor edits for clarification

Overview

This material risk model calculates the risk due to material failure including service tees, service pipe, main pipe and leaks that were repaired without replacing the pipe.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Type	Name	Description
Input	Pipe_Office_State	Feature class found in Parameters.gdb containing all pipe segments.
Input	Virutal Service Tees	Tees are not mapped in AFM yet so this is the intersection of main and service pipe. Output feature class is produced by the Virtual Service Tee model.
Input	Trouble All Features	Leak data for each feature. Feature class found in parameters.gdb
Input	Exposed All Features	Exposed pipe report data tied to each feature. Feature class in parameters.gdb
Output	Service Tees	Intermediate data used as input to summary model
Output	Srv Pipe Exposed	Intermediate data used as input to summary model
Output	Main Pipe Exposed	Intermediate data used as input to summary model
Output	Material Leaks	Intermediate data used as input to summary model

Assumptions

- If plastic pipe installed before 1987 (< 1987) assume it is Aldyl-A.
- Pipe InstallDate is more accurate than InstallYear so it is used in the models. .

Risk Due to Service Tees

Service Tees currently don't exist in GIS and are modeled as a point feature using the Network Junctions where Main and Service intersect. The risk is due to bending stress incurred where two pipes are joined using a tee. Aldyl-A pipe teeing off of steel is susceptible to failure caused by bending stress so higher risk is assigned it. Aldyl-A pipe teeing off of Aldyl-A is also susceptible to failure caused by bending stress so higher risk is assigned it. Install year and type of material are used to identify Aldyl-A since it was plastic pipe installed before 1987.

MATERIALCODE and InstallDate is for the main pipe.
MATERIALCODE_1 and InstallDate_1 are for the service pipe.

Select Tees

"MATERIALCODE" NOT IN ('UN', 'UK') and "MATERIALCODE_1" NOT IN ('UN', 'UK')

Assign Gridvalue for Service Tees

```
Static CalcValue As Double
Dim Score As Double

If [MATERIALCODE] = "ST" And [MATERIALCODE_1] = "PL"
And Year([InstallDate_1]) < 1987Then
   Score = 0.5
ElseIf [MATERIALCODE] = "PL" And Year([InstallDate]) < 1987  And
          [MATERIALCODE_1] = "PL" And Year([InstallDate_1]) < 1987 Then

      Score = 1
Else
   Score = 0
End If

CalcValue = Score
```

Risk Due to Service Pipe

Services are a line feature class which has an attribute defining the type of material from which the gas pipe segment is constructed. The Material and Coating Type of a gas pipe have a direct impact on the risk of failure of a Gas Service segment. The data in this model was configured for did not have a populated "Coating Type" attribute. Therefore we have compiled a vintage table to determine in finer detail the Material and Coating Type.

Select Service Pipe

"UACLASSCODE" IN ('SI', 'SH', 'UK') and "INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01' and "MATERIALCODE" NOT IN ('UN', 'UK')

Spatially Join Service Pipe and Exposed Pipe Data

Since AldylA pipe is more susceptible to cracks, more risk is added if the pipe was Aldyl-A and there was a squeeze off present or the pipe is in contact with rocky soil.

Assign Gridvalue for Service Pipe

```
Static CalcValue As Double
Dim Score As Double
Select Case [MATERIALCODE]
   Case "PL"       If Year([INSTALLDATE]) <= 1973 Then
          If [SIZENUMBER] < 1.25 then
                    Score = 1
          Else
                    Score = 3
```

```
        End if
     ElseIf Year([INSTALLDATE]) > 1973 And Year([INSTALLDATE]) < 1987 Then
          Score = 1
     ElseIf Year([INSTALLDATE]) >= 1987 Then
        Score = 0
     Else
        Score = 3
     End If
   Case "ST"
     If Year([INSTALLDATE]) <= 1975 Then
        Score = .5
     ElseIf Year([INSTALLDATE]) > 1975 Then
        Score = 0
     Else
        Score = .5
     End If
   Case Else
         Score = 3
End Select

If [MATERIALCODE] <>  "ST" And Year([INSTALLDATE]) < 1987 Then
   If Ucase ([SQUEEZE_OFF_PRESENT_FLAG]) = "Y" Then
    Score = Score + 1
   End If
   If [SOIL_TYPE_CONTACT_PIPE] = "4" Then
     Score = Score + .5
   End If
End If

CalcValue = Score
```

Risk Due to Main Pipe

Mains are a line feature class which has an attribute defining the type of material from which the gas pipe segment is constructed. The Material and Coating Type of a gas pipe have a direct impact on the risk of failure of a Gas Main segment. The data in this model was configured for did not have a populated “Coating Type” attribute. Therefore we have compiled a vintage table to determine in finer detail the Material and Coating Type.

Select Main Pipe

"UACLASSCODE" IN ('MI', 'MH') and "INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 and "InstallDate" < date '2011-01-01' and “MATERIALCODE” NOT IN ('UN', 'UK')

Spatially Join Main Pipe and Exposed Pipe Data

Since Aldyl-A pipe is more susceptible to cracks, more risk is added if the pipe was Aldyl-A and there was a squeeze off present or the pipe is in contact with rocky soil.

Assign Gridvalue for Main Pipe

Refer to the Assign GridValue for Service Pipe since the same logic is used to calculate risk.

Risk Due to Leaks

If there was a material leak and the material was not replaced then assign additional risk for the leak.

Select Material Leaks

"FAILURECAUSECODE" = 10

Assign Gridvalue for Leaks

```
Static CalcValue As Double
Dim Score As Double
If [REPAIRCODE] = "R" Then
  Score = 0
Else
  Score = 0.5
End If
CalcValue = Score
```

Future Improvements:

1) Need to add Pipe Type by year table to documents.
2) Need to add Pipe Coating Table and assign risk values
3) Use a different field for each calculation rather than summing up a bunch of unrelated risks together. For example, squeeze-offs mixed in with age of steel pipe.
4) Integrate updated Aldyl-A risks from the Aldyl A risk model and any other recent research or findings on the topic.

Appendix

Code Table Values:

FAILURECAUSECODE of 10 is a leak caused by material failure.

REPAIRCODE of “R” means that the leak was repaired by replacing the material.

MATERIALCODE

- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

UACLASSODE

- MH – Main high pressure
- MI – Main intermediate pressure
- SI – Service intermediate pressure

SH – Service high pressure

TRANSMISSIONFLAG
- 1 – Pipe is transmission
- 0 – Pipe is not transmission

Category Natural Forces

AVISTA®
Utilities

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Change Management

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2. Add brief description of change.
3. Changes should only be approved by someone in gas compliance.

Date	Who	Ver	Change Description
1/3/2012	Kevin F	1.0	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents form 2010 where merged into this document and updated with the latest changes and risk factors.
1/17/2012	Jake J	1.2	Minor edits for clarity
4/4/2012	Linda Burger	.5	Added information under Assumptions and in Future Enhancements.

Overview

The natural forces risk model assigns risk to those factors that are related to natural forces. Some of the factors evaluated in this model include regulator stations in a floodplain, pipes in a floodplain, plastic pipe near gophers, pipe in geological fault zones, land instability, and metersets in snow/ice areas.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Type	Name	Description
Input	Pipe_Office_State	Feature class found in Parameters.gdb containing all pipe segments with office and state data.
Input	RegStn_office_state	Feature class found in Parameters.gdb containing all regulator stations with office and state data. .
Input	Trouble_All_Features	Gas trouble inspection results/leak data for all features. Feature class found in Parameters.gdb.
Input	FEMAFloodWAStatePlane	Floodplain data ordered from the FEMA map service center on DVD for each state where Avista has facility. The S_FLD_HAZ_AR.shp files for each state were merged and re-projected into the WA State Plane N before being used in the model.
Input	Faultlines	Fault line data. http://www.arcgis.com/home/item.html?id=223fd022e0d74fb2831b274008e87140 This map layer contains locations and information on faults and associated folds, in the United States, that are believed to be sources of significant earthquakes (those of magnitude 6 or greater) during the past 1,600,000 years. A fault is a fracture or zone of fractures in the

		Earth's crust, along which the blocks of crust have moved relative to one another; an earthquake is the result of such a movement. Folds are curves or bends in rock layers. The Quaternary Faults and Fold database contains information compiled by the Earthquake Hazards Program of the U.S. Geological Survey (USGS). The database describes faults and associated folds in the United States that are believed to be sources of earthquakes, greater than magnitude 6, in the past 1,600,000 years, and is intended to be an archive of historical (less than 150 years) and ancient earthquake sources. These data are intended for geographic display and analysis at the national level, and for large regional areas. The data should be displayed and analyzed at scales appropriate for 1:250,000-scale data. The data was downloaded from http://earthquake.usgs.gov/hazards/qfaults/ **Credits** Acknowledgment of the Quaternary Faults and Fold Database, the U.S. Geological Survey, and (or) the National Atlas of the United States of America would be appreciated in products derived from these data.
Input	ForcesPolygon	Land instability polygons.
Input	Compliance construction areas	Used to determine snow/ice areas. Table is sdeadmin/efmd_compliance_constr_area.
Input	GSPB_office_state	Gas service point banks with state and office found in parameters.gdb
Input	Gas Service Points	Child records of GSPB. Table found in the GFMDataset.gdb extract file.
Input	Usage Point	Service point data from in CSS/WMS containing meter location data. Data table is dwwppcdl.UsagePoint
Output	NF_RegStnFlood	Intermediate data used as input to summary model.
Output	NF_MainsFlood	Intermediate data used as input to summary model.
Output	NF_Pipe_Gopher	Intermediate data used as input to summary model.
Output	NF_PipeFault	Intermediate data used as input to summary model.
Output	NF_PipeUnstable	Intermediate data used as input to summary model.
Output	NF_GSPB_Snow	Intermediate data used as input to summary model.

Assumptions

Assumptions were made on the 500' impact radius for gopher damage. Also the assumption was made that pipelines that fall within 1000 feet of a fault zone are at risk.

Risk due to Regulator Stations in Floodplain

If a regulator stations falls within a flood zone assign additional risk. Even more risk is assigned if the regulator station is in a vault since it is more susceptible to prolonged water contact.

Select Reg Stations

"INSTALLDATE" < date '2011-01-01 00:00:00'

Select Floodplains

"FLD_ZONE" IN ('A', 'AE', 'AH', 'AO', 'D', 'OPEN WATER', 'V', 'VE')

Select Layer By Location
Intersect the “Select Reg Stations” with the “Select Floodplains”

Assign Gridvalue
```
Static CalcValue as variant
Dim Score as Double

IF [INVAULTFLAG] = 1 Then
  Score = .5
Else
  Score = .35
End If

CalcValue = Score
```

Risk due to Pipes in Floodplain
If a pipe falls within a flood zone assign additional risk of .1.

Extract Pipe
"INSTALLDATE" < date '2011-01-01 00:00:00' AND "TRANSMISSIONFLAG" = 0 AND "INSERVICEFLAG" = 1

Select Floodplains
"FLD_ZONE" IN ('A', 'AE', 'AH', 'AO', 'D', 'OPEN WATER', 'V', 'VE')

Select Layer By Location
Intersect the “Extract Pipe” with the “Select Floodplains”

Assign Gridvalue
GRIDVALUE = .1

Risk due to Gophers
Small diameter plastic pipe is susceptible to gopher damage so assign additional risk if an underground leak was caused by natural forces and the pipe is within 500 feet of it.

Extract Pipe
"INSTALLDATE" < date '2011-01-01 00:00:00' AND "TRANSMISSIONFLAG" = 0 AND "INSERVICEFLAG" = 1

Select Plastic Pipe
MATERIALCODE = 'PL' AND SIZENUMBER <= .75

Select Leaks Caused by Natural Forces underground

"INSPECTION_DATE" < date '2011-01-01 00:00:00' AND FAILURECAUSECODE = 8 AND "LEAKINFOLOCATION" = 'B'

Buffer

Surround leaks with a 500 foot buffer

Select Layer By Location

Intersect the Buffered leaks with the Select Plastic Pipe results.

Assign Gridvalue

GRIDVALUE = .2

Risk Due to Pipelines near geological fault zone

Pipelines that fall within 1000 feet of a fault zone need additional risk of 1.

Extract Pipe

"INSTALLDATE" < date '2011-01-01 00:00:00' AND "TRANSMISSIONFLAG" = 0 AND "INSERVICEFLAG" = 1

Select Pipe

Create a layer of extracted pipe so that it can be intersected. The subset of pipe is already chosen in the Extract Pipe tool.

Extract Faults

Create an extract of fault features.

Select Layer By Location

Intersect the the “Select Pipe” with the “Extract Faults” using a search distance of 1000 feet.

Assign Gridvalue

GRIDVALUE = 1

Risk Due to Pipelines near Land Instability

Pipelines that are in instable land get additional risk.

Extract Pipe

"INSTALLDATE" < date '2011-01-01 00:00:00' AND "TRANSMISSIONFLAG" = 0 AND "INSERVICEFLAG" = 1

Select Pipe
Create a layer of extracted pipe so that it can be intersected.

Extract Instability Monitor
Create an extract of instability areas. .

Select Layer By Location
Intersect the the “Select Pipe” with the “Extract Instability Monitor”.

Assign Gridvalue

GRIDVALUE = .3

Risk Due to Meter sets in Snow Areas
Assign additional risk if there is a meter set outside in a snowy construction area. If the meter set is inside then reduce risk.

Extract Snow Areas
CONSTRUCTIONAREA NOT IN ('DAV', 'GOS', 'RIT')

Select GSPB
Create a layer of all gas service point banks.

Select Layer By Location
Intersect the “Select GSPB” with the “Extract Snow Areas”.

Join Field (13)
Join all of the child GasServicePoints to the parent “Select GSPB” rows so that you have the usage_pt_ky of each. The usage point is needed to determine where the meter is located.

Table to Table (2)
Get all of the usage points that have inside metersets.
"RDG_INSTRCTN_CDE1" IN ('BA', 'BC', 'BE', 'BO', 'BR', 'BS', 'BW', 'B1', 'B2', 'B3', 'CA', 'CL', 'FR', 'IC', 'IE', 'IG', 'IN', 'IS', 'IW', 'MR', 'VT', '0', '00') OR "RDG_INSTRCTN_CDE2" IN ('BA', 'BC', 'BE', 'BO', 'BR', 'BS', 'BW', 'B1', 'B2', 'B3', 'CA', 'CL', 'FR', 'IC', 'IE', 'IG', 'IN', 'IS', 'IW', 'MR', 'VT', '0', '00') OR "RDG_INSTRCTN_CDE3" IN ('BA', 'BC', 'BE', 'BO', 'BR', 'BS', 'BW', 'B1', 'B2', 'B3', 'CA', 'CL', 'FR', 'IC', 'IE', 'IG', 'IN', 'IS', 'IW', 'MR', 'VT', '0', '00')

Assign Gridvalue
If there is no usage_pt_ky (that is, there was not a join to an inside meterset reading instruction) then the meterset is outside and risk is added, otherwise, risk is reduced.

Static CalcValue as variant

```
Dim Score as Double

IF [USAGE_PT_KY] & "" = "" Then
  Score = .2
Else
  Score = -.2
End If

CalcValue = Score
```

Future Improvements

Use subtype for Failure Cause to assign gopher risk rather than assigning it to everywhere there was an underground natural forces leak. Also need additional study of gopher/mole tunneling patterns for distance to validate the impact radius.

Change the input of Land Instability Monitoring Areas to the new SDE featureclass SDEADMIN.AFMNonVersioned.ForcesPolygon

Figure out a way to use clips to select the intersections of hazards and facility so that the hazards are not spread too widely. For example, right now the flood zones are applied to any pipe that intersects the flood area, so a long piece of pipe would get this risk applied to its whole length, not just where it is in the flood zone.

Appendix

Code Table Values:

FLD_ZONE
https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA%2520Flood%2520Zone%2520Designations

INSPECTION_TYPE

EFMD_INSPECTION_TYPE	
INSPECTION_TYPE	**INSPECTION_TYPE_NAME**
CAA	Cathodic Annual
CAR	Cathodic Rectifier
CCB	Cathodic Critical Bond
CEP	Exposed Steel Piping
CZF	Isolated Steel Survey Follow-up
CZJ	Riser Replacement Job
CAG	Isolated Main >= 100 ft
CAS	Cathodic Casing

EFMD_INSPECTION_TYPE	
INSPECTION_TYPE	INSPECTION_TYPE_NAME
CAL	Cathodic Isol Main < 100 ft & Isol Svcs
CEM	End Of Main
CPP	Exposed Plastic Piping
CSP	Exposed Steel/Plastic Piping
CZL	Isolated Steel Survey Monitor
CZS	Isolated Steel Survey

SOIL_TYPE_CONTACT_PIPE

EFMD_EXPOSED_PIPE_SOIL_TYPE	
SOIL_TYPE	SOIL_TYPE_DESC
1	Sand
2	Loam
3	Clay/Bentonite
4	Rocky (Obsolete - Do Not Use)
5	Concrete/Grout
6	Control Density Fill (CDF)
7	Other
8	Rocky (smaller 3/4")
9	Rocky (larger 3/4")

FAILURECAUSECODE

EFMD_FAILURE_CAUSE_CODE	
FAILURE_CAUSE_CODE	FAILURE_CAUSE_DESC
1	Corrosion
2	Excavation/3rd Party
3	Other Outside Force Damage
4	Operations
6	Other
7	Loose/Needs Grease
8	Natural Forces
9	Equipment
10	Material
11	Weld/Joint

EFMD_LEAK_INFO_LOCATION_CODE

LEAK_INFO_LOCATION_CODE	LEAK_INFO_LOCATION_DESC
A	Above Ground
B	Below Ground

CONSTRUCTIONAREA

EFMD_COMPLIANCE_CONSTR_AREA		
STATE_CODE	CONSTRUCTION_AREA	CONSTRUCTION_AREA_NAME
ID	BOF	Bonners Ferry
ID	CDA	Coeur d Alene
ID	KEL	Kellogg
ID	LEC	Lewiston/Clarkston
ID	PUM	Pullman/Moscow
ID	SAN	Sandpoint
ID	UNK	Unknown
OR	KLF	Klamath Falls
OR	LAG	LaGrande
OR	MED	Medford
OR	ROS	Roseburg
OR	UNK	Unknown
WA	COL	Colville
WA	DAV	Davenport
WA	GOS	Goldendale/Stevenson
WA	LEC	Lewiston/Clarkston
WA	PUM	Pullman/Moscow
WA	RIT	Ritzville
WA	SPO	Spokane
WA	UNK	Unknown

TRANSMISSIONFLAG

1 – Pipe is transmission
0 – Pipe is not transmission

MATERIALCODE
PL = Plastic
ST = Steel
UN = Unknown
UK = Unknown

RDG_INSTRCTN_CDE1, RDG_INSTRCTN_CDE2, RDG_INSTRCTN_CDE3

RDG_INSTR_LOC_CDE	RDG_INSTR_LOC_DESC
BA	BASEMENT
BC	BASEMENT CENTER
BE	BASEMENT EAST
BO	BOILER ROOM
BR	BACK ROOM
BS	BASEMENT SOUTH
BW	BASEMENT WEST
B1	BASEMENT ONE
B2	BASEMENT TWO
B3	BASEMENT THREE
CA	CABINET
CL	CLOSET
FR	FURNACE ROOM
IC	INSIDE CENTER
IE	INSIDE EAST
IG	INSIDE GARAGE
IN	INSIDE NORTH
IS	INSIDE SOUTH
IW	INSIDE WEST
MR	METER ROOM
VT	VAULT
0	BASEMENT

Data Sources:

Category Other Outside Force

Utilities

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DATA SOURCES: ..... **ERROR! BOOKMARK NOT DEFINED.**
IMPROVEMENTS: 5

Change Management

1. Make sure changes are being tracked in this document (go to the Review ribbon and click on Track Changes). This will allow changes to be tracked and reviewed.
2. Add brief description of change to the list.
3. Changes must be approved by gas compliance.

Date	Who	Ver	Change Description
8/15/2011	Kevin F	1.0	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents form 2010 where merged into this document and updated with the latest changes and risk factors.
01/17/2012	Jake J	.2	Minor edits for clarification

Overview

The other outside force model calculates the risk factors due to outside forces caused by humans. The following risk factors are calculated:

- Risk due to vehicle damage on meter sets.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Type	Name	Description
Input	AC_All_Features	All features have atmospheric corrosion associated with it. Feature class found in the parameters.gdb
Input	Trouble_All_Features	All features having gas trouble associated with it. Feature class found in the parameters.gdb
Output	AC_With_Trouble	AC_With_Trouble

Assumptions

Risk Due to Possible Vehicle Damage

If an atmospheric corrosion inspection indicated that meter protection was needed in the last 3 years and the protection was installed then risk is reduced. However, if the protection was not installed the risk is added. Risk is also added if the inspection indicated protection was not needed and there were previous leaks on that feature caused by other outside forces.

Variables:
ACInspections_METER_PROT_NEEDED_FLAG = “Y” indicates that the AC inspector reported that meter protection was needed at the location.
ACInspections_ISSUE_RESOLVED_FLAG = "Y" indicates the meter protection was installed or the serviceman or CPC determined that meter protection was not needed..

Select AC Service Points

Select AC service point inspections from AC_All_Features done in the last 3 years. This represents the most recent turn of the 3 year cycle for atmospheric corrosion across all three states.

"FEATURE_TYPE_ID" = 610 and ("INSPECTION_DATE" >= date '2008-01-01' and "INSPECTION_DATE" <= date '2010-12-31')

Select Leaks at Service Point Bank

Select the leaks out of Trouble_All_Feature at the service point. Leaks are not mapped in AFM to the child gas meter.

"PARENT_FEATURE_TYPE_ID" = 606

Join the Inspection and Leak Layers

Assign Gridvalue

```
Static CalcValue As Double
Dim Score As Double

If [ACInspections_METER_PROT_NEEDED_FLAG] = "Y" Then
   If [ACInspections_ISSUE_RESOLVED_FLAG] = "Y" Then
      If [LeaksOutsideForces_FAILURECAUSECODE] = 3 Then
         Score = -0.1
      Else
         Score = -0.25
      End If
   Else
      If [LeaksOutsideForces_FAILURECAUSECODE] = 3 Then
         Score = 0.5
      Else
         Score = 0.25
      End If
   End If
Else
```

```
    If [LeaksOutsideForces_FAILURECAUSECODE] = 3 Then
        Score = 0.75
    Else
        Score = 0
    End If
End If

CalcValue = Score
```

Future Improvements

Appendix

Code Table Values:

FEATURE_TYPE_ID = 610 indicates a service point.
PARENT_FEATURE_TYPE_ID = 606 indicates a gas service point bank.

FAILURECAUSECODE

EFMD_FAILURE_CAUSE_CODE	
FAILURE_CAUSE_CODE	**FAILURE_CAUSE_DESC**
1	Corrosion
2	Excavation/3rd Party
3	Other Outside Force Damage
4	Operations
6	Other
7	Loose/Needs Grease
8	Natural Forces
9	Equipment
10	Material
11	Weld/Joint

Unknown Data

AVISTA®
Utilities

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Change Management

1. Make sure changes are being tracked in this document (go to the Review ribbon and click on Track Changes). This will allow changes to be tracked and reviewed.
2. Add brief description of change to the list.
3. Changes should only be approved by someone in gas compliance.

Date	Who	Ver	Change Description
4/5/2012	Kevin Farrington	.1	Created document.

Overview

This model was created to apply risk to features in GIS that have unknown data. Currently, the model only applies risk to pipe that has unknown material type.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Type	Name	Description
Input	Pipe_office_state	Line feature class in parameters.gdb that identify all pipe segments and their construction office and state.
Output	Un_Pipe_Poly	Polygon output features identifying the risk and rasters containing unknown pipe.

Assumptions

Risk due to Unknown Pipe

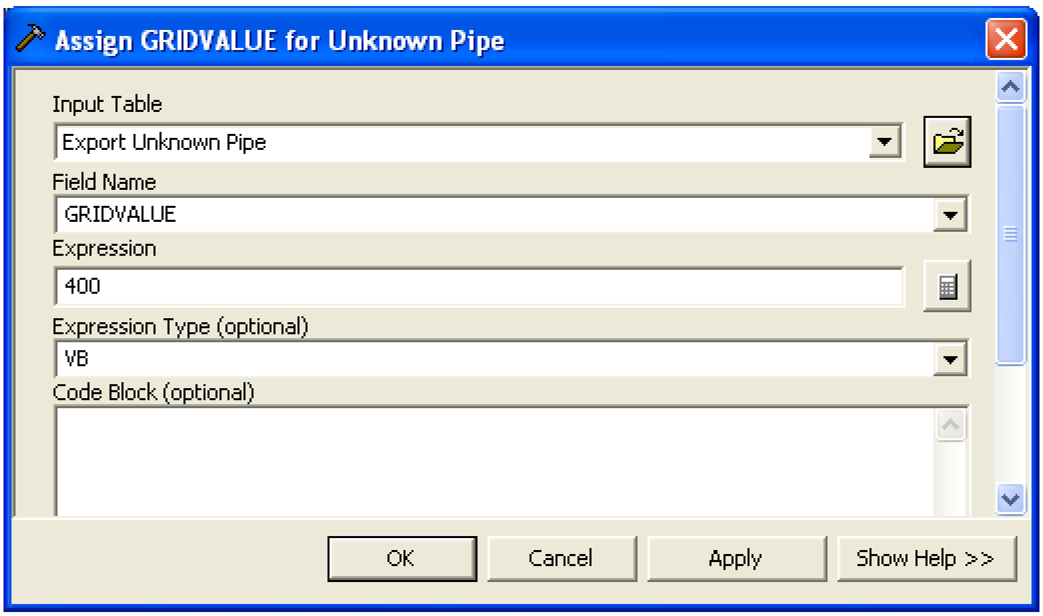
Apply risk to pipe that has unknown material type.

Select Active Unknown Pipe

"INSERVICEFLAG" = 1 and "TRANSMISSIONFLAG" = 0 AND "MATERIALCODE" IN ('UK', 'UN') and "INSTALLDATE" < date '2011-01-01'

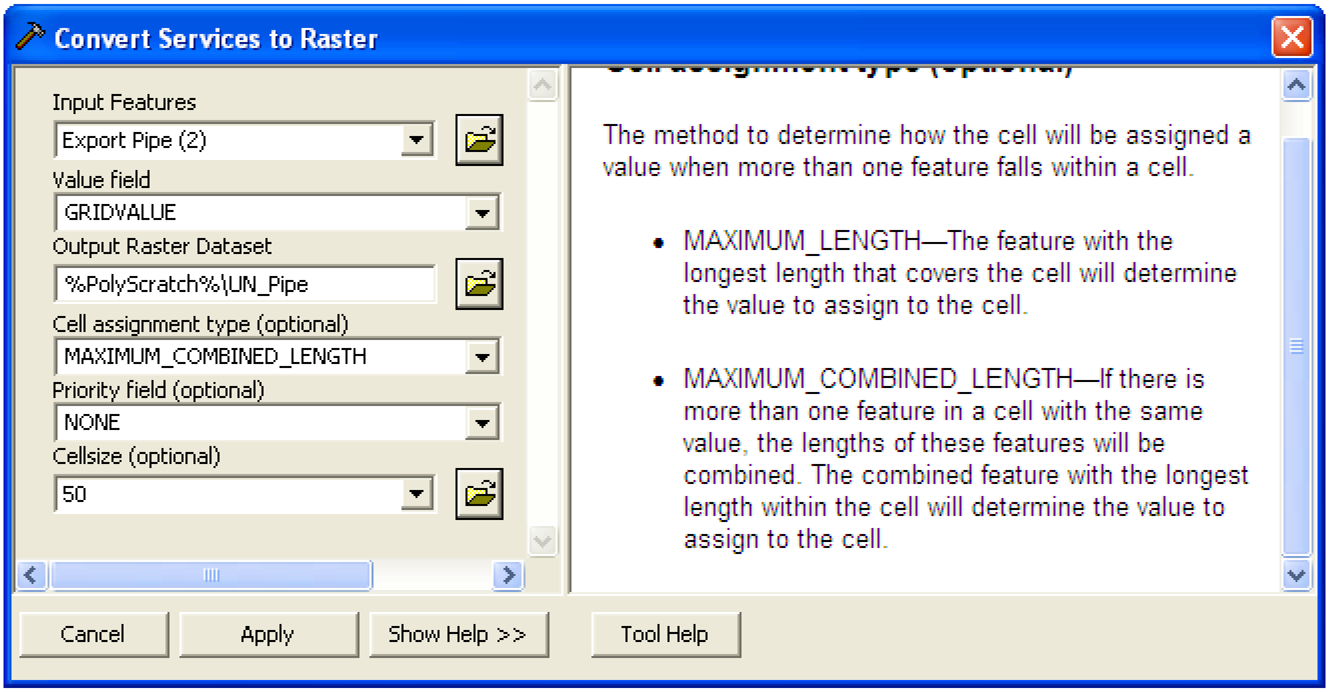
Assign GRIDVALUE for unknowns

A field called GRIDVALUE was added as an attribute to the pipe so assign a fixed number for the risk.



Convert Service to Raster

Convert the pipe to a raster data set and assign the GRIDVALUE to the rasters GRIDCODE attribute.



Convert UN Pipe Raster to Polygon (5)
This tool converts the raster cells to polygons so that a new field can be added later called risk_un_pipe.

Calculate Field Risk_UN_Pipe
This tool assigns the polygons GRIDCODE attribute to the risk_un_pipe attribute.

Add Field Risk_Unknown_Pipe
Adds another field to the polygon for the final risk.

Calculate Field Risk_Unknown
This tool assigns the risk_unknown_pipe to the risk_un_pipe.

Future Improvements

1. Elimate all steps after the Calcualte Field risk_un_pipe tool.
2. Read the risk score, currently 4, from the risk factor spreadsheet or access database. This will be done for all models.

Appendix

Code Table Values:

INSERVICEFLAG = 1 means the pipe is being used.
TRANSMISSIONFLAG = 0 means the pipe is not transmission and must be main or service pipe.
MATERIALCODE of UK or UN means the material is unknown.

Consequences

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Change Management

1. Make sure changes are being tracked in this document (go to the Review ribbon and click on Track Changes). This will allow changes to be tracked and reviewed.
2. Add brief description of change to the list.
3. Changes should only be accepted by someone in gas compliance.

Date	Who	Ver	Change Description
8/19/2011	Robert Cloward	.1 .2	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents form 2010 where merged into this document and updated with the latest changes and risk factors. Remove unknown pipe from select tool.
1/10/2011	Robert Cloward	.3	Document cleanup and verification.
3/15/12	Linda Burger	1.0	Added clarifications for the consequence factors.

Overview

This model calculates the consequence factors that are applied to the total risk for each raster. Factors are calculated for population, pipe pressure, business districts and gas ingress proximity. If an excess flow valve is installed the consequence is reduced.

Model Parameters and Settings

Scratch Workspace: D:\DIMP\DIMP_RiskAnalysis_Parameters\scratch.gdb
Extent: Same as Layer NWStreets
Snap Raster: D:\DIMP\DIMP_RiskAnalysis_Parameters\Parameters.gdb\SnapRaster

Data Input and Outputs

Type	Name	Description
Input	Pipe_Office_State	Pipe data is extracted from Avista's GIS which is considered the system of record. Feature class found in Parameters.gdb containing all pipe segments.
Input	Leak Survey Annual	Leak Survey Annual data is extracted from Avista's GIS which is considered the system of record.
Input	GSPB_Office_State	Gas Service Point data is extracted from Avista's GIS which is considered the system of record. Feature class found in Parameters.gdb containing all gas service point banks segments.
Input	Fitting_Office_State	Feature class found in Parameters.gdb containing all gas pipe fittings segments.
Input	SYSTEM_MAOP	System MAOP data is extracted from Avista's GIS which is considered the system of record.
Input	Block Group Boundaries	ESRI's Census data
Output	Conseq_Population_Project	Intermediate data used as input to summary model.
Output	ExportPipeConseq	Intermediate data used as input to summary model.
Output	ExportAnnualSurveyPolys	Intermediate data used as input to summary model.
Output	ExportGasServicePoints	Intermediate data used as input to summary model.
Output	ExportExcessFlowValves	Intermediate data used as input to summary model.

Assumptions

Consequence Factor Population

The number of persons living near a gas system that has failed has a direct correlation to the consequences of the gas system failure. The census block group data included with every ESRI ArcGIS Desktop or ArcGIS Server product provides a 2008 estimated population per square mile.
This value will be used as one of the measures of the impact of a gas system failure on the user community adjacent to the gas system. (ESRI DIMP Toolset Documentation p. 67)

Assign Gridvalue for Population

```
8-2-2011
Static CalcValue as variant
Dim Score as Double
If [POP08_SQMI] = 0 Then
Score = 0
ElseIf [POP08_SQMI] > 0 AND [POP08_SQMI] < 100 then
Score = 1.1
ElseIf [POP08_SQMI] >= 100 AND [POP08_SQMI] < 500 then
Score = 1.2
ElseIf [POP08_SQMI] >= 500 AND [POP08_SQMI] < 1000 then
Score = 1.3
ElseIf [POP08_SQMI] >= 1000 AND [POP08_SQMI] < 2000 then
Score = 1.4
ElseIf [POP08_SQMI] >= 2000 AND [POP08_SQMI] < 5000 then
Score = 1.5
ElseIf [POP08_SQMI] >= 5000 AND [POP08_SQMI] < 10000 then
Score = 1.6
Else
Score = 1.7
End If

CalcValue = Score
```

Consequence Factor Pipe Pressure

Mains are a line feature class which has an attribute referencing a table which defines MAOP pressure of a specific pipe. The DIMP model is using the MAOP pressure to identify risk due to Gas Ignition Pressure.

Select Active Pipe

Prior to final DIMP results – SQL was changed to:
Pipe_Office_State.INSERVICEFLAG = 1 and Pipe_Office_State.TRANSMISSIONFLAG = 0 AND Pipe_Office_State.INSTALLDATE < date '2011-01-01'

8-19-2011
Pipe_Office_State.INSERVICEFLAG = 1 and Pipe_Office_State.TRANSMISSIONFLAG = 0 AND Pipe_Office_State.MATERIALCODE NOT IN ('UK', 'UN') and Pipe_Office_State.INSTALLDATE < date '2011-01-01'

8-2-2011
Pipe_Office_State.INSERVICEFLAG = 1 and Pipe_Office_State.TRANSMISSIONFLAG = 0 and Pipe_Office_State.INSTALLDATE < date '2011-01-01'

Assign Gridvalue for Active Pipe

```
8-2-2011
Static CalcValue as variant
Dim Score as Double
If [SYSTEM_MAOP_SYSTEM_MAOP] > 0 and [SYSTEM_MAOP_SYSTEM_MAOP] <= 60 Then
   Score = .1
ElseIf [SYSTEM_MAOP_SYSTEM_MAOP] > 60 and [SYSTEM_MAOP_SYSTEM_MAOP] <= 250 Then
   Score = .2
ElseIf [SYSTEM_MAOP_SYSTEM_MAOP] >250 and [SYSTEM_MAOP_SYSTEM_MAOP] <=500 Then
   Score = .3
```

```
Elseif [SYSTEM_MAOP_SYSTEM_MAOP] > 500 Then
  Score = .4
Else
  Score = .1
End If

CalcValue = Score
```

Consequence Factor Annual Survey - Business Districts

Annual Leak Survey is a polygon dataset which identifies the pipe that Avista considers a business district. The Select Annual Survey query is excluding the Accelerated Action of annually surveying ALD pipe. Due to these areas normally being in wall to wall paving and high occupancy structures. (This is in lieu of Avista having the ability use building footprints and hard surface modeling for migration.)

Select Annual Survey

8-2-2011
"typecode" = 3 AND ("CREATEUSERID" <> 'RDCALD' or "CREATEUSERID" IS NULL)

Assign Gridvalue for Annual Survey

8-2-2011
Expression = .5

Consequence Factor Gas Service Point - Gas Ingress Proximity

The Gas Service Point is a point feature class which identifies the riser at every premise location. The DIMP model is using this gas service point to identify Gas Migration points. (This is in lieu of having building footprints that we can model. Avista is using service points since they are normally located right at the building.)

Assign Gridvalue for Gas Service Points

Prior to final DIMP results – SQL was changed to:
Expression = .25

8-2-2011
Expression = .5

Consequence Factor Excess Flow Valve

Excess flow Valves are a point feature which is found on service pipe. Excess flow valves are shown to reduce the consequences as indicated in the DIMP model.

Select Excess Flow Valves

8-2-2011
"TYPECODE" = 'VE' and "INSERVICEFLAG" = 1 and "INSTALLDATE" < date '2011-01-01'

Assign Gridvalue for Excess Flow Valves

8-2-2011
Expression = -.9

Future Improvements

Appendix

Code Table Values:

MATERIALCODE

- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

UACLASSODE

- MH – Main high pressure
- MI – Main intermediate pressure
- SI – Service intermediate pressure
- SH – Service high pressure

TRANSMISSIONFLAG

- 1 – Pipe is transmission
- 0 – Pipe is not transmission

Total Score

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Change Management

1. Make sure changes are being tracked in this document (go to the Review ribbon and click on Track Changes). This will allow changes to be tracked and reviewed.
2. Add brief description of change to the list.
3. Changes should only be approved by someone in gas compliance.

Date	Who	Ver	Change Description
1/3/2012	Kevin F	.1	This was the first version of the model created for the 8/2/2011 PHMSA filing deadline. All model documents form 2010 where merged into this document and updated with the latest changes.
1/17/2012	Jake J	.2	Minor edits for clarification
3/8/2012	Kevin F	.3	Correct header and add future improvement to fix the pipe and total score intersect.

Overview

The Total Score model adds up the risk due to each category model and multiplies this by the consequences. The model currently does not assign additional weighing to any category so they are all treated equally. The model also calculates what percentage of the total risk is due to each category.

Data Input and Outputs

This section describes the inputs to the model and the outputs it produces.

Type	Name	Description
Input	Pipe_Office_State	See RiskAnalysisModeling.docx
Input	DIMPRiskSum_Poly	Contains total risk scores for each category
Input	Conequence_Poly	Contains the calculated consequences for each raster/polygon.
Output	RiskRanking	The risk score for each category, the ratio/percentage of risk attributable to each category, the total risk score which includes the consequence.

Assumptions

Calculate Risk_Total and Total_Score

This logic first combines the risk summary polygon with the consequences polygon so the data for each raster is in one polygon. It then sums up the risk for each category into the Risk_Total variable. It then multiplies the Risk_Total by the consequences for that raster.

Calculate Field Risk_Total

[Risk_Unknown_Pipe] + [Risk_OutsideForces]+ [Risk_IncorrectOps]+ [Risk_Material]+ [Risk_NaturalForces]+ [Risk_Corrosion]+ [Risk_Equipment]+ [Risk_Excavation]+ [Risk_JointWeld]

Calculate Field Total_Score

[Consequence] * [Risk_Total]

Calculate Percentage of Risk attributable to each Category

This logic simply divides the risk for each category by the risk_total and stores it in the DIMPRisk_poly.

Join Risk Rankings with pipe

Intersect the total score with the pipe that falls in each raster. (This did not run in the original version due to geometry errors that prevented the Identity tool from running).

Future Improvements:

Figure out another way to intersect pipe and total score since the overlapping vertices causes the regular intersect to fail; perhaps select by location will work.

Appendix

Code Table Values:

TRANSMISSIONFLAG
- 1 – Pipe is transmission
- 0 – Pipe is not transmission

MATERIALCODE
- PL = Plastic
- ST = Steel
- UN = Unknown
- UK = Unknown

Tab

APPENDIX D
IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS

Table 8.1-2: Leak Survey Performance Measures

AVISTA SYSTEM	2011	2010	2009	2008	2007
# of Grade 1 Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.018	0.015	0.019	0.015	0.010
# of Grade 1 Leaks Found	45	64	71	58	36
Total Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.740	1.039	0.691	0.554	0.375
# of Total Leaks Found	1093	1430	820	690	435
IDAHO DATA	**2011**	**2010**	**2009**	**2008**	**2007**
# of Grade 1 Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.008	0.010	0.005	0.011	0.005
# of Grade 1 Leaks Found	9	8	5	10	3
Total Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.194	0.220	0.091	0.125	0.125
# of Total Leaks Found	219	178	89	115	76
OREGON DATA	**2011**	**2010**	**2009**	**2008**	**2007**
# of Grade 1 Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.027	0.027	0.049	0.014	0.014
# of Grade 1 Leaks Found	39	35	57	16	17
Total Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.303	0.575	0.526	0.274	0.159
# of Total Leaks Found	434	748	610	316	191
WASHINGTON DATA	**2011**	**2010**	**2009**	**2008**	**2007**
# of Grade 1 Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.018	0.010	0.005	0.019	0.009
# of Grade 1 Leaks Found	32	21	9	32	16
Total Leaks Found During Leak Survey Per Miles of Pipeline Surveyed	0.244	0.245	0.074	0.155	0.090
# of Total Leaks Found	440	504	121	259	168

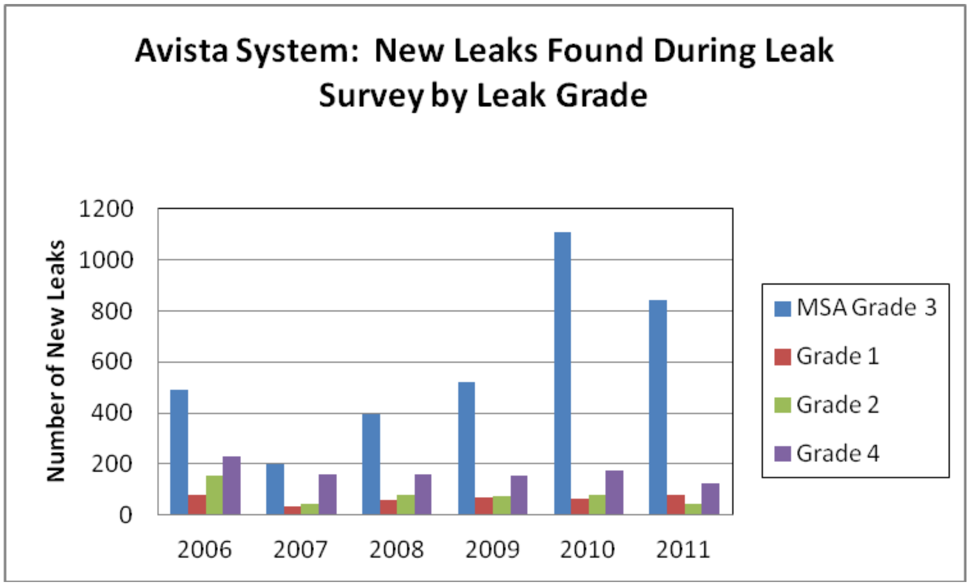

Figure D-1: System: New Leaks Found During Leak Survey by Grade

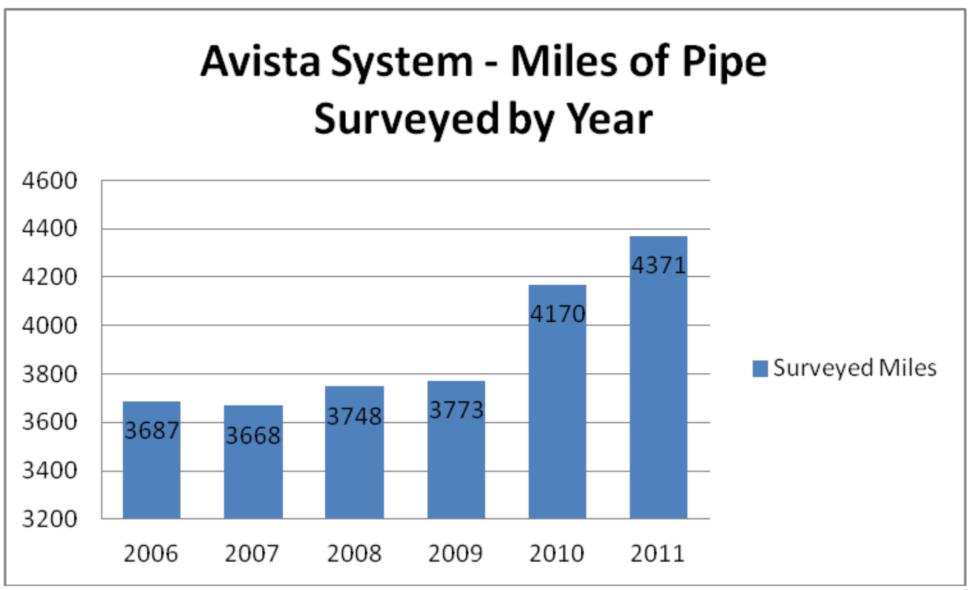

Figure D-2: Avista System: Miles of Pipe Surveyed by Year

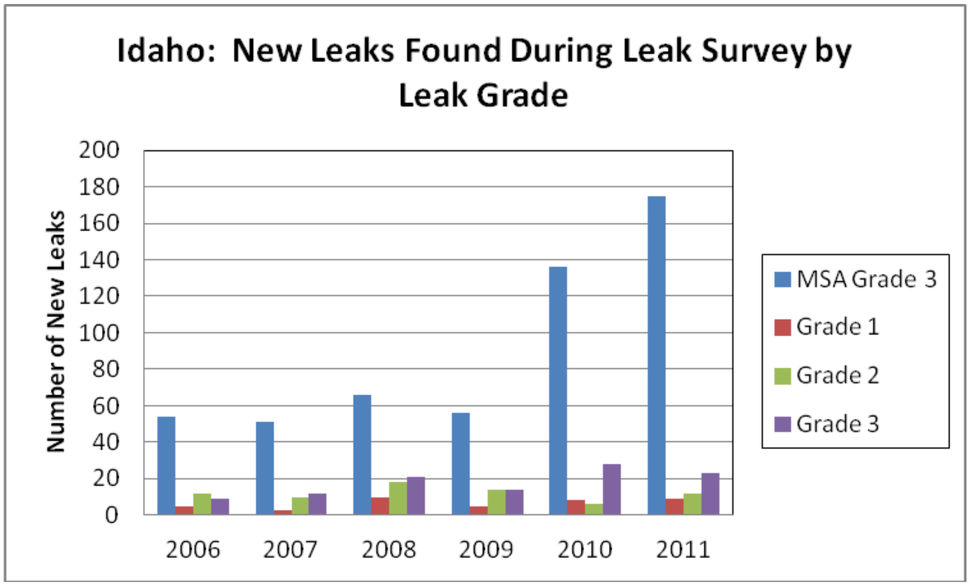

Figure D-3: ID: New Leaks Found During Leak Survey by Grade

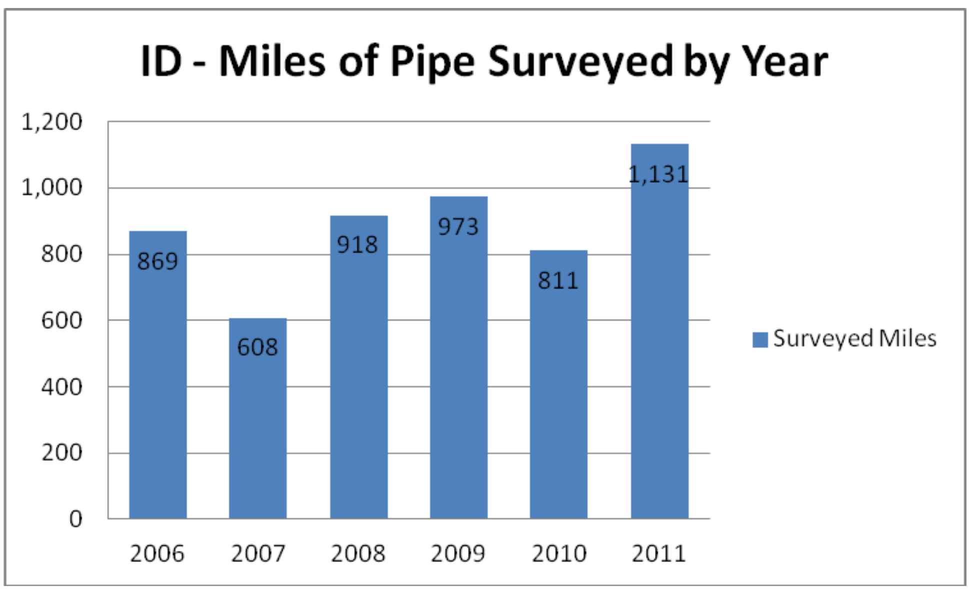

Figure D-4: ID: Miles of Pipe Surveyed by Year

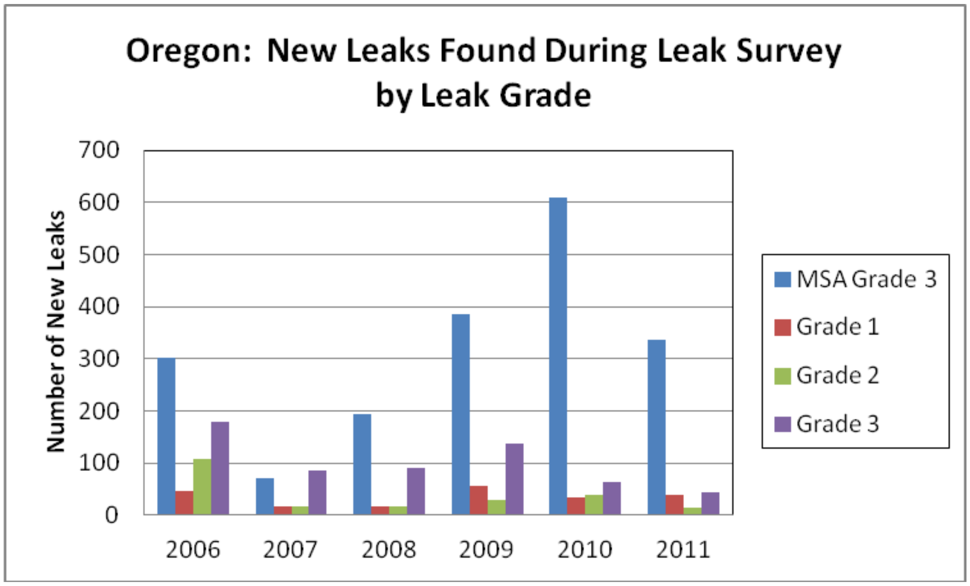

Figure D-5: OR: New Leaks Found During Leak Survey by Grade

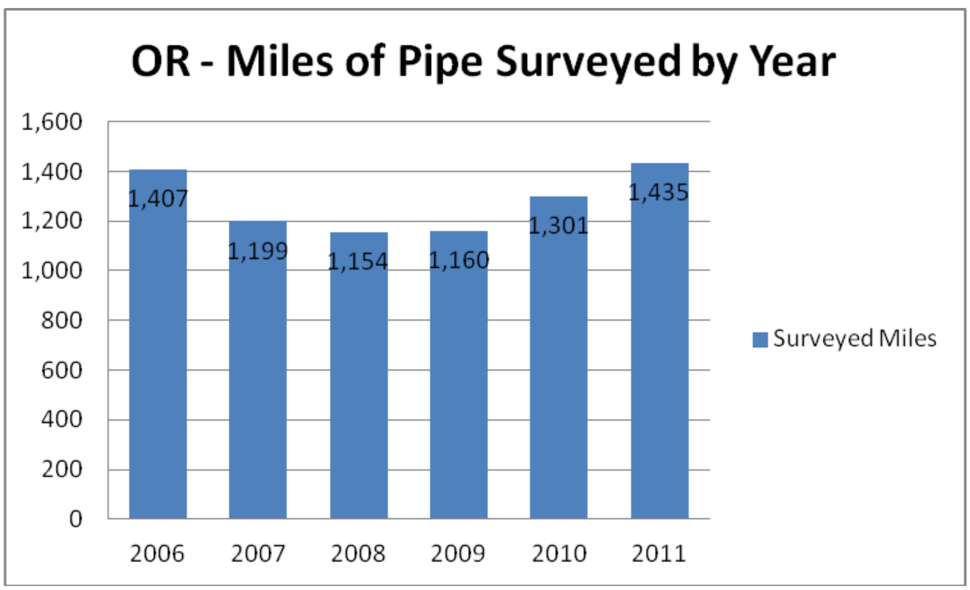

Figure D-6: OR: Miles of Pipe Surveyed by Year

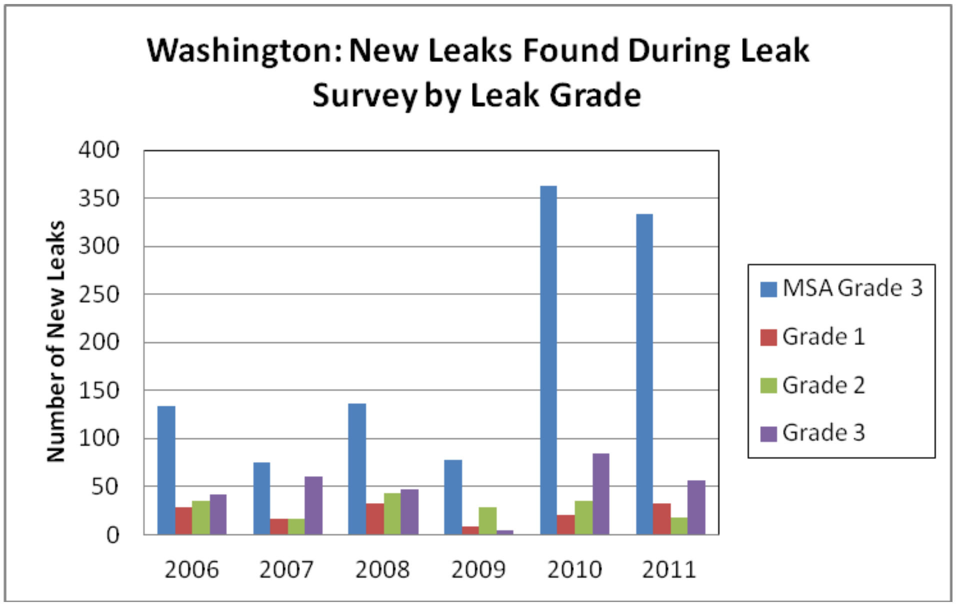

Figure D-7: WA: New Leaks Found During Leak Survey by Grade

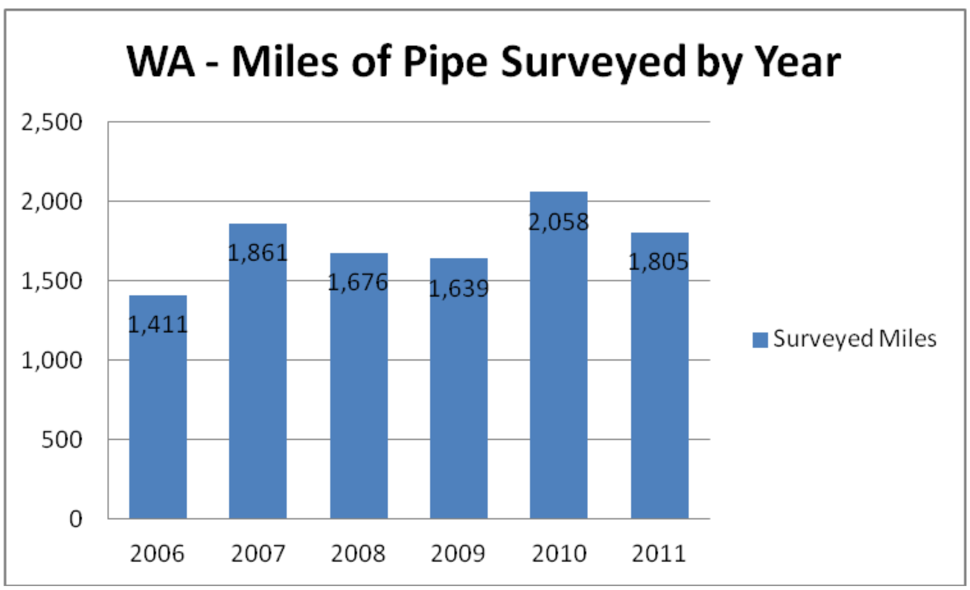

Figure D-8: WA: Miles of Pipe Surveyed by Year

The charts in Figure D-1 through D-8 reflect the number of leaks found by grade each year and the number of miles of pipeline, main and service, surveyed in each state. There is also a chart for Avista's overall system totals.

In 2010 there was a considerable increase in the number of aboveground meter set assembly (MSA) leaks. This is the result of a change in the criteria from 10,000 parts per million (ppm) lowered down to 5,000 ppm.

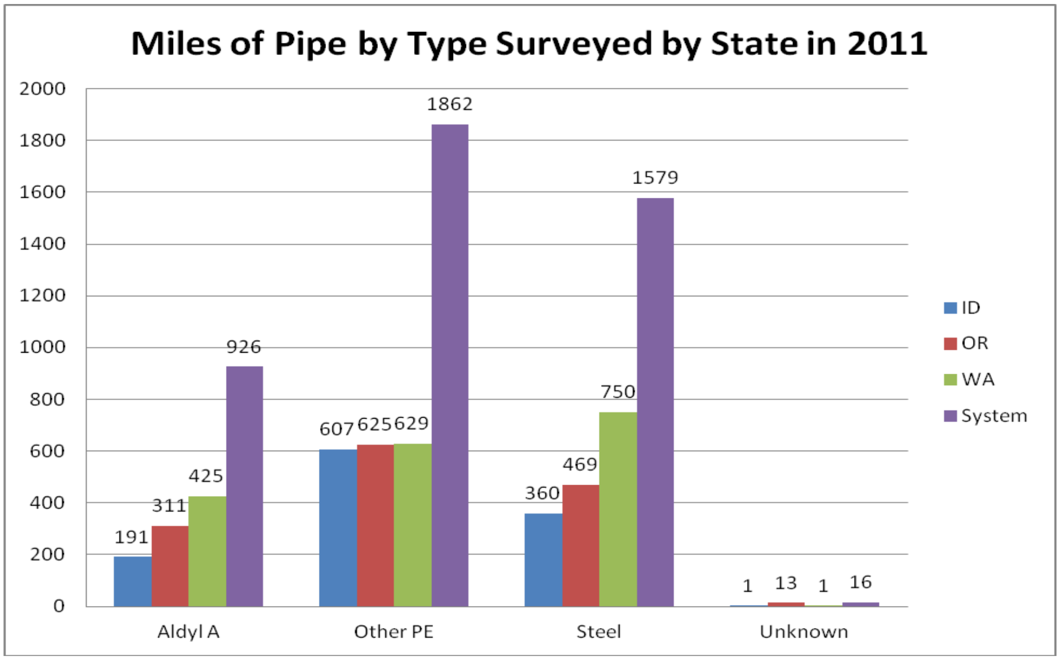

Figure D-9: Miles of Pipe by Type Surveyed in 2011 by State

Figure D-9 indicates miles of pipe type surveyed by state for 2011. This is also the year that Avista began leak surveying Aldyl A main piping annually in 2011.

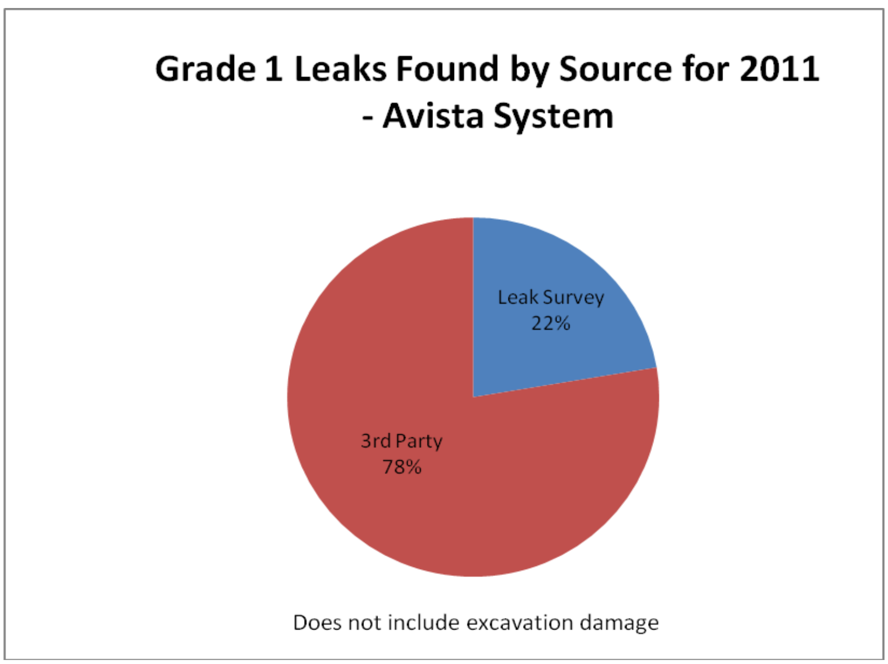

Figure D-10: Grade 1 Leaks Found by Source

In Figure D-10, the chart reflects the percentage of Grade 1 (hazardous) leaks found by Leak Survey versus customer called in leaks, other than excavation damages. These percentages are for Avista's overall system total in 2011.

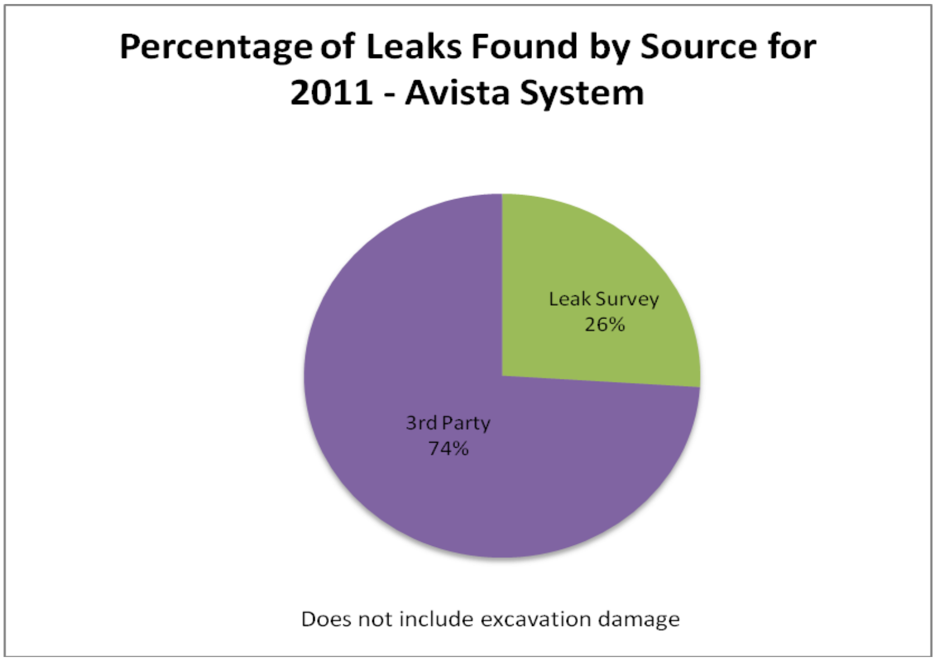

Figure D-11: Percentage of Leaks Found by Source

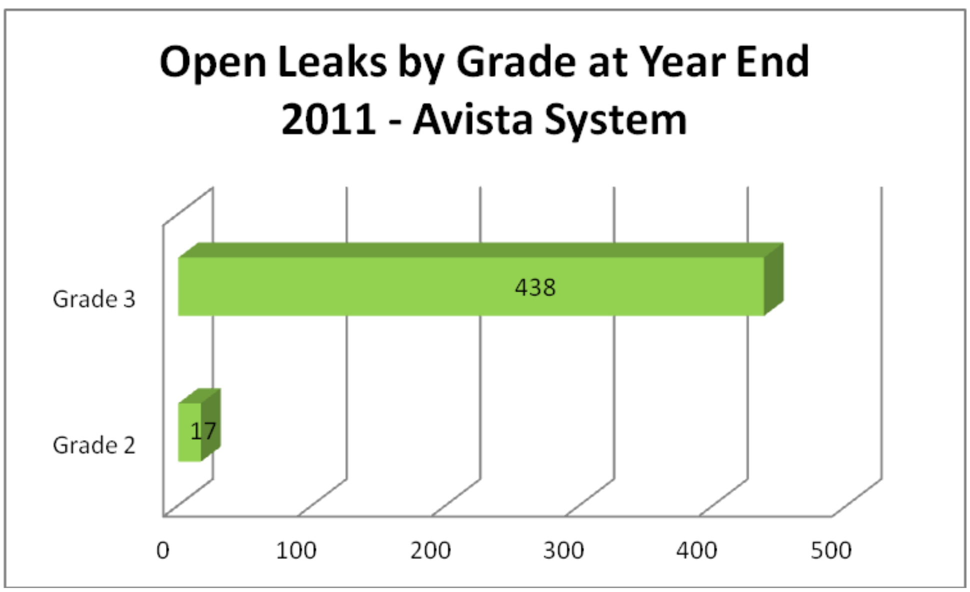

Figure D-12: Number of Open Leaks by Grade at End of 2011

There were 455 open leaks at the end of 2011. Figure D-12 shows the breakdown by leak grade. 380 of these leaks were in Oregon with a small number in both Idaho and Washington. The number of leaks in Oregon include leaks from the Ashland Uprate that was completed in the fall of 2011.

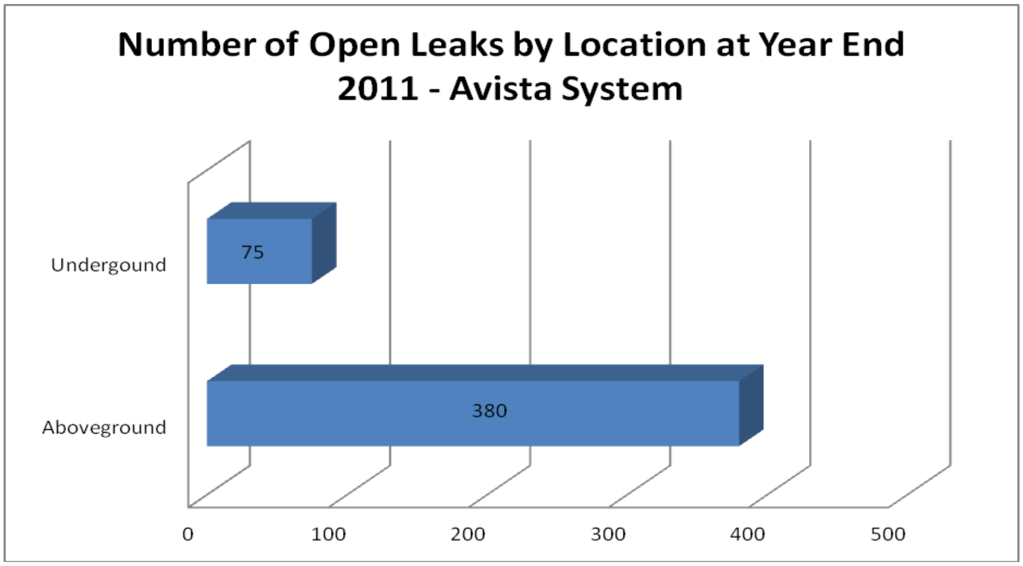

Figure D-14: Number of Open Leaks by Location at End of 2011

Of the 455 open leaks at the end of 2011, 380 were aboveground and 75 were belowground. Again, the majority of these are in Oregon.

Tab

APPENDIX E
LIST OF THREATS AND MEASURES TO REDUCE RISK

Table 8.2-1: List of Threats & Measures to Reduce Risk

THREAT CATEGORY	A/A REQ Y/N	MEASURE TO REDUCE RISK	MEAS BEYOND 192 REQ Y/N	PERFORMANCE MEASURE	2010 BASE-LINE	IMPLEMENT-ATION TIMEFRAME	CURRENT YEAR'S PERFORMANCE BASED ON 5 YR AVG FREQUENCY OF FAILURE
Excavation Damage	Y	1. Repeat Offender Tracking and Training 2. Create a Corporate Damage Prevention Program	Y	Damages per 1000 locates	8.42000	1. A/A in place prior to 2011 2. In 2012 an assigned committee will begin creating the framework for a Corporate prevention program.	The performance of this threat is currently stable, decreasing slightly overall, however there was an increase in Idaho's damage rate beyond 5%.
Unknown Pipe	Y	Research to determine unknown material of pipe segments	N	Percentage left of original identified segments	82%	Fall of 2011	Since pipe material is identified during a failure, there is no failure data to track for this, only unknown segments left in the system.
Material - Aldyl A SCG/LDIW Pipe	Y	Annual Leak Survey/ Replacement Program	Y	Leaks per mile of susceptible pipe	0.002	2011 began annual leak survey and replacement program.*	The performance of this threat is increasing slightly over 5% of the baseline.
Incorrect Operations – Improper Installation	Y	Internal Crew/Serviceman Inspections	Y	Leaks per mile of pipeline	0.001	2011	The performance of this threat is currently stable
Weld/Joints – Steel Welds	N	Continue trending	N	Leaks per mile of steel pipeline	.003	N/A	The performance of this threat is currently stable.
Material - Aldyl A Svc Tees/Bending	Y	Annual Leak Survey (& Replacement Program)	Y	Leaks per # of susceptible services	0.000	2011 began leak surveying main & svc tees off the	The performance of this threat is currently stable.

THREAT CATEGORY	A/A REQ Y/N	MEASURE TO REDUCE RISK	MEAS BEYOND 192 REQ Y/N	PERFORMANCE MEASURE	2010 BASE-LINE	IMPLEMENT-ATION TIMEFRAME	CURRENT YEAR'S PERFORMANCE BASED ON 5 YR AVG FREQUENCY OF FAILURE
Stress						main. Also began a replacement program.*	
Weld/Joints – Mechanical Joints	N	Continue trending	N	Leaks per # of services	.001	N/A	The performance of this threat is currently stable
Natural Forces – Snow/Ice	N	Continue monitoring	Y	Leaks per # of services	.000	A/A in place prior to 2011. Avista has a standard for snow areas in GSM 2.22 and 3.16	The performance of this threat is currently stable.
Corrosion Isolated Riser	Y	Monitoring/Replacement of isolated risers	Y	Leaks per # of services	.000	Monitoring/Replace ment program**	The performance of this threat is currently stable.
Weld/Joints – PE Joints	N	Continue trending	N	Leaks per miles of pipe	.000	N/A	The performance of this threat is currently stable.
Equipment Failure	A	Further analysis	N	Leaks per mile of pipeline	0.007	2012	The performance of this threat is increasing slightly above 5%. This category is too broad and needs to be broken down with further analysis to determine what is causing the increase
Natural Forces – Faults	N	Continue monitoring	N	Leaks per mile of pipe in susceptible areas	.000	N/A	No failures due to this threat. Stable
Natural Forces - Flooding	N	Continue monitoring	N	Leaks per mile of pipe in susceptible areas	.000	N/A	No failures due to this threat. Stable

THREAT CATEGORY	A/A REQ Y/N	MEASURE TO REDUCE RISK	MEAS BEYOND 192 REQ Y/N	PERFORMANCE MEASURE	2010 BASE-LINE	IMPLEMENT-ATION TIMEFRAME	CURRENT YEAR'S PERFORMANCE BASED ON 5 YR AVG FREQUENCY OF FAILURE
Corrosion External	N	Continue monitoring	N	Leaks per mile of pipeline	.001	N/A	The performance of this threat is currently stable.
Corrosion - Atmospheric	N	Trend Failures	N	Leaks per # of meters	0.000	N/A	The performance of this threat is currently stable.
Other Outside Force – Vehicular Damage	N	Barricade Inspections & collect data	Y	Leaks per # of meters	0.000	A/A in place prior to 2011	The performance of this threat is currently stable
Natural Forces - Gophers	Y	More Trending and Gopher Pattern Study Needed	Y	Leaks per mile of pipe in susceptible areas	.640	2012	The performance of this threat is currently stable. However, a gopher pattern study would be beneficial
Natural Forces – Land Movement	N	Continue monitoring	N	Leaks per miles of pipe in susceptible areas	4.348	N/A	The performance of this threat is currently stable.

*In 2011 Avista began leak surveying Aldyl A main that is susceptible to slow crack growth in all states. Avista's hired a project manager to manage the replacement project. Avista's first project was the replacement of the main and service tees in Avista's Odessa, WA system. The DIMP project team has provided the project manager with 17 initial strategic prioritized project areas across Avista's service territory.
**Avista has a mandated identification/replacement program in Washington per Docket PG-100049 to identify any isolated steel section including isolated risers through an "on/off" pipe potential survey and replace them no later than 10 years from identification, sooner depending on the criteria within the docket. Other states are in a voluntary replacement program.

See Appendix F for additional data on performance measures.

Tab

APPENDIX F
MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS

Table 9.1-1: Number of Grade 1 (Hazardous) Leaks Eliminated/Repaired, Categorized by Cause System wide

Hazardous Leaks Category	Breakout of Leaks 2011	5 Yrs of Leaks 2007 - 2011	5 Yr Avg of Leaks	5 yr Avg Baseline (Established with 5 year data 2006 to 2010)	5 Yr Avg / Facility Mile (or # of Facility)	Re-Eval Required? (> 5%)	Performance of Measure
Corrosion	11	47	9	0.000	0.000	No	Stable
Natural Forces	15	230	46	0.001	0.001	No	Stable
Excavation Damage	447	3444	689	0.013	0.011	No	Decreasing
Other Outside Force	64	350	70	0.001	0.001	No	Stable
Material/Weld	48	220	44	0.001	0.001	No	Stable
Equipment Failure	28	151	30	0.001	0.000	No	Stable
Incorrect Operations	26	79	16	0.000	0.000	No	Stable
Other	72	237	47	0.001	0.001	No	Stable

Table 9.2-1: Number of Grade 1 (Hazardous) Leaks Eliminated/Repaired, Categorized by Material System Wide

Material Type	Breakout of Leaks 2011	5 Yrs of Leaks 2007 - 2011	5 Yr Avg of Leaks	5 yr Avg Baseline (Established with 5 year data 2006 to 2010)	5 Yr Avg / Facility Mile (or # of Facility)	Re-Eval Required? (> 5%)	Performance of Measure
Steel	65	390	78	0.004	0.004	No	stable
Other Plastic	347	2595	519	0.018	0.015	No	decreasing
Aldyl A SCG/LDIW	132	886	177	0.029	0.027	No	decreasing
Unknown	1	5	1	0.004	0.003	No	stable
Aboveground	166	882	176	0.000	0.000	No	stable

In Table 9.2-1 the plastic material decrease is a result of a reduction in the number of excavation damages in 2011 as compared to the number of damages in 2006, which shows that our numbers have gradually decreased over the last five years. This is most likely due to the decrease in construction activity attributed to the economic slowdown.

Table 9.3-1: Number of Leaks Eliminated/Repaired, Categorized by Cause - Avista System

Performance Measures by Primary Threats	Breakout of Leaks 2011	5 Yrs of Leaks 2007 - 2011	5 Yr Avg of Leaks	5 yr Avg Baseline (Established with 5 year data 2006 to 2010)	5 Yr Avg / Facility Mile (or # of Facility)	Re-Eval Required? (> 5%)	Performance of Measure
Corrosion	39	166	33	0.001	0.001	No	Stable
Natural Forces	34	81	16	0.001	0.000	No	Decrease
Excavation Damage	458	3587	717	0.014	0.012	No	Decrease
Other Outside Force	97	530	106	0.002	0.002	No	Stable
Material/Weld	200	929	186	0.003	0.003	No	Stable
Equipment Failure	505	2352	470	0.007	0.008	Yes	Increase
Incorrect Operations	69	262	52	0.001	0.001	No	Stable
Other	92	662	132	0.002	0.002	No	Stable

The Natural Forces damages have decreased in snow/ice damage as a direct result of milder winters over the last two years. Gopher damages are also down from previous years.

Equipment Failure has increased slightly by more than 5%. This is an area that Avista needs to breakdown further to understand what is going on with this primary threat category and what is driving the number of failures, see Appendix F

The Other category has been a miscellaneous category used when not determining leak cause and only replacing pipe and/or components including MSA fittings. The number of unknown Other leak failures were reduced in 2011. This category also includes any leaks that were graded as a hazardous leak (grade 1) that only required a fitting to be tightened or lubricated.

Excavation Damages are down slightly overall, see Table 9.4-1 through Table 9.4-3 below for specifics.

Table 9.4-1: Number of Excavation Damages

Peformance Measure	2008 - 2010 3 Yr Avg	2008 - 2011 4 Yr Avg	2011
IDAHO	127	129	136
OREGON	202	199	190
WASHINGTON	251	245	226
SYSTEM	579	573	552

Table 9.4-2: Number of Locate Tickets

Peformance Measure	2008 - 2010 3 Yr Avg	2008 - 2011 4 Yr Avg	2011
IDAHO	24525	23313	19679
OREGON	20232	20448	21098
WASHINGTON	29691	29461	28770
SYSTEM	74447	73222	69547

Table 9.4-3: Excavation Damages per 1000 Locate Tickets

Peformance Measure	2008 - 2010 3 Yr Avg Baseline	2008 - 2011 4 Yr Avg	Breakout of 2011	Re-Eval Required? (> 5%)	Performance of Measure
IDAHO	5.2	5.6	6.9	Yes	Increase
OREGON	10.0	9.7	9.0	No	Stable
WASHINGTON	8.5	8.3	7.9	No	Stable
SYSTEM	7.8	7.8	7.9	No	Stable

The ratio of excavation damages to locate tickets has decreased slightly overall for Avista. However, in 2011 Idaho's number of damages have increased while the number of locate tickets have decreased resulting in a higher ratio as compared to the 4 year average. Oregon and Washington are both showing a decrease in 2011 from the 4 yr average. (Avista is using a 4 year average comparison rather than a 5 year average as the data prior to 2008 is unreliable and inconsistent.)

For 2012 Avista has formed a governance committee to create a framework for a corporate damage prevention program. In the past, each construction office was managing the damages in their own area which resulted in inconsistent results.

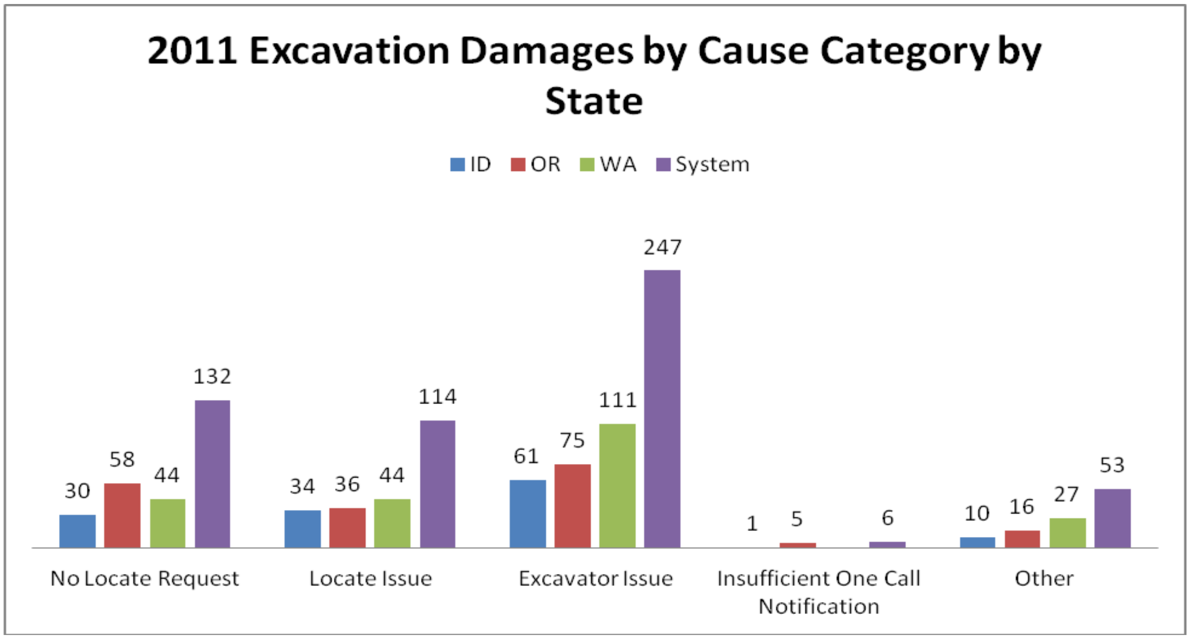

Figure E-1: 2011 Excavation Damages by Cause by State

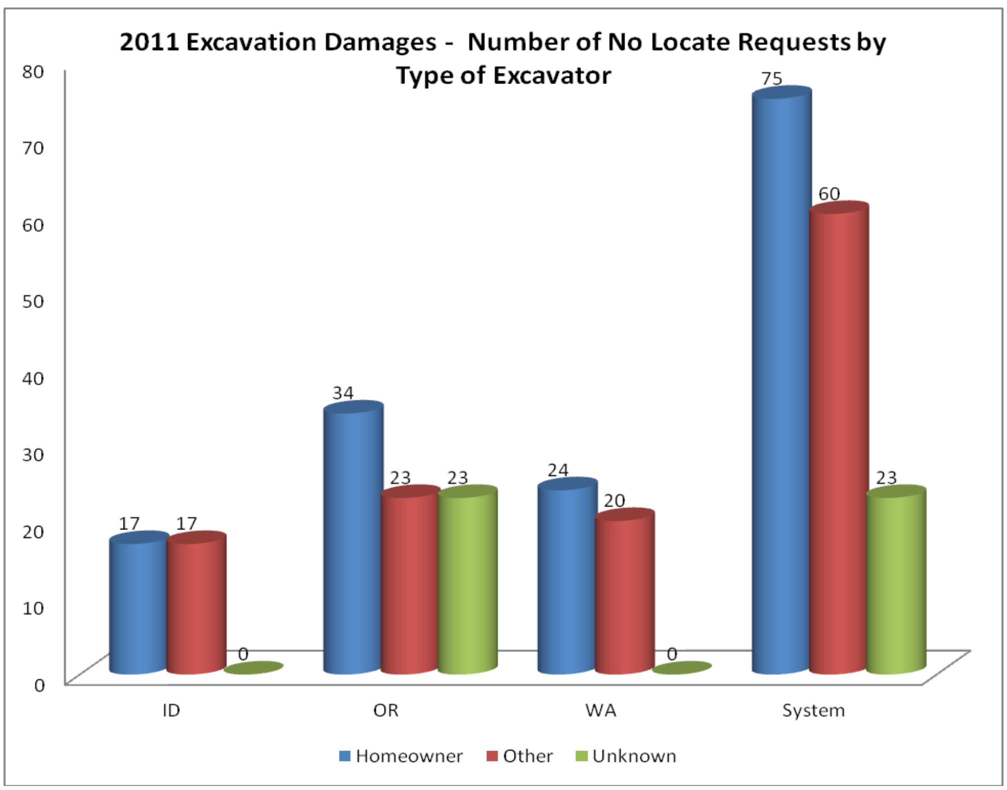

Figure E-2: 2011 Excavation Damages – Number of No Locate Requests by Type of Excavator

Table 9.5-1: Other Additonal Performance Measures - Leaks Eliminated/Repaired, Categorized by Subthreat - Avista System

Performance Measure of Subthreat	5 Yrs Avg of Leaks 2007 - 2011	Year 2011	Total Miles of Pipe or # of Facility 2007-2011	5 Yr Avg / Facility Mile (or # of Facility)	5 yr Avg Baseline (Established with 5* years data 2006 to 2010)	Re-Eval Required? (> 5%)	Performance of Measure
# Leaks Eliminated or Repaired – **Corrosion - External Corrosion**	24	25	19782.98	0.001	0.001	No	**Stable**
# Leaks Eliminated or Repaired – **Corrosion - Atmospheric Corrosion**	8	12	1581151	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Corrosion - External Stray Current**	0	2	19782.98	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Corrosion - Internal Chemical**	0	0	19782.98	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Corrosion - Internal Biological**	0	0	19782.98	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Material Failure - SCG/LDIW**	17	20	6588.48	0.003	0.002	Yes	**Increasing**
# Leaks Eliminated or Repaired – **Material Failure - Aldyl A Svc Tees**	22	37	129510	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Material Failure** - **Steel Pipe**	3	4	19782.98	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Material Failure – Other Plastic Svc Tees & Caps**	5	4	1040758	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Welds – Steel**	63	60	19782.98	0.003	0.003	No	**Stable**

Performance Measure of Subthreat	5 Yrs Avg of Leaks 2007 - 2011	Year 2011	Total Miles of Pipe or # of Facility 2007-2011	5 Yr Avg / Facility Mile (or # of Facility)	5 yr Avg Baseline (Established with 5* years data 2006 to 2010)	Re-Eval Required? (> 5%)	Performance of Measure
# Leaks Eliminated or Repaired – **Welds – PE Joints**	20	20	41858.75	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Welds – Mechanical**	29	21	41858.75	0.001	0.001	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces - Snow/Ice**	49	6	1581151	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces - Gophers**	27	25	44.5	0.607	0.640	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces - Wind**	1	0	1581151	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces Tree Roots**	3	1	62004.64	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces - Flooding**	0	0	248.25	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces - Fault Lines**	0	0	65.81	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Nat Forces - Earth Move/Landslide**	0	0	0.23	4.348	4.348	No	**Stable**
# Leaks Eliminated or Repaired – **OOF - Vehicle Damage**	56	50	1581151	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **OOF - Vandalism**	11	6	1581151	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **OOF -Structure Fire**	2	4	1581151	0.000	0.000	No	**Stable**

Performance Measure of Subthreat	5 Yrs Avg of Leaks 2007 - 2011	Year 2011	Total Miles of Pipe or # of Facility 2007-2011	5 Yr Avg / Facility Mile (or # of Facility)	5 yr Avg Baseline (Established with 5* years data 2006 to 2010)	Re-Eval Required? (> 5%)	Performance of Measure
# Leaks Eliminated or Repaired – **OOF - Misc**	37	34	1581151	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **IO – Improper Installation**	44	33	62004.64	0.001	0.001	No	**Stable**
# Leaks Eliminated or Repaired –**IO – Gas Lines thru Sewer Lines**	1	0	62004.64	0.000	0.000	No	**Stable**
# Leaks Eliminated or Repaired – **Other - Pipeline Overbuilds**	0	0	62004.64	0.000	0.000	No	**Stable**

Table 9.5-2: Other Additonal Performance Measures: Unknown Pipe Material - Identification Process

Construction Area	Starting Count of Pipe Segments	Starting Footage	Current Count of Pipe Segments	Current Footage	% Footage Left
Medford	2334	154030	1479	103911	67%
LaGrande	81	2928	3	85	3%
Klamath Falls	1437	97038	1321	88945	92%
Roseburg	782	57929	710	51111	88%
Bonners Ferry	25	1774	24	1708	96%
Kellogg	21	2159	17	1917	89%
Sandpoint	6	176	0	0	0%
Coeur d'Alene	12	581	6	252	43%
Pullman/Moscow	349	12965	252	10690	82%
Lewiston/Clarkston	253	7347	3	131	2%
Golden/Stevenson	0	0	0	0	0%
Davenport	13	1391	12	1385	100%
Ritzville	326	14443	320	13996	97%
Colville	0	0	2	35	100%
Spokane	101	6157	102	6095	99%
Total	**5740**	**358917**	4251	280261	82%
Percentage Left					

Table 9.5-2 reflects the progress that Avista has made in identifying segments of pipe that the material is unknown. Unknown pipe was a threat that Avista determined after the initial program was developed. The GIS editor group has been assigned the task of doing a record search to find the as-built, an exposed pipe report or other record that can identify any characteristics of the pipe. This identification process started in the fall of 2011 and continues into 2012. The majority of these unknown segments are in Oregon. The data in the table reflects the results as of the end of March 2012. Percentage of footage left indicates the percentage of the original footage that is left to be identified. The majority of these segments are associated with service pipe.

Tab

APPENDIX G
PERIODIC EVALUATION AND IMPROVEMENT

Table 10.1-1 Documentation of Program Re-evaluation

Required frequency	Program Re-evaluation Element	Date Completed
Annually	Update on-going performance measures	4/9/12
Annually	Review Knowledge of System Characteristics, Environmental Factors and Threats for Updates	4/12/12
Annually	Update Leak Management Program Key Performance Metrics	4/9/12
Annually	Review and update general information such as contact information, form names and numbers, etc.	4/9/12
As needed*	Update Threat Identification Process	N/A
As needed*	Update Threat Identification	4/9/12
As needed*	Update Risk Evaluation and Ranking Process	4/9/12
As needed*	Update Evaluation of Risks	4/9/12
As needed*	Update Risk Evaluation and Ranking Validation	N/A
As needed*	Update Risk Evaluation and Ranking Process Improvement Action Plans	4/9/12
As needed*	Update Action Plans	4/9/12

** as needed to address the risk category whose performance measure was exceeded*

Table 10.2-1: Documentation of Re-evaluation of Threats and Risks

Summary of Performance Measures that Exceeded Baseline				
System or State	**Threat/Performance Measure**	**Actual Performance for the Year**	**Established Baseline**	**Re-evaluation required?**
All	**Material Failure - SCG/LDIW Aldyl A –**5 yrs of leaks/5 yrs of miles of pipe = .003	20 leaks in 2011 which is slightly more than the 5-yr average of 17.	.002	This is more than a 5% increase over the baseline. Avista's Accelerated action is a 20 yr replacement program. Avista's Additional Action is an annual leak survey of this main. Recommendation is to continue the current A/A Actions

Date of Review: 4/10/12

Scheduled Date for Complete Program re-evaluation: August 2, 2016

Is a shorter timeframe for complete program re-evaluation warranted? : No

If yes, Date of Re-evaluation: ____________________

Is the frequency of the measure to reduce risk adequate? It is still early in the program to determine if the frequency is adequate or not. Avista will continue to monitor this.

System or State	Performance Measure	Actual Performance for the Year	Established Baseline	Re-evaluation required?
All	**Equipment Failure** – 5 yrs of leaks/5 years of miles of pipeline = .008	505 leaks in 2011 which is higher than the 5-yr average of 470.	.007	This is more than a 5% increase over the baseline. Since this category is so broad and encompasses meter set assembly failures along with underground equipment failures. The recommendation is to break this category into subcategories and the appropriate performance measure applied.

Date of Review: 4/10/12

Scheduled Date for Complete Program re-evaluation: August 2, 2016

Is a shorter timeframe for complete program re-evaluation warranted? : Yes in 2012

If yes, Date of Re-evaluation: _________________________

Is the frequency of the measure to reduce risk adequate? _________________

System or State	Performance Measure	Actual Performance for the Year	Established Baseline	Re-evaluation required?
Idaho	**Excavation Damage** – 4 yrs of damages/4 yrs of locates per 1000 = 5.6	In 2011 Idaho's ratio of damages to 1000 locates was 6.9 this is quite an increase over previous years	5.2	This is more than a 5% increase over the baseline. In 2012 Avista created a governance committee to create a framework for a Corporate Damage Prevention program in order to drive the damages down in number not only in Idaho but in all states.

Date of Review: 4/10/12

Scheduled Date for Complete Program re-evaluation: August 2, 2016

Is a shorter timeframe for complete program re-evaluation warranted? : No

If yes, Date of Re-evaluation: ________________________

Is the frequency of the measure to reduce risk adequate? Avista will look at this as part of the Corporate Damage Prevention program that is being created.

Tab

APPENDIX H
CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE IM PLAN

The table below provides a cross reference between 49 CFR Part 192, Subpart P (Gas Distribution Pipeline Integrity Management) and this Gas Distribution Integrity Management Plan.

49 CFR Part 192, Subpart P	IM Plan Reference
§192.1005 No later than August 2, 2011 a gas distribution operator must develop and implement an integrity management program that includes a written integrity management plan as specified in § 192.1007.	3.0
§192.1007 A written integrity management plan must contain procedures for developing and implementing the following elements:	
§192.1007 (a) *Knowledge.* An operator must demonstrate an understanding of its gas distribution system developed from reasonably available information.	5.0 & App A
§192.1007 (a) (1) Identify the characteristics of the pipeline's design and operations and the environmental factors that are necessary to assess the applicable threats and risks to its gas distribution pipeline.	5.3 & App A
§192.1007 (a) (2) Consider the information gained from past design, operations, and maintenance.	5.2 & App A
§192.1007 (a) (3) Identify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities).	5.4 & App A
§192.1007 (a) (4) Develop and implement a process by which the IM program will be reviewed periodically and refined and improved as needed.	10.0
§192.1007 (a) (5) Provide for the capture and retention of data on any new pipeline installed. The data must include, at a minimum, the location where the new pipeline is installed and the material of which it is constructed.	5.5 & App A
§192.1007 (b) *Identify threats.* The operator must consider the following categories of threats to each gas distribution pipeline: corrosion, natural forces, excavation damage, other outside force damage, material, weld or joint failure, equipment failure, incorrect operation, and other concerns that could threaten the integrity of the pipeline.	6.0 & App B
§192.1007 (b) An operator must consider reasonably available information to identify existing and potential threats. Sources of data may include, but are not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, and excavation damage experience.	6.0, Appendix A
§192.1007 (c) *Evaluate and rank risk.* An operator must evaluate the risks associated with its distribution pipeline. In this evaluation, the operator must determine the relative importance of each threat and estimate and rank the risks posed to its pipeline. This evaluation must consider each applicable current and potential threat, the likelihood of failure associated with each threat, and the potential consequences of such a failure.	7.0 & App C
§192.1007 (c) …. An operator may subdivide its pipeline into regions with similar characteristics (e.g., contiguous areas within a distribution pipeline consisting of mains, services and other appurtenances; areas with common materials or environmental factors), and for which similar actions likely would be effective in reducing risk.	7.0

49 CFR Part 192, Subpart P	IM Plan Reference
§192.1007 (d) *Identify and implement measures to address risks.* Determine and implement measures designed to reduce the risks from failure of its gas distribution pipeline. These measures must include an effective leak management program (unless all leaks are repaired when found).	8.0 & App D & App E
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* Develop and monitor performance measures from an established baseline to evaluate the effectiveness of its IM program. …... These performance measures must include the following: (i) Number of hazardous leaks either eliminated or repaired, per § 192.703(c), categorized by cause; (ii) Number of excavation damages; (iii) Number of excavation tickets (receipt of information by the underground facility operator from the notification center); (iv) Total number of leaks either eliminated or repaired, categorized by cause; (v) Number of hazardous leaks either eliminated or repaired per § 192.703(c), categorized by material; and (vi) Any additional measures the operator determines are needed to evaluate the effectiveness of the operator's IM program in controlling each identified threat.	9.0 & App F
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* …. An operator must consider the results of its performance monitoring in periodically re-evaluating the threats and risks.	10.0 & App F
§192.1007 (f) *Periodic Evaluation and Improvement.* An operator must re-evaluate threats and risks on its entire pipeline and consider the relevance of threats in one location to other areas.	7.6 & 10.0 & App G
§192.1007 (f) Each operator must determine the appropriate period for conducting complete program evaluations based on the complexity of its system and changes in factors affecting the risk of failure. The operator must conduct a complete program reevaluation at least every five years. The operator must consider the results of the performance monitoring in these evaluations.	10.0 & App G
§192.1007 (g) *Report results.* Report, on an annual basis, the four measures listed in paragraphs (e)(1)(i) through (e)(1)(iv) of this section, as part of the annual report required by § 191.11. An operator also must report the four measures to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	11.0
§192.1009 Each operator must report, on an annual basis, information related to failure of compression couplings, excluding those that result only in nonhazardous leaks, as part of the annual report required by §191.11 beginning with the report submitted March 15, 2011. This information must include, at a minimum, location of the failure in the system, nominal pipe size, material type, nature of failure including any contribution of local pipeline environment, coupling manufacturer, lot number and date of manufacture, and other information that can be found in markings on the failed coupling. An operator also must report this information to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	11.0
§192.1011 An operator must maintain records demonstrating compliance with the requirements of this subpart for at least 10 years. The records must include copies of superseded integrity management plans developed under this subpart.	12.0

49 CFR Part 192, Subpart P	IM Plan Reference
§192.1013 (a) An operator may propose to reduce the frequency of periodic inspections and tests required in this part on the basis of the engineering analysis and risk assessment required by this subpart. (b) An operator must submit its proposal to the PHMSA Associate Administrator for Pipeline Safety or, in the case of an intrastate pipeline facility regulated by the State, the appropriate State agency. The applicable oversight agency may accept the proposal on its own authority, with or without conditions and limitations, on a showing that the operator's proposal, which includes the adjusted interval, will provide an equal or greater overall level of safety. (c) An operator may implement an approved reduction in the frequency of a periodic inspection or test only where the operator has developed and implemented an integrity management program that provides an equal or improved overall level of safety despite the reduced frequency of periodic inspections.	Not covered by IM Plan at this time

Tab

APPENDIX I
COPY OF 49 CFR PART 192, SUBPART P

Subpart P—Gas Distribution Pipeline Integrity Management (IM)

§ 192.1001 What definitions apply to this subpart?

The following definitions apply to this subpart:

Excavation Damage means 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 means 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.

Integrity Management Plan or *IM Plan* means a written explanation of the mechanisms or procedures the operator will use to implement its integrity management program and to ensure compliance with this subpart.

Integrity Management Program or *IM Program* means an overall approach by an operator to ensure the integrity of its gas distribution system.

Small LPG Operator means an operator of a liquefied petroleum gas (LPG) distribution pipeline that serves fewer than 100 customers from a single source.

§ 192.1003 What do the regulations in this subpart cover?

General. This subpart prescribes minimum requirements for an IM program for any gas distribution pipeline covered under this part, including liquefied petroleum gas systems. A gas distribution operator, other than a master meter operator or a small LPG operator, must follow the requirements in §§ 192.1005–192.1013 of this subpart. A master meter operator or small LPG operator of a gas distribution pipeline must follow the requirements in § 192.1015 of this subpart.

§ 192.1005 What must a gas distribution operator (other than a master meter or small LPG operator) do to implement this subpart?

No later than August 2, 2011 a gas distribution operator must develop and implement an integrity management program that includes a written integrity management plan as specified in § 192.1007.

§ 192.1007 What are the required elements of an integrity management plan?

A written integrity management plan must contain procedures for developing and implementing the following elements:

(a) *Knowledge.* An operator must demonstrate an understanding of its gas distribution system developed from reasonably available information. (1) Identify the characteristics of the pipeline's design and operations and the environmental factors that are necessary to assess the applicable threats and risks to its gas distribution pipeline. (2) Consider the information gained from past design, operations, and maintenance. (3) Identify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities). (4) Develop and implement a process by which the IM program will be reviewed periodically and refined and improved as needed. (5) Provide for the capture and retention of data on any new pipeline installed. The data must include, at a minimum, the location where the new pipeline is installed and the material of which it is constructed.

(b) *Identify threats.* The operator must consider the following categories of threats to each gas distribution pipeline: Corrosion, natural forces, excavation damage, other outside force damage, material, weld or joint failure (including compression coupling), equipment failure, incorrect operation, and other concerns that could threaten the integrity of its pipeline. An operator must consider reasonably available information to identify existing and potential threats. Sources of data may include, but are not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, and excavation damage experience.

(c) *Evaluate and rank risk.* An operator must evaluate the risks associated with its distribution pipeline. In this evaluation, the operator must determine the relative importance of each threat and estimate and rank the risks posed to its pipeline. This evaluation must consider each applicable current and potential threat, the likelihood of failure associated with each threat, and the potential consequences of such a failure. An operator may subdivide its pipeline into regions with similar characteristics (e.g., contiguous areas within a distribution pipeline consisting of mains, services and other appurtenances; areas with common materials or environmental factors), and for which similar actions likely would be effective in reducing risk.

(d) *Identify and implement measures to address risks.* Determine and implement measures designed to reduce the risks from failure of its gas distribution pipeline. These measures must include an effective leak management program (unless all leaks are repaired when found).

(e) *Measure performance, monitor results, and evaluate effectiveness.* (1) Develop and monitor performance measures from an established baseline to evaluate the effectiveness of its IM program. An operator must consider the results of its performance monitoring in periodically re-evaluating the threats and risks. These performance measures must include the following: (i) Number of hazardous leaks either eliminated or repaired as required by § 192.703(c) of this subchapter (or total number of leaks if all leaks are repaired when found), categorized by cause; (ii) Number of excavation damages; (iii) Number of excavation tickets (receipt of information by the underground facility operator from the notification center); (iv) Total number of leaks either eliminated or repaired, categorized by cause; (v) Number of hazardous leaks either eliminated or repaired as required by § 192.703(c) (or total number of leaks if all leaks are repaired when found), categorized by material; and (vi) Any additional measures the operator determines are needed to evaluate the effectiveness of the operator's IM program in controlling each identified threat.

(f) *Periodic Evaluation and Improvement.* An operator must reevaluate threats and risks on its entire pipeline and consider the relevance of threats in one location to other areas. Each operator must determine the appropriate period for conducting complete program evaluations based on the complexity of its system and changes in factors affecting the risk of failure. An operator must conduct a complete program re-evaluation at least every five years. The operator must consider the results of the performance monitoring in these evaluations.

(g) *Report results.* Report, on an annual basis, the four measures listed in paragraphs (e)(1)(i) through (e)(1)(iv) of this section, as part of the annual report required by § 191.11. An operator also must report the four measures to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.

§ 192.1009 What must an operator report when compression couplings fail?

Each operator must report, on an annual basis, information related to failure of compression couplings, excluding those that result only in nonhazardous leaks, as part of the annual report required by § 191.11 beginning with the report submitted March 15, 2011. This information must include, at a minimum, location of the failure in the system, nominal pipe size, material type, nature of failure including any contribution of local pipeline environment, coupling manufacturer, lot number and date of manufacture, and other information that can be found in markings on the failed coupling. An operator also must report this information to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.

§ 192.1011 What records must an operator keep?

An operator must maintain records demonstrating compliance with the requirements of this subpart for at least 10 years. The records must include copies of superseded integrity management plans developed under this subpart.

§ 192.1013 When may an operator deviate from required periodic inspections under this part?

(a) An operator may propose to reduce the frequency of periodic inspections and tests required in this part on the basis of the engineering analysis and risk assessment required by this subpart. (b) An operator must submit its proposal to the PHMSA Associate Administrator for Pipeline Safety or, in the case of an intrastate pipeline facility regulated by the State, the appropriate State agency. The applicable oversight agency may accept the proposal on its own authority, with or without conditions and limitations, on a showing that the operator's proposal, which includes the adjusted interval, will provide an equal or greater overall level of safety. (c) An operator may implement an approved reduction in the frequency of a periodic inspection or test only where the operator has developed and implemented an integrity management program that provides an equal or improved overall level of safety despite the reduced frequency of periodic inspections.

§ 192.1015 What must a master meter or small liquefied petroleum gas (LPG) operator do to implement this subpart?

(a) *General.* No later than August 2, 2011 the operator of a master meter system or a small LPG operator must develop and implement an IM program that includes a written IM plan as specified in paragraph (b) of this section. The IM program for these pipelines should reflect the relative simplicity of these types of pipelines. (b) *Elements.* A written integrity management plan must address, at a minimum, the following elements: (1) *Knowledge.* The operator must demonstrate knowledge of its pipeline, which, to the extent known, should include the approximate location and material of its pipeline. The operator must identify additional information needed and provide a plan for gaining knowledge over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities). (2) *Identify threats.* The operator must consider, at minimum, the following categories of threats (existing and potential): Corrosion, natural forces, excavation damage, other outside force damage, material or weld failure, equipment failure, and incorrect operation. (3) *Rank risks.* The operator must evaluate the risks to its pipeline and estimate the relative importance of each identified threat. (4) *Identify and implement measures to mitigate risks.* The operator must determine and implement measures designed to reduce the risks from failure of its pipeline. (5) *Measure performance, monitor results, and evaluate effectiveness.* The operator must monitor, as a performance measure, the number of leaks eliminated or repaired on its pipeline and their causes. (6) *Periodic evaluation and improvement.* The operator must determine the appropriate period for conducting IM program evaluations based on the complexity of its pipeline and changes in factors affecting the risk of failure. An operator must re-evaluate its entire program at least every five years. The operator must consider the results of the performance monitoring in these evaluations. (c) *Records.* The operator must maintain, for a period of at least 10 years, the following records: (1) A written IM plan in accordance with this section, including superseded IM plans; (2) Documents supporting threat identification; and (3) Documents showing the location and material of all piping and appurtenances that are installed after the effective date of the operator's IM program and, to the extent known, the location and material of all pipe and appurtenances that were existing on the effective date of the operator's program.