Simple, Handy, Risk-based Integrity Management Plan (SHRIMP)
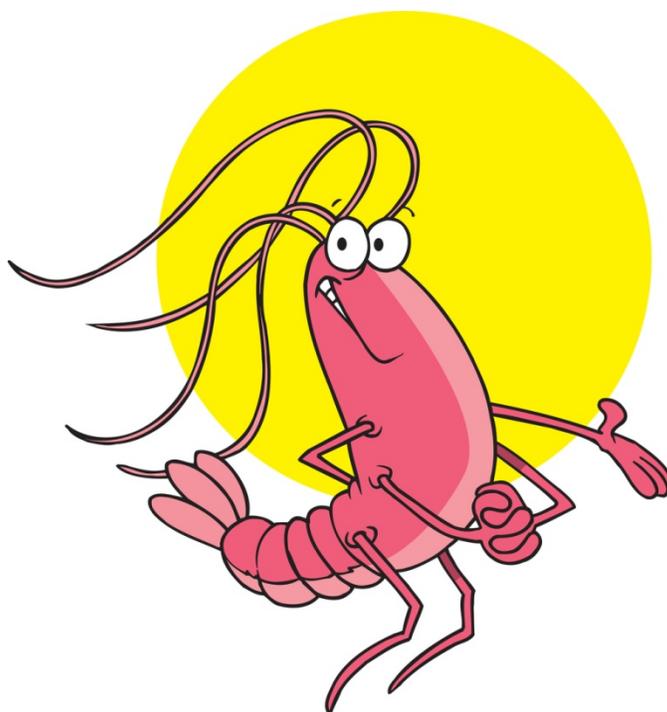
Users' Guide

Table of Contents

2

BEFORE USING SHRIMP, PLEASE READ THIS BACKGROUND DOCUMENT!

On December 4, 2009 the Pipeline and Hazardous Materials Safety Administration (PHMSA) published the final Distribution Integrity Management Programs (DIMP) rule. The rule requires each operator of a natural gas utility, master meter system or propane pipeline system to prepare and follow a written DIMP plan by no later than August 2, 2011.

The APGA Security and Integrity Foundation (SIF), with financial support from PHMSA, developed SHRIMP ("Simple, Handy, Risk-based Integrity Management Plan, an on-line tool to create a written DIMP plan that is customized for your unique system. An advisory group composed of government and industry pipeline safety experts guided the development of SHRIMP, ensuring that all the requirements of the rule are included in the written DIMP plan that SHRIMP creates for you. We are pleased that you have elected to use SHRIMP to develop your plan. This document is intended to prepare you to use SHRIMP to develop your DIMP plan.

What is "SHRIMP?"

SHRIMP is an on-line tool that creates a written Distribution Integrity Management Plan. It is much more than a model plan. It asks questions about your pipeline system inspection and maintenance history and creates a written DIMP plan ready to implement.

SHRIMP includes (bold text indicates an element required by the DIMP regulation):

- A template for a written DIMP plan, which is filled out with text, either provided by SHRIMP or text that you enter during the question and answer process;
- PHMSA Distribution Annual Report data preloaded into the program, so it already knows about your system materials of construction and leaks repaired by cause. You can edit these data or , if not found (as will be the case with master meter and LP piping systems, which do not file annual reports) enter your system data;
- A question an answer **threat identification and assessment** process including:
  - Questions that ask for specific construction, inspection and maintenance history (e.g. "**knowledge of the infrastructure**") to assess each of the eight threats required by the DIMP rule,
  - Questions that ask for information to help the user decide if subdividing the system for any threat is advisable and
  - Questions to help SHRIMP recommend one or more Additional/Accelerated Actions to address one or more threats;
- A mathematical model to **evaluate and rank risk** according to the relative risk;
- A pick list of possible Additional/Accelerated Actions ("A/A Actions") the user may choose to **identify and implement measures to address risks**;

- A pick list of possible performance measures the user may choose to **measure performance, monitor results, and evaluate effectiveness.** The 6 performance measures required by the rule are written into all DIMP plans generated by SHRIMP;
- Includes all mandatory items, such as leak management, excess flow valve installation, compression coupling failure reporting, recordkeeping, periodic evaluation and improvement and more; and
- Provisions for **periodic evaluation and improvement.**

What is a "Threat?"

A threat is something that can cause distribution pipe or components to leak. The DIMP rule requires the user to assess the following 8 threats:

1. Corrosion,
2. Natural forces,
3. Excavation damage,
4. Other outside force damage,
5. Material, weld or joint failure (including compression coupling),
6. Equipment failure,
7. Incorrect operation, and
8. Other threats not included in the above seven specific threats

What are "Additional/Accelerated Actions?"

The objective of an integrity management program is to determine if you should be doing more to address any of the 8 threats on all or just certain parts of your distribution system. The term "Additional/Accelerated Actions" is used in SHRIMP to mean actions to reduce threats that go beyond the minimum maintenance and inspection requirements of the federal pipeline safety regulations. For example, though not explicitly required by pipeline safety regulations, a utility might determine that a construction project poses an unacceptably high risk of excavation damage to a major feeder main, therefore the utility will do more than just mark the location of the main – it will conduct daily inspections of the job site to ensure the pipeline is being protected and supported and that no damage to the coating or pipe has occurred. Daily excavation inspection is one example of an Additional/Accelerated Action to address an excavation damage threat.

The SHRIMP software includes over 60 optional Additional/Accelerated Actions ("A/A Action") that the user can pick from if it is determined that more needs to be done to address any of the 8 threats on all or any portion of the users distribution system. When you pick an A/A Action SHRIMP inserts text describing the A/A Action into your written DIMP Plan. You can review the words that SHRIMP will insert into your DIMP Plan and substitute your own description in place of the pre-written SHRIMP description if you choose. You may already be doing something beyond regulatory requirements – perhaps a replacement program for bare steel, cast iron or

6

other materials. SHRIMP allows you to enter a description of these as an A/A Action that will be included in your DIMP Plan.

Why Would I Want To Subdivide My System When Using SHRIMP?
SHRIMP begins by considering your system as a whole, but you may want to subdivide it into smaller sections for the purpose of evaluating threats, ranking risks and taking A/A Actions.

The goal of DIMP is to focus resources on the problem areas – areas with a higher risk relative to the rest of the system. Some of the possible A/A Actions could be expensive – replacing pipe for instance. You don't want to write into your DIMP Plan that you will replace your entire system if only a small portion of it is higher relative risk.

When answering the questions asked by SHRIMP you find some where the answer if true for parts of your system but not for the rest. An obvious example, when considering the threat of corrosion, corrosion leaks may be occurring on your steel piping but (hopefully!) not on your plastic piping. Keep in mind that, at the end of the process, SHRIMP will create a written plan that may include Additional/Accelerated Actions to address corrosion. You want those actions to be focused on the problem area – the steel part of your system – not on the entire system, so you would subdivide your system into steel and plastic and evaluate the corrosion threat on each part separately.

Evaluating the threat of corrosion separately for different materials is so obvious that SHRIMP forces you to separately evaluate the corrosion threat for plastic, steel (further subdivided according to coated, bare, cathodically-protected and unprotected steel) and cast iron pipe. Other than that, it is up to you to decide whether you want to further sub-divide your system.

The advantage of subdividing, as mentioned previously, is that it focuses A/A Actions on the problem areas. The disadvantage is that subdividing increases the time and effort you expend creating your plan using SHRIMP and results in a longer, more complicated written plan. SHRIMP includes some questions to get information to help you decide whether or not to subdivide, but the ultimate decision is yours. Giving this some thought <u>BEFORE</u> you begin using SHRIMP will save time and avoid confusion.

Some of the questions SHRIMP will ask are:

- Are corrosion leaks, indications of metal loss due to corrosion, low pipe-to-soil potential readings, etc occurring all over or concentrated in certain localized areas?

- Is the number of ONE-CALL locate tickets and/or excavation damages spread throughout the system or concentrated in certain areas?

- Are there certain excavators that cause excavation damage more often than others?

- Are there areas in your system subject to flooding, washouts, landslides or other earth movement?

- Have you experienced a rash of failures of certain types of equipment or piping materials?

SHRIMP does not force you to keep the subdivisions you created for one threat when you begin another threat – each threat assessment starts out treating your system as a whole. You can subdivide your system one way for evaluating the threat of corrosion and an entirely different way for evaluating excavation damage.

If you are already doing something above and beyond the regulations on part of your system – a bare steel pipe replacement project, for instance – it probably makes sense to treat that part of your system as a separate section when evaluating the corrosion threat. Or, if you are replacing part of your system made of a type of plastic pipe prone to brittle cracking, that should be treated as a separate segment when assessing the threat of material, weld or joint failure.

Some A/A Actions are relatively inexpensive, or aren't practical on small areas. If, for example, at the end of the SHRIMP process the A/A Action chosen is to increase leak survey frequency, it may be just easier and no more expensive to conduct the more frequent surveys to a fairly large area rather than in just a few isolated areas within the system.

What Records Must I Have To Use SHRIMP?
SHRIMP was designed to create a DIMP Plan using information from construction records and gathered from inspections and maintenance activities required by federal and state pipeline safety regulations, such as leak surveys, pipe-to-soil potential measurement, exposed pipe inspections, leak repair records, etc. Appendix A lists the specific records required for each threat assessment that you should have available before trying to use SHRIMP. It also describes how SHRIMP will ask you to sort some of your inspection and maintenance data.

Procedures for developing and implementing DIMP elements using SHRIMP

Creating a written DIMP Plan using SHRIMP should follow the steps shown in the SHRIMP process diagram. Each step should be completed before moving on to the next step. These steps are described in detail later in this Users Guide.

SHRIMP PROCESS DIAGRAM

Enter/confirm system info

Select Settings

Complete threat interviews

Validate Risk Rankings

Select Additional Actions*

Select Performance Measures

Create Implementation Plan

Download Plan

Step 1: Enter/confirm system information

If you are a public utility your system probably filed a Distribution Annual Report (Form 7100.1-1) and you should find your 2009 system data already entered into SHRIMP. This is not be the most current data – at the time SHRIMP was created only the annual reports for 2009 were available. This information is shown only to allow you to confirm that this is your system – it is not used for any other purpose in SHRIMP.

If you are a master meter or LP piping system operator that is not required to file annual reports, or your annual report is missing from PHMSA's database, you must enter the data manually.

Step 2: Select settings

The next step is to enter settings for your plan. These include:

- The name of your system as it will to appear in the written plan,

- A description of what part of your system this plan covers (default is entire system),

- Whether you are a utility, master meter or LP-piping system. (There are different recordkeeping requirements for master meter and LP systems),

- The effective date of the plan (for your first plan this should be no later than August 2, 2011 as required by the DIMP rule),

- The History Period – Some of the threat assessments ask for past data on leak repairs and excavation damage. You enter here is how many years back you will enter such inspection and maintenance data. The default and minimum is 5 years and but you can change this to up to 10 years if you have the data. More years data = better DIMP plans.

- A LEAK management policy – Either select one of the two pre-written options in SHRIMP or if you already have a leak management plan that meets the rule's requirements enter a cross reference to that policy, and

- A program re-evaluation period, anywhere from 1 to 5 years.

- The identity of the pipeline safety agency that audits your regulatory compliance.

You can go back and change these at any time by clicking on the Required Settings link in the menu bar on the left side of SHRIMP screens

Step 3: Complete threat interviews

SHRIMP uses an interview process to assess each of the eight threats required by the DIMP rule. The 8 threats are:

1. Corrosion

2. Equipment Malfunction

3. Incorrect Operations

4. Material, Weld or Joint Failure

5. Excavation Damage

6. Natural forces

7. Other outside forces

8. Other Threats

Some of the threats are broken down into two or more subthreats. You must complete each threat and subthreat interview before going to Steps 4 and beyond. You can go back and change any of the information you provide in the threat interviews. Make changes, but you may have to re-complete other interview questions if your change affects answers to later questions. This is described in more detail later in this users guide.

NOTE: You can complete the first seven threat interviews in any order, however you MUST complete the first seven interviews before attempting to complete the "Other Threats" interview. The answers you provide in the Other Threats interview depend on the answers you provided in the other 7 threat interviews.

The threat interviews are intended to satisfy the following two requirements of the DIMP rule: Section 192.1007 (a) Knowledge and (b) Identify Threats. These requirements and the procedure followed by SHRIMP are further described in an attachment to this document.

Step 4: Validate Risk Rankings

After all 8 threat interviews have been completed SHRIMP will rank each threat and section by relative risk, from highest to lowest, based on a numerical model that considers the likelihood and consequences were a segment of your system to fail due to the threat. A complete description of this risk ranking model is found in an appendix to this user's guide and an attachment to your written DIMP Plan created by SHRIMP.

The risk ranking validation process is intended to satisfy the following requirement of the DIMP rule: Section 192.1007 (c) Evaluate and rank risk.

Step 5: Select Additional Actions

After you are satisfied that all threat-sections are ranked in the correct order, the next step is to select additional actions you will undertake to reduce those threats. "Additional actions" means actions above and beyond what is required by pipeline safety regulations. Other than implementing a leak management program, the DIMP rule does not presume that any further additional actions are necessary. You must decide whether any of the threats pose a level of risk that warrants additional action. SHRIMP cannot make that determination. There is additional guidance on selecting additional actions in the additional actions section of this user's guide.

SHRIMP offers at least one additional action for each threat. This step is intended to satisfy the following requirement of the DIMP rule: Section 192.1007 (d) Identify and implement measures to address risks.

Step 6: Select Performance Measures

The next step is to select performance measures for each of the additional actions you selected in Step 5. If you didn't feel any threats warranted additional actions you can skip this step. This is not required for master meter and LP-piping operators.

This step is intended to satisfy the following requirement of the DIMP rule: Section 192.1007 (e) Measure performance, monitor results and evaluate effectiveness.

Step 7: Create Implementation Plan

Now you are ready to review the actions required to implement your written DIMP plan. All of the actions required by the rule or selected by you in the additional actions and performance measures steps can be displayed by clicking on "Implementation Plan" in the left-side menu. The Implementation Plan should answer the questions of Who, What, When, Where and How each required action will be accomplished. Action items in your written DIMP Plan can be summarized in the following areas:

1.   Describing how you will modify your procedures, policies and recordkeeping system(s) as necessary to collect and retain information required to be collected and retained under the DIMP

plan, including mandatory performance measures and performance measures you selected in the previous step, and

2.   Describing how you will implement any Additional/Accelerated Actions that you included in your written DIMP plan.

3.   Describe how, during the normal course of business, you will gather any information that was unknown to you during the threat assessment process.

Each action item will be listed separately with a text box in which you must enter a description of how you will accomplish this action.

Step 8: Generate and download your written DIMP Plan

When you are satisfied that Steps 1-7 are complete you should download your written DIMP plan to your computer.

Step 9: Implement the action Items in your DIMP Plan Just like all the other plans required by pipeline safety regulations, you must follow your plan exactly as written. Failure to follow through on actions in your written DIMP plan can result in fines and other penalties. You must maintain records to demonstrate that you are following through on each action item listed in your written DIMP Plan. You must have these records and your written plan available for review by your state (or federal, if you are under federal jurisdiction) pipeline safety inspectors. At this time there is no need to submit your written DIMP plan to either the state or the federal OPS.

Getting Started

Open your internet browser and log on to SHRIMP at:

http://shrimp.imp-tools.com/

Enter your user name and password, then a screen like this will appear:

Email Support: If at any time you encounter problems using SHRIMP or have questions not answered in this user's guide, click "email Support," which will open your email software to send an email message to the SHRIMP help desk. When you use "email Support," SHRIMP automatically includes information about where you are in the program that assists our help desk to pinpoint the source of your problems or questions.

Add New System: If you are a master meter or LP system that is not required to file annual reports, or for some reason your annual report is missing, you will have to create a new system by clicking on the Add New System button. Also, if you want to create separate DIMP plans for different portions of your system (e.g. different districts, or for master meters, different locations) you would use "Add System" to create another, separate written DIMP Plan

13

If you choose to create a new system (or if this is the first time the system you selected has been accessed by any user) you will eventually get to the following screen:

Operator Name is your system name as it appears in the PHMSA database. It cannot be changed, but also is not used for any purpose by SHRIMP. If you want to use a different system name in your written plan enter this name in the box labeled "System Name." You can go back and change it at any time.

Enter a description of the portion of the system to which this plan will apply. If you are writing one plan for your entire system, leave it as "entire system." If it is only for a portion of your system, describe it so you and other users of this DIMP plan will know what portion this Plan applies to. What you enter here will be written into the Scope section of the written plan.

Select the state in which your system operates. If your system operates in more than one state we encourage you to consider creating separate plans for each state.

IMPORTANT: Once you begin creating a written DIMP Plan using SHRIMP you can stop at any time and your data entered up to that point will be saved, but data entered on the current page will be saved **ONLY IF** you click on the NEXT button at the bottom of the screen before logging off. Even if you think you will be away from the computer only a short time, click on NEXT even if you're not finished with data entry on that page – you can always go back and continue where you left off. If there is no activity for a period, SHRIMP will disconnect you and you may lose any data you entered on that screen if you didn't click on NEXT

Enter/Confirm Annual Report Data

Depending on whether or not your system was in PHMSA's annual report database the next several screens will ask you to enter or confirm data about your system and its distribution piping. If data exists for your system, but you are creating a plan for a portion of that system you will have to change the data to reflect just that portion of your system for which this plan will apply. Instructions explaining annual report information are attached to this users guide.

NOTE: Once you begin entering the new system data or begin reviewing the system data for the first time, SHRIMP will require that you answer each question until all the data is entered or

reviewed. It is OK to stop in the middle of the questions to logout but SHRIMP will continue the questioning any time you choose to continue until all questions are answered.

Error Messages

If at any time you get an error message such as this:

Fatal error: Uncaught exception 'Zend_Db_Statement_Exception' with message 'SQLSTATE[42000]: Syntax error or access violation

Send an email to email support by clicking the email Support button in the Menu Box.

Choose Your System

If you included your system name when you signed up for SHRIMP, or you are returning to SHRIMP after already having set up one or more systems, SHRIMP may skip this screen and take you directly to a list of your systems, as shown below:

SHRIMP will list all the systems you have created under this user name, the Plan Year, the Version Number and the Status of the Plan

Plan Year means the last year that leak repair and other trending data was considered in the Plan.

Version is the number assigned by SHRIMP to your Plan. This is explained later in this guide under Plan Revisions

Status is the mode that you will be in if you select Manage.

Click on the radio button next to the Plan you wish to work on. Then:

Click on <u>Manage</u> if you want to begin or continue working on the Plan

Click on <u>Plans</u> if you only want to view any of the written Plans, but not make any changes to it.

Click on <u>Delete</u> if you want to permanently delete this System. Once you delete a system it is gone forever – it cannot be recovered.

If you clicked on <u>Plans</u>, this screen will appear:

It shows all the versions of Plans for this system that have been generated by SHRIMP, with the most recent at the top and plans that have been superceded by more recent plans listed below. Previous plans have been archived and can no longer be revised. This is explained in more detail under Plan Revisions. Plans can be stored in a MS WORD compatible format, as an Adobe Acrobat file, and/or as a web page.

Written Plans

Choose Written Plan To View Or Download

Guidance

This is a list of all the plans archived for this system.

The data shown reflects settings in effect when the plan was generated.

- Year is the Plan Year.
- Version is the Plan Version.
- Effective is the Plan Effective Date.
- Mode is the Edit Mode being used when the plan was generated.
- Created is the date the written plan was created.

Year	Version	Effective	Mode	Created	Click To Show		
2011	2.1.2	2012-10-01	Correct	2012-10-12	Web	PDF	Word
2011	2.1.1	0000-00-00	Finalized	2012-10-01	Web	PDF	Word
2009	1.1.1	0000-00-00	Finalized	2012-09-18	Web	PDF	Word
2009	Legacy Version	0000-00-00	Finalized	2012-09-18	Web	PDF	Word

If you click <u>Manage</u> the following screen may appear:

Please define a version number for this system?

- The current version is **none**.
- You may use your own version numbers.
  Enter the version number here:

  Use My Version
- You may let **SHRIMP** manage version numbers.
  This wil be version 1.1.1
  Use SHRIMP Version

Version Numbering in SHRIMP

You may create your own version numbering system or use SHRIMP's version numbering system. SHRIMP's numbering system is as follows:

When you first create a Plan, it is assigned Version Number 1.1.1

If you make minor editorial changes to text using SHRIMP's "Correct" mode (Explained in more detail in the Plan Revisions section of this guide) the corrected plan is given version number 1.1.**2**.

If you use SHRIMP's "Revise" mode, which allows text revisions and changes to threat assessments, risk rankings and all other sections of your plan, the new plan is given Version number 1.**2**.1

If you use SHRIMP's "Re-evaluate" mode to perform a complete, comprehensive review of your DIMP plan, the resulting plan is given a version number **2**.1.1.

16

WARNING – Once you choose to Correct, Revise or Re-evaluate, you may not switch to one of the other change modes until you have completed changes in the mode you selected and generated a new written plan. When you re-enter your plan the only option will be to Resume the mode you were in when you last exited SHRIMP.

When will SHRIMP show the Define Version screen?

SHRIMP will ask you to define a version number whenever SHRIMP cannot determine what a new version number should be. This will always happen when you start a new system. This will also happen when you first start using this version of SHRIMP with systems started on the previous version of SHRIMP.

If you choose to allow SHRIMP to manage version numbers when first asked for a version number, SHRIMP will automatically create an appropriate version number whenever you choose to correct, revise or reevaluate your system. You will not be asked to enter a version number.

If you choose use your own version numbers, SHRIMP will ask you for the next appropriate version number whenever you choose to correct, revise or reevaluate your system.

Plan Revision Modes

SHRIMP offers 5 modes for revising and/or viewing your written plan.

Review allows the information for the current plan to be reviewed. SHRIMP will NOT allow changes to any data. The version will remain the same.

Correct allows minor text changes within the current Plan. Minor changes include: Data sources may be changed, but data and answers to interview questions may not be changed, implementation plan text may be changed, user entered text may be changed. A new version number will be created (1.1.1 becomes 1.1.2). A copy of the previous plan will be archived.

17

Choose how to proceed with this system?

| Resume | Review | Correct | Revise | Reevaluate | New Leaks | Revert |

Revise allows any entry to be revised, but does not require a complete plan re-evaluation. SHRIMP will allow changes to all data including the threat assessments, risk ranking, choices of AAs, choices of PMs. The old plan is archived and the new plan assigned a new version number (1.1.1 becomes 1.2.1). SHRIMP will track and record changes from the replaced version in Chapter 11.4 of the revised Plan. You will have the option to change the Plan Year to any year up to, and including, the most recently ended year. If you so choose, SHRIMP will then begin using any leak data entered covering this new plan year and any other prior years.

Choose how to proceed with this system?

| Resume | Review | Correct | Revise | Reevaluate | New Leaks | Revert |

Reevaluate begins the process for conducting the required, periodic, complete plan re-evaluation as described in Chapter 8.0 of your Plan.

You must review and either correct or confirm all threat assessments, risk rankings, assignment of AA's and PM's and the implementation plan. All sections will be tagged "incomplete" until you open those screens and confirm or correct your choices. Please read the User's Guide for details of this process. The major version number would change (1.1.1 becomes 2.1.1). SHRIMP will archive a copy of your existing Plan.

When you choose to reevaluate your system, SHRIMP will change the plan year to the most recently ended year. SHRIMP will then begin using any leak data entered covering this new plan year and any other previous years.

SHRIMP will track and record in Chapter 11.4 of the revised Plan changes from the prior version.

Choose how to proceed with this system?

| Resume | Review | Correct | Revise | Reevaluate | New Leaks | Revert |

New Leaks allows new leak repair and other trending data to be entered and stored in SHRIMP without requiring that the Plan be updated to consider this new data. The version number would not change. Leak data for years after the "Plan Year" may be entered without affecting the plan information. SHRIMP will NOT use this data until you choose to revise or reevaluate your plan to consider the new data. You will not be allowed to view or change any other data.

Edit is an additional Revision Mode that is chosen automatically by SHRIMP when there is no prior data available for comparison. This mode is chosen when you create a new system or when using your existing system for the first time with this version (Version 2) of **SHRIMP**. It is the same as **Revise** mode except that **SHRIMP** will not track and record changes.

If your system is in **Edit** mode because you are using your system with the new version of **SHRIMP**, it is recommended that you ensure your plan is complete and generate a Final Plan as soon possible. This will enable **SHRIMP** to begin tracking revisions.

System Overview

This is the main screen that you will come back many times during the course of developing your plan. It lists summary data about your system and the status of the threat assessment. You can return to this page from anywhere in the program by Clicking on System Overview in the left menu box.

(To save space only 3 threats are shown above) Threats will be flagged as unstarted, incomplete or completed. Some threats have subthreat assessments. Under Corrosion, for example, are subthreat assessments of external corrosion, atmospheric corrosion and internal corrosion. External corrosion is further subdivided by type of metal, coated or bare and cathodically-protected or not. Subthreat assessments are created based on data you provided or confirmed in your annual report. If there are subthreats under a threat a + sign will appear just before the threat name. Click on the + to open the subthreats.

Click on "begin" to start the interview process for one of the first seven threats. For reasons that will become obvious later, wait until the other 7 threat assessments are complete before beginning the interview for "Other threats"

19

Once you have begun a threat interview the System Overview Screen will display the following options:

Clicking on "Continue" will take you to the first incomplete interview page for this threat or subthreat.

Clicking "Review" will display an Interview Report of the threat assessment, displaying the questions and answers provided by the user to each question and the weighting that SHRIMP's risk ranking model applies to this threat based on those answers. If you want to go back and change any answer in the threat assessment interview, that can be done by clicking "Review" to display the screen shown below.

The Interview Report includes a hyperlink for each question, highlighted in blue that, when clicked, will take you to that question screen in the threat assessment interview process. You may change your answers. Everything prior to where you return to the interview will remain unchanged, but changing your answers may affect answers to questions asked later in this threat assessment interview. For example, if you change the number of corrosion leaks for one

20

or more years and that change results in SHRIMP's statistical analysis now finding that corrosion leaks per mile are increasing over time, you will be asked additional questions that would not have been asked had leaks not been increasing.

 "Refs" is short for references and will display anything you have entered in the Data Source fields in this threat interview.

The Left-Side Menu Box

System Overview
Incomplete Sections
Entered Leak Data
Risk Ranking
Implementation Plan
Threat Summary
Leak Repair Summary
Manage Operator AAs
Manage Operator PMs
Sections By Threat
All Data Source Refs
Reports
Required Settings
Add Text
PHMSA 7100.1-1
Written Plans
Preview Plan
Finalize Plan
SHRIMP Help
Resources
Background
Users' Guide
Announcements
email Support

On most screens a menu box such as this will appear on the left side of the screen. This can be used to navigate to other sections of the program or to bring up helpful reference materials.

System Overview is the main page in SHRIMP. It shows all the threat assessments that are completed, in progress or not started.

Incomplete Sections provides a status report on tasks that are yet to be completed in developing your DIMP plan. This is a very important report as you cannot consider your plan ready until there is nothing listed as incomplete in this report. This report will also contain "links" that will take you to whatever items need completion.

Entered Leak Data provides a listing of all trend data you entered in tables in each of the threat assessments, such leaks, failed drug tests, # of locate tickets, etc.

Risk Ranking displays a summary of all the threat assessments by section, listed in descending order of risk based on SHRIMP's risk-ranking model and any adjustments the user has made to the order of various threat-sections. You can also select Additional/Accelerated Actions (AAs) and Performance Measures (PMs) for any threat or section from the Risk Ranking screen.

Implementation Plan displays all the action items listed in your plan including both mandatory items from the regulation and items that you selected or entered. You should enter the names and/or titles of those responsible for completing each action item, a schedule for beginning and completing the action and other information describing how the action will be accomplished.

Threat Summary is a summary of the answers the user provided during the threat assessment process.

Leak Repair Summary displays the number of leak repairs for this system by cause for the last 5 years with the total for all distribution systems in the PHMSA database. If your system has had more than 50 leak repairs over the past 5 years the SHRIMP risk ranking model boosts the riskl score for each threat by the percentage of leak repairs on your system for that threat. If you have had fewer than 50 leak repairs SHRIMP uses the national averages rather than your system data in the risk ranking model.

Manage Operator AA's displays Additional/Accelerated Actions that have been created by the user. Additional AA's can be entered on this screen.

Manage Operator PM's displays Performance Measures that have been created by the user. Additional PM's can be entered on this screen.

Sections by Threat is a summary of threat-sections created during the SHRIMP threat assessment process along with any AA's and PMs selected by the user for that section.

All Data Source Refs displays all the notes the user has entered in the Data Source text boxes during the interview process.

Required Settings allows the user to view and/or change the system name as it appears in the plan, the system description and the selections for LEAKS, EFVs, and program re-evaluation period.

Add Text allows you to insert your own text into any chapter of your SHRIMP written plan.

Form 7100.1-1 will display the PHMSA Distribution Annual Report (Form 7100.1-1) for the system.

Written Plans will display any existing written DIMP plans for the system – your current plan as well as archived plans. Written plans can be in any or all of three formats: Web-based (html), Adobe Acrobat (pdf) and/or MS WORD (doc).

Preview Plan allows you to view what a new or revised plan would look like while you are still working on it. Initially, the written DIMP plan will consist of headings with little or no text underneath, but as the user completes the steps in creating the plan, these blanks will be filled in with text selected from SHRIMP or entered by the user. At anytime your can go to Preview Plan and view the changes that have resulted from information you have just entered.

Finalize Plan creates a written plan that will supercede any prior plans. Before finalizing your plan be sure to check that there are no incomplete sections (see Incomplete Sections menu command above), review Required Settings, select an Effective Date and provide Version Notes.

From there you will be able to generate the plan in various formats including as a web page on your screen or as a Microsoft Word file which may be downloaded to your computer.

Resources provides helpful links to other resources such as PHMSA's DIMP webpage and PHMSA's frequently asked question page**.**

Background displays this users' guide's opening comments about DIMP and records needed to complete the threat assessments.

User's Guide displays this users guide.

Announcements displays current announcements from the SHRIMP development team. These will be displayed each time you log onto SHRIMP.

Email Support allows you to send an email with questions, comments, concerns, etc to the SHRIMP support technical team.

The NEXT button is extremely important!

The information you enter on any page is not saved until you hit this button. On a question with one or two choices this is no big deal, but on the pages that ask for a lot of information, such as the tables of leak history, losing data you have entered may be frustrating. If you have to stop in the middle of entering data on a screen, if you are inactive for long you may be timed out and lose connection with SHRIMP. To be on the safe side, if you have to stop to do something else, hit the NEXT button, even if you haven't finished data entry. You can always come back and continue entering data where you left off.

Also, changes to the written plan as the result of choices you have made on a screen are not made until you hit the NEXT button. For example, at the end of a threat assessment you will see a screen that says "Interview Complete." The results of that threat assessment are not made to the written plan until you hit NEXT. If want you open the written plan to view its current state hit the NEXT button first.

Interview Start
Each threat assessment will begin with an interview start page that lists the records that you should have available before beginning this threat assessment. A complete list of records required by each threat assessment is included as Attachment A to this document.

Initially each threat assessment will treat your system as one section and you should answer questions thinking about your entire distribution system, or whatever you entered as the System Description in the System General Information (SYSD101) screen. One exception is corrosion, where SHRIMP requires that you separately assess the risk to different materials of construction that may exist in your system. Later in the interview you will be asked to decide whether it makes sense to treat some portions of your system as separate sections for this threat. A discussion of reasons to subdivide your system can be found in the beginning of this guide.

Typical SHRIMP Interview Screens

The following shows a typical interview screen in a SHRIMP threat assessment. It asks a question and provides choices for answers and/or space for the user to enter data or text, but there is much more on these screens.

25

System Name, Threat and Section Information are displayed to remind the user what portion of the system this question is being asked about. When answering questions always look to this section of the screen so that the answers provided are limited to the portion of the system listed on the screen. You cannot edit this information on this screen.

Guidance will be provided for most question screens to help the user understand exactly what information SHRIMP is asking for.

Data Source provides the user a way to record information about the source of the data that was used to answer this question in SHRIMP. It can be a reference to the location of the records that were reviewed while answering this question, but it can also be used to store any

26

information that the user believes will be helpful to future users when reviewing or updating the answers to this question.

Data Source:

PHMSA has published FAQ's (Frequently Asked Questions) which state that "the written integrity management plan must contain a list of the sources used to demonstrate an understanding of the gas distribution system including documents, records, and information obtained from subject matter experts. These sources are used to identify the characteristics of the pipeline's design, operations and environmental factors that are necessary to assess the applicable threats and risks to the distribution system. The information about the sources should include the name of the documents, the time period covered by the documents, and the location and format (e.g. electronic, paper, or subject matter expert interview, etc.)." The rule is not so specific about data source documentation, however this is good insight into what regulators may expect as far as data source information. We encourage you to read the FAQ's if you have questions – a link to the FAQ's is under the "Resources" button (circled) on SHRIMPs left menu.

Data Entry Screens

In many of the threat assessment interviews the user is asked to enter historical data on leak repairs, locate tickets and other inspection and maintenance data. An example is shown below.

Threat Assessment
Corrosion
Kastanasburg Utilities
Enter Section Description

Corrosion (CORR)

How many leak repairs resulting from corrosion occurred by year for the last 5 years? (CORR-Leak)

Guidance
The information in the table shown was imported from your PHMSA 7100.1-1 Annual Report. If this is incorrect you may make changes to the table.

Leak Repairs From PHMSA 7100.1-1

End of Year	Corrosion		Totals	
	Mains	Services	Mains	Services
In 2005	0	0	0	0
In 2006	0	0	0	0
In 2007	0	0	0	0
In 2008	0	0	0	0
In 2009	0	0	0	0

Five years' data is the default, but you can change how many years' data SHRIMP will accept in the Required Settings screen.

On some screens SHRIMP will already have entered some data if that data was found in PHMSA's Annual Report database. You should confirm that these data are correct and make any additions or changes.

Sometimes SHRIMP will be asking for records for the entire system and other times it will ask for records for just one section of the system. A description of the section will appear at the top of the screen. It is important that you look at this information when entering data to ensure the data you enter is the right information for that particular section.

SHRIMP asks for these data to determine if there is a statistically significant upward or downward trend. SHRIMP uses the Mann-Kendall trend test to identify trends. The result affects both the risk score for the section and the follow up questions that will be asked.

Subdividing Your System

The DIMP rule states that "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." 49 CFR 192.1007(c). You do not have to subdivide your system, but if there are portions with similar characteristics and for which similar actions would be effective in reducing risk, there are advantages to subdividing.

First and foremost, if you determine additional actions are necessary, some additional actions can be expensive, so you would want to limit those actions to the problem areas.

Whenever you begin a new threat assessment SHRIMP begins by asking questions about your system as a whole. Unless any of the 8 threats is a non-issue on your entire system, at some point you will have to decide whether or not to subdivide your system into sections that will considered separately for the threat assessment. You should subdivide the system into regions with similar characteristics and for which similar actions are likely to be effective in reducing risk.

Threat Assessment

Corrosion	-> Atmospheric Corrosion
Kastanasburg Utilities	-> Kastanasburg Utilities
Enter Section Description	-> Enter Section Description

Atmospheric Corrosion (CORRAC)

Enter sections or facilities of concentrated atmospheric corrosion (CORRAC112)

Guidance
- Define sections of your system to be individually assessed for this threat later.
- The totals at the bottom have been set to the totals for this overall threat.
- The totals for your sections must always add to the same totals for this area being sectioned. In order to make this easier for you the amounts for the first section, on the top line, will be automatically adjusted so that the totals are correct. Unless these amounts become negative, they represent any amount which has not been included in the other lines. If the top line amounts become negative, you should adjust the other sections accordingly.
  Think of the top line as "**the rest of your system.**"
- You may not make changes in any of the grayed boxes.
- Be sure to enter meaningful names (the first column) and descriptions (the last column) for each section including the section on the top line.
- Only sections, including the top one, that have non-zero amounts will be considered for later assessment.

Section Facility	Mains	Services	Description
Rest of system	63.900	4055	Remainder of system
Meter sets near ocean	10.000	800	Meter sets within 1 mile of the
4th street bridge crossing	0.100	0	Pipe on 4th St bridge
ConcAtmo 03	0.000	0	

Subdivisions in SHRIMP may be geographic (e.g. in the downtown business district), by material (bare, unprotected steel, PE 3306 plastic, etc), by equipment type, by utility or contractor crew (for excavation damage), by task (for incorrect operations) or any other manner that groups things with similar risk profiles together.

Subdividing is done by creating two or more sections in a table like the one shown to the left. In this example the user knew that atmospheric corrosion was occurring more frequently on meter sets located near the ocean, perhaps due to salt water in the air. The user also knew the gas main hanging below the 4th Street Bridge had a history of atmospheric corrosion problems. The user created 3 named sections – the third being the remainder of the system. Enter the name for the section as you want it to appear in your written plan. The name should be something that makes sense to you,

that you can identify exactly what parts of your system are included in that section. Some threats will ask for miles of main and # of services within each section – others (e.g. atmospheric corrosion) will ask for the count of facilities in the section. In just about all sectioning screens, the top row is reserved for "the rest of the system" meaning those portions of your system that are not having problems with the threat that is being considered. In these cases the top row will show the total miles of main and # of services in this portion of your system and, as you create new sections on the rows below, the miles and service count you enter in those sections will be deducted from the top row.

The description field is for a more detailed description of the section, which will also be included in the final written plan. You should enter a description that

If you create subsections for any threat, you will then go through all the threat assessment questions for each of the sections and a separate subchapter for each section will be included in the threat assessment chapter of your written plan.

When you move on to another threat you will start with the entire system being treated as one section again. The subsections you create for one threat do not have to be treated as subsections for any of the other threats. In most systems it would be pure chance if the same portions of the system had similar risk characteristics for more than one threat – say excavation and external corrosion.

Risk Ranking

After threat assessments have been completed the next step is risk ranking. SHRIMP uses an index model developed by the development team that assigns a numeric score to the answers provided by the user during the threat assessment process. A description of the risk ranking model is included in Appendix B of this guide.

Click on Risk Ranking in the SHRIMP Menu Box to go to the risk ranking screen.

Threat-segments are displayed in descending order with the highest relative risk threat-segment at the top of the page.

The four components of the relative risk score are shown.

A brief description of the factors that led to the relative risk ranking shown in bullets.

If the user rearranged the order of relative risk for the segment, an explanation of the factors justifying this action is displayed. This explanation is created by the user whenever the user elects to move a threat-segment to a different order than originally assigned by SHRIMP. More on this below.

The risk ranking screen also contains links to Choose AA's (Additional/Accelerated Actions the operator will implement on this segment to address the identified threat) and Choose PMs (threat-specific Performance Measures). If AAs and/or PMs have already been selected, they will be displayed as shown above.

VALIDATING RISK RANKINGS AND MOVING THREATS HIGHER OR LOWER

A critical step in developing your written DIMP Plan is validating the results of the risk ranking. "Validating" means comparing the results of the SHRIMP risk ranking model with what you, as the operator of system, believe are the highest risk areas in your system. Before you began developing your DIMP plan you probably had a sense for which parts of your system, if any, were relatively trouble-free and which parts required extra attention. You undoubtedly know more about your system than SHRIMP will ever know, even though SHRIMP attempts to ask all the relevant questions that affect the probability and consequences of a failure of your system due to any of the 8 threats. If you disagree with the relative rankings produced by SHRIMP it is most likely because you are aware of factors that SHRIMP did not consider.

At this point you should review the relative risk rankings produced by SHRIMP and the explanation for that ranking listed in the bullets under the threat-segment. If you agree with the relative risk ranking you can leave them unchanged, but if you believe one or more threat-segments are higher or lower in the list than they should be, you should move them.

Some threat-segments may not be ranked. If you created any threats under "Other" threats, for instance, SHRIMP cannot rank them because the threat assessment does not include any probability for consequence questions. You must manually move these threat segments into the list where you believe the relative risk of these threat-segments should be. Follow the steps below to place these threats somewhere in the list.

To move a threat segment higher or lower on the list, type into the User Rank box the number where you believe the threat-segment should be in the list. If you type "1" the threat segment will be moved to the top of the list and every other threat-segment pushed down one rank. If you type "7" it will be inserted in the 7th place on the list and threat segments 7 and below will be pushed down one rank.

Anytime you move a threat-segment you must enter an explanation of the factors that led you to believe the threat-segment justified a higher or lower rank on the list. For example in the

30

example shown above, the user moved the threat segment of atmospheric corrosion on a bridge crossing to #1 because of its proximity to a school and hospital which could lead to higher consequences should it break.

Your explanation will be written into your written DIMP plan created by SHRIMP so that the reasons for your decision are recorded.

Selecting Accelerated/Additional Actions (AA Actions)

Once you are comfortable with the order your threat-segments are ordered, you must determine which threat-segments have relative risk ranks justifying Additional/Accelerated Actions (AA Actions). As described earlier in this guide, AA Actions are actions to minimize a threat to distribution integrity above and beyond what is required by pipeline safety regulations

Actions not required by regulations might include:

- Pipeline replacement

- Inspection of 3rd party excavation sites

- Inspection of areas of erosion after significant rainfall

AA Actions could also include increasing the frequency of inspections or other activities above what is required by regulations, such as:

- More frequent leak surveys

- Additional public awareness activities

You do not have to select AA Actions for every threat segment. You should select AA Actions for those threat segments that you decide have a high enough relative risk ranking to merit additional actions to reduce the risk. For some threats SHRIMP will strongly urge that AA Actions be taken based on answers you provided to certain "threshold" questions during the threat assessment process. For example, if during the external corrosion threat assessment you answered that external corrosion leaks were increasing, that exposed pipe inspections found evidence of metal loss or that you were having difficulty maintaining pipe-to soil potentials above criteria, SHRIMP will urge that AA Actions be selected for that threat-segment. Not all threats have threshold questions, however, and the ultimate decision whether or not ot select AA Actions for a threat-segment resides with you the user.

For every threat except "Other," SHRIMP offers at least one possible AA Action you can choose,

	User Rank	Relative Risk Score	Probability Score	Consequence Score	Leak Cause Factor	Incident Probability Factor
1	2	12	10	1.2	1	1.00
	Explanation:	There is a school and hospital near this bridge crossing				

Section: 4th street bridge crossing portion of Kastanasburg Utilities portion of Kastanasburg Utilities
Threat: Corrosion -> Atmospheric Corrosion -> Atmospheric Corrosion
Description: Pipe on 4th St bridge
Ranked here, in part, for the following reasons:

- Operator overrode ranking with this explanation: There is a school and hospital near this bridge crossing
- Repaired atmospheric corrosion leaks are increasing.
- Atmospheric corrosion leaks have occurred.
- Inspections have found problems with above ground pipe coatings that could not be fixed by routine maintenance

To address the threat of atmospheric corrosion on the entire system on the 4th street bridge crossing, Kastanasburg Utilities will take the following action(s): **Choose AAs**

- relocate piping or facilities

which will then insert some pre-written text into the appropriate places in your written DIMP plan.

To display a list of possible AA Actions for a particular threat-segment, click on "Choose AA's" from the risk ranking screen.

That will cause a screen as shown below to appear, listing 3 categories of possible AA Actions.

```
1. Kastanasburg Utilities -> Kastanasburg Utilities -> 4th street bridge crossing
   (Corrosion -> Atmospheric Corrosion -> Atmospheric Corrosion)
   (Enter Section Description -> Enter Section Description -> Pipe on 4th St bridge)
        ◦ Mains: 0.100; Services: 0.000;
        ◦ Threat: CORR; Probability: 10; Consequence: 1.2; Leak: 1; Incidence: 1.00;
        ◦ User Rank: 2; Score: 12;
   To address the threat of atmospheric corrosion on the entire system on the 4th street bridge crossing,
   Kastanasburg Utilities will take the following action(s):
   Only those checked will be included in the plan.
        ◦ Based on the answers you provided to the threat assessment questions, SHRIMP suggests you consider
          one or more of the following Additional/Accelerated Actions:
          ☐ perform leakage surveys on an accelerated frequency of ◉ Weekly ○ Monthly ○ Semiannually ○
          Annually ○ Longer on this portion of the distribution system.
          ☐ rehabilitate the pipeline coating by removing/replacing the coating or making significant repairs or
          improvements to the coating. The Kastanasburg Utilities will rehabilitate [      0] miles) (and/or
          [      0] services) per year of this portion of the distribution system
          ☐ replace/rehab [      0] miles (and/or [      0] services) per year of this portion of the
          distribution system.
          ☑ relocate piping or facilities
        ◦ The following Additional/Accelerated Actions are also offered:
        ◦ Operator Additional/Accelerated Actions
          ☐ When corrosion is found on the meter then a paint meter or replace meter order is issued
          ☐ When corrosion is found on the pipelines hung on bridges then it is recorded and a determination is
          made by engineering for repair
          ☐ When corrosion is found in the station then the segment is painted.
          ☐ When corrosion is found on main pipelines ( Valves and vaults) then an order is issued to paint
          ☐ Meter sets will be checked for atmospheric corrosion during the yearly leak survey
   ─────────────────────────────────────────────────────────────────────────────
   Save Changes and Go To ...
   [ Manage Operator AAs ]
```

Listed first will be one or more AA Actions that SHRIMP has determined are most likely to address the problems you identified during the threat assessment. This is based on the collective expertise of the SHRIMP Advisors, who reviewed the possible combination of answers to the threat assessment questions and developed the list of AA Actions most likely to held.

Listed next are other possible AA Actions that could address this threat, but which are not recommended because answers you provided during the threat assessment process indicated these AA Actions were not likely to resolve the problems you are experiencing.

Lastly, though not shown above, will be listed AA actions that you have created to address this threat. You can always create your own AA Actions and select those rather than one of the pre-written AA's in SHRIMP. This is particularly useful if you are already taking additional actions to address a particular threat-segment. For instance, if you have an existing policy for managing cast iron or bare steel pipe, you can create an AA Action that cross references that policy. If you

32

have an ongoing program to upgrade your cathodic protection system in problem areas you can create an AA that references that program.

To create your own AA Actions, click on the "Manage AA Actions" link on the AA Actions screen.

That will bring up a screen that looks like this:

Under New Additional Action type a short title of the AA Action. This is what will appear on the Select AA Actions screen under Operator-defined AA Actions, so it needs to be something that you will recognize when you read it on that screen.

Select from the drop down list the threat or subthreat that this AA Action is intended to address. This Operator defined AA Action will only appear in those threat segments where the threat is what you selected here. For example the Operator-defined additional action "Paint meter" will only appear for sections where the threat is atmospheric corrosion.

In the description filed enter a more detailed description of the AA Action. This text will be inserted into your written DIMP plan under every threat-section where you select this AA Action. I should be detailed enough that someone reading your DIMP plan can understand what it is you have committed to do. It can also be a cross reference to an existing policy or program if you are already doing something that addresses this threat on this section of your system.

To select one or more AA Actions for this threat-segment, click on the box next to that AA Action. You can select more than one AA Action for each threat segment. Keep mind that this written DIMP plan is enforceable just like your Operations and Maintenance Manual is enforceable, even if what you write into it goes beyond what regulations require. You are obligated to follow through on all AA Actions you specify in your written DIMP plan.

Selecting Performance Measures

SHRIMP will automatically include in your written plan statements that you will track the following mandatory performance measures that are required of all operators under the DIMP rule:

(i)   Number of hazardous leaks either eliminated or repaired as required by 49 CFR 192.703(c) (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 Sec. 192.703(c) (or total number of leaks if all leaks are repaired when found), categorized by material;

The rule also states that the written plan must include any additional measures the operator determines are needed to evaluate the effectiveness of the operator's DIMP program in controlling each identified threat. To address this requirement, SHRIMP will require you to select at least one threat-specific performance measure for each threat segment for which you have selected AA Actions. SHRIMP will offer at least one potential performance measure for each threat. Based on the AA Action that you selected, SHRIMP may recommend one or more performance measures as appropriate for measuring the effectiveness of an AA Action. For example, if you selected that you would upgrade the cathodic protection system on a particular section that you reported was having trouble maintaining CP levels above criteria, a performance measure might be the number of cathodic protection measurements that are below criteria.

To select performance measures for those threat-segments for which you selected AA actions, click on "Choose PM's" on the risk ranking screen as shown to the left.

	User Rank	Relative Risk Score	Probability Score	Consequence Score	Leak Cause Factor	Incident Probability Factor
1	2	12	10	1.2	1	1.00
	Explanation:	There is a school and hospital near this bridge crossing				

Section: 4th street bridge crossing portion of Kastanasburg Utilities portion of Kastanasburg Utilities
Threat: Corrosion -> Atmospheric Corrosion -> Atmospheric Corrosion
Description: Pipe on 4th St bridge
Ranked here, in part, for the following reasons:

- Operator overrode ranking with this explanation: There is a school and hospital near this bridge crossing
- Repaired atmospheric corrosion leaks are increasing.
- Atmospheric corrosion leaks have occurred.
- Inspections have found problems with above ground pipe coatings that could not be fixed by routine maintenance

To address the threat of atmospheric corrosion on the entire system on the 4th street bridge crossing, Kastanasburg Utilities will take the following action(s): **Choose AAs**

- relocate piping or facilities

To determine if this additional/accelerated action is effective at reducing the threat from atmospheric corrosion on the entire system on the 4th street bridge crossing, Kastanasburg Utilities will conduct the following performance measure(s): **Choose PMs**

- track the percentage of inspections that find or failures due to atmospheric corrosion per mile of main (and/or per service) in the 4th street bridge crossing.

The following screen will appear:

Just as with AA Actions you can create your own performance measures by clicking on "Manage Operator PMs" and following a process just as you did to create Operator-defined AA Actions. SHRIMP will always offer at least one performance measure for you to choose from. The performance measure(s) you select will be inserted into the appropriate sections of you written DIMP plan.

Creating an Implementation Plan

Your written DIMP plan created using SHRIMP will include a number of actions that must be accomplished in order to demonstrate that you are following through with both the mandatory and risk-based action items in the plan. Click on Implementation Plan in the left side menu to open the Implementation Plan screen. Action items fall into three categories:

1.   Modifying your procedures, policies and recordkeeping system as necessary to collect and retain information required to be collected and retained under the DIMP plan, including:

a. Records for all piping system installed after the effective date of this Plan, including, at minimum, the location where new piping and appurtenances are installed and the material of which they are constructed.

b. Number of hazardous leaks either eliminated or repaired as required by 49 CFR 192.703(c) (or total number of leaks if all leaks are repaired when found), categorized by cause;

c. Number of excavation damages;

d. Number of excavation tickets (receipt of information by the underground facility operator from the notification center);

e. Total number of leaks either eliminated or repaired, categorized by cause;

f. Number of hazardous leaks either eliminated or repaired as required by Sec. 192.703(c) (or total number of leaks if all leaks are repaired when found), categorized by material;

g. Any threat-specific-performance measures that you selected in your plan to measure the effectiveness of selected AA Actions; and

h. Mechanical fitting failure data, including:

   i.   location of the failure in the system,

   ii. nominal pipe size,

   iii. material type,

   iv. nature of failure including any contribution of local pipeline environment,

   v.   fitting manufacturer,

   vi. lot number and date of manufacture, and

   vii. other information that can be found in markings on the failed fitting

Performance Measure Baselines: NOTE: Items b through g above are performance measures. The DIMP rule requires that each operator "[d]evelop and monitor performance measures from an established baseline to evaluate the effectiveness of its IM program." [emphasis added]. Your implementation description for items b through g should describe what you have established as the baseline for each performance measure. If you have historical data necessary to calculate a particular performance measure (e.g. you have previous years' data on total number of leaks either eliminated or repaired, categorized by cause) then you may use historical data as the baseline. If, as a result of this DIMP Plan, you

will be collecting data for a performance measure for the first time, then the appropriate baseline will be your first year's or first few years' results for this performance measure.

2.   Developing an implementation plan for how you will address LEAKS and any risk-based Additional/Accelerated Actions that you included in your written DIMP plan.

SHRIMP will list these action items in risk ranked order, with a text box under each where you should describe how you plan to implement this action item. At minimum the implementation description should include the name(s) and/or job titles of the person(s) responsible for following through on the listed action and timetables for initiating and completing the action item.

3.   Procedure for collecting additional information needed for your integrity management program.

The DIMP rule requires that your written plan 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). If you answered "I don't know" to any question where that was an option, it will be listed here in the implementation plan, along with options for how you could gain that knowledge. You can use SHRIMP's text or replace it with your own. If there is more additional information you feel you need, list it here and include a procedure for gaining that information.

If you have all the information you need for your plan you should state here that no additional information is needed.

You should also review the written plan to ensure it meets any state regulations in the state(s) in which you operate because SHRIMP does not address state-specific requirements.

Viewing and Downloading Your Written DIMP Plan

At this point your written DIMP Plan is complete. Click on "Finalize Plan" to display options for generating and downloading your written plan.

Reports
Required Settings
Add Text
PHMSA 7100.1-1
Written Plans
Preview Plan
Finalize Plan

You can view the written plan at any time during the development process by clicking on "Preview Plan".

Generate Review Plan(s)

Messages

<mark>Your plan must be complete before you may finalize it.</mark>

Your plan is not complete.

You may access archived **Written Plans** here.

Be sure you have reviewed and updated the following information before you generate any written plan(s):

Review the **Required Settings**.

Review the **Risk Rankings**.

Review the **Implementation Plan**.

Update the Version information:

Plan Effective: 2012-10-16

May Not Enter Until You Have Completed All Steps. See **Incomplete Sections.**

Version: 3.1.1

Version Notes:

Replaces Version: 2.1.2

Choose Formats To Generate:

☐ **Microsoft Word**
☐ **Web Page**
☐ **Adobe PDF**

If you see the highlighted message that your plan is not complete, check the "Incomplete Sections" button to display a list of steps that have yet to be completed.

Review "Required Settings" to make sure the System Name is as you wish it to appear in your plan and to select and effective date for your plan. SHRIMP will automatically insert the "Replaces Plan dated" field if this plan replaced an existing plan, and will also insert Version numbers.

If you wish to download the written plan, which is highly, highly, HIGHLY recommended, you can choose either a MS Word file or an Adobe pdf format. The WORD file can be edited after it is downloaded – the pdf cannot be edited.

38

Appendix A: Records Required to Use SHRIMP

Threat: External Corrosion

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)

Leak Repair Records for the past 5 years of all leaks caused by external corrosion.	Must be able to sort leaks repaired by type of pipe where the leak occurred:
	1. Steel
	    a. coated, cathodically-protected (CP)
	    b. coated, not CP
	    c. bare, CP
	    d. bare, not CP
	2. Cast Iron/Ductile Iron/Wrought Iron
	3. Isolated metal components on a plastic piping system
	4. Other
	
	Within each of these subsets of pipe it will be valuable if the user can plot the geographic location of leaks repaired, to identify clusters of leak repairs, if such clusters exist.
		Y

Pipe to Soil Cathodic Protection readings required by 192.465.	Must be able to sort CP readings by type of pipe where the reading occurred:
	1. Steel
	    a. coated, cathodically-protected (CP)
	    b. bare, CP
	2. Other
	
	Within each of these subsets of pipe it will be valuable if the user can plot the geographic location of CP readings or the CP section.
		Y

Rectifier inspection reports required by 192.465	Must be able to sort rectifier readings by type of pipe where the reading occurred:	Y

	1. Steel
	   a. coated, cathodically-protected (CP)
	   b. bare, CP
	2. Other
	
	Within each of these subsets of pipe it will be valuable if the user can plot the geographic location of rectifier readings or the CP section.	

Exposed Pipeline Inspection Reports required by 192.459.	Must be able to sort pipe inspections by type of pipe where it occurred, e.g.
	1. Steel
	   a. coated, cathodically-protected (CP)
	   b. coated, no CP
	   c. bare, CP
	   d. bare, no CP
	2. Cast Iron/Ductile Iron/Wrought Iron
	3. Isolated metal components on a plastic piping system
	4. Other
	
	Within each of these subsets of pipe it will be valuable if the user can plot the geographic location of pipe inspections, to identify clusters of pipe in poor condition, if such clusters exist.
		Y

Leak Survey Records required by 192.723.	Same as above.	N

Threat: Atmospheric Corrosion

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
List of above-ground and indoor piping requiring monitoring for atmospheric corrosion		Y
Atmospheric corrosion monitoring records (192.481). This also includes records of patrols, meter set inspection, regulator	Sorted by geographic location on the system (to identify possible clusters of problem	Y

40

| station inspections and any other records of inspections of above ground facilities where checking for atmospheric corrosion is conducted. | areas) | |
| Leak repair records for the past 5 years for leaks caused by atmospheric corrosion | Same as above | Y |

Threat: Internal Corrosion

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
Internal corrosion monitoring records (192.477.	Sorted by geographic location on the system (to identify possible clusters of problem areas)	Y
Leak repair records for the past 5 years for leaks caused by internal corrosion	Same as above	Y
Records of any liquids removed from the distribution system	Same as above	Y
Gas composition for any gas received from local production	Same as above	Y

Threat: Equipment

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
Leak repair records associated with any leaks caused by equipment failure.	Sort equipment leak histories by type of equipment. The primary equipment categories are regulators/relief valves, valves, meters, controls, EFVs, odorizers, heaters, dehydrators, compressor, filters, other.	Y
Equipment failure and maintenance records for equipment which failed but did not result in a leak.	Sort equipment failures by type of equipment. The primary equipment categories are regulators/relief valves, valves, meters, controls, EFVs, odorizers, heaters, dehydrators, compressor, filters, other.	Y
Equipment inspection and maintenance records including but not limited to Regulator Station/Relief Valve records required by 192.739, Valve inspections required by 192.747.		Y
System MAOP in areas where equipment		Y

41

failure is occurring.		
Log of abnormal operations caused by equipment malfunction.		N
Manufacturer's installation and operating/maintenance procedures for failed equipment.		N

Threat: Excavation caused damage

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
One-call system ticket information for the past 5 years. This information may be available from the operator's one-call system.	Sort by geographic location to identify areas by degree of excavation activity	Y
Excavation caused damage reports for the past 5 years	Sort by geographic location to identify areas with higher probability of damage. Sort by excavator to identify excavators by number of damages Sort by type of facility damaged • Steel • Plastic • Cast iron • Other	Y
Maintenance, repair, replacement records relating to excavation caused damage	Sort by geographic location and excavator as above Sort by type of facility damaged • Steel • Plastic • Cast iron • Other	Y
Leak repair reports relating to excavation caused damage	Sort by geographic location, excavator, facility damaged as above. Sort by date to identify damages	Y

42

	that occurred in the past and were not reported to the operator. If possible match this with excavator information or type of project to identify possible areas where additional damage may not have been reported.	
Incident reports relating to excavation caused damage.	Sort by geographic location, excavator, facility damaged as above.	Y
Patrol or inspection reports identifying excavation caused damage.	Sort by geographic location, excavator, facility damaged as above.	Y
Blasting studies, inspections, reports	Sort by geographic location and facility type.	Y
Operator prepared reports or audits of company contractors identifying damage due to excavation or backfill activities.		Y
Exposed pipe reports related to excavation caused damage	Sort by geographic location, excavator, facility damaged as above.	N
Line marker replacement information to identify areas where line markers are damaged or destroyed by others.		N

Threat: Natural Forces

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
Maintenance or repair records including pipe replacements for facilities damaged by subsidence, landslide earthquakes, floods, washouts, temperature extremes (frost, ice build-up, high temperature), mudslide, ice falls	Sort by geographic location to identify areas with more than one damage or failure Sort by type of facility • Steel pipe • PE pipe • Meter sets • Regulator stations • Other above ground facilities	Y
Leak repairs due to the above causes	Sort by geographic location,	Y

	type of facility as above	
Patrol or inspection reports indicating damage or failure due to above causes	Sort by geographic location, type of facility as above	Y
Incident reports as a result of failure from above causes	Sort by geographic location, type of facility as above	Y
Failure investigation reports as a result of above causes	Sort by geographic location, type of facility as above	Y
Environmental or geological records to identify flood plains, areas with potential for seismic activity (earthquakes). Topographic maps to identify areas prone to landslides, mudslides and to identify geographic features within the system (rivers, streams, ravines, tidal influence zones)	Identify facilities within these areas.	Y
Safety related condition reports, or evaluations for SRC as a result of above causes	Sort by geographic location, type of facility as above	N
Exposed pipe reports as a result of above causes	Sort by geographic location, type of facility as above	N

Threat: Other outside forces

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
Repair/replacement records for above ground facilities damaged by vehicles, vandalism	Sort records by type of facility: • Meter sets • Regulator/pressure limiting stations • Other above ground facilities Sort records by geographic location to identify areas with more than one damage or failure	Y
Repair/replacement of below grade facilities caused by external loading. Operator should identify cause of damage such as heavy vehicle traffic or dumping of material	Sort by: • Geographic location to identify areas with more than one damage • Facilities such as valves, valve	Y

44

	boxes, vaults, meters or regulators in below grade meter boxes/vaults	
	Sort by type of facility • Steel • Plastic • Cast iron • Other	
Leak repair reports relating to vehicles, vandalism or external loading	Sort by geographic location, facility as above.	Y
Incident reports for incidents caused by vehicles or external loading.	Sort by geographic location, facility as above	Y
Patrol or inspection reports with indications of damage to facilities	Sort by geographic location, facility as above	Y
Reports to law enforcement officials regarding vandalism or unauthorized operation of facilities.	Sort records by: Type of facility Type of damage reported • Vehicle • Vandalism	Y
Failure investigation reports for failures related to vehicles, vandalism, external loading	Sort by geographic location, facility as above	Y
Safety related condition reports, or evaluations for SRC related to vehicles, vandalism, external loading	Sort by geographic location, facility as above	N
New construction records of facilities where additional barriers, bump guards or additional protection was included	Sort by geographic location, facility as above These records may indicate locations where damages have previously occurred and additional protection is required	N
Reports of gas theft	Identify situations where theft occurred as a result of system modification	N
Exposed pipe reports related to exposure of facilities as a result of vehicle damage or vandalism		N

45

Threat: Materials/Welds

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
Leak Repair history including the details of the materials involved (and installation procedures for workmanship leak failure) for any leaks caused by material failure or from poor workmanship.	Separate leak history by material failures and workmanship defects. Further separate material failures into steel pipe, PE pipe, CI/PI/WI Pipe, copper pipe, tapping tees, couplings, directional fittings, flanges, transition fittings, screwed fittings.	Y
Records of use of any material that have been recalled or been a topic of a PHMSA Advisory Bulletin.	Separate by: • Low ductile Aldyl A PE pipe manufactured by Dupont prior to 1973. • PE 3306. • Compression Coupling for PE pipe. • Delrin insert tap tees. • Plexco service tee Celcon (polyacetal) caps. • Other.	N
O&M and Construction Specifications for materials and installation procedures.		N
Leak Survey Records.		N
Pressure test records for failures associated with material/weld failures.		N

Threat: Inappropriate Operations

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)
Records of failures due to poor workmanship, failure to follow procedures and/or inadequate procedures, if any	Sort by employee involved, by department, if applicable and by task	Y
Records of for cause revocation of operator qualification, if any		Y
Records of incident/accident investigations – Root cause analyses, if any		Y
Records of drug and alcohol tests		Y

Threat: Other Threats

Record	Is any sorting of the data required? If so describe:	Critical (Y/N)

© 2012-2013 American Public Gas Association Security and Integrity Foundation
All rights reserved

None		

Appendix B – SHRIMP Risk Ranking Model
SHRIMP Relative Risk Model

The centerpiece of the Simple, Handy, Risk-based Integrity Management Plan (SHRIMP) is the risk ranking model. SHRIMP uses an index model in which numeric scores are assigned based on answers provided by the user to questions asked by SHRIMP. The index model was developed by the APGA Security and Integrity Foundation (SIF) with guidance by an advisory group comprised of industry and federal and state pipeline safety regulators.

Risk is the product of the probability of a failure times the consequences of a failure. The SHRIMP relative risk model considers both the probability and consequences of a failure for each of the eight threats. The equation is as follows:

Relative Probability	=	Probability Score (normalized to 1-10)	x	Consequence Score (1.0-1.5)	x	Leak History Factor (1+% of LKS)	x	Incident Factor (1 or 1.25)

Each of the four components that go into the relative risk score are described in the following sections.

Probability Score is the sum of points assigned by answers to threat interview questions. Each segment receives a relative probability score for each threat based on the answers to a series of questions. The probability questions are based on the GPTC DIMP guidance, as modified and added to by the SIF SHRIMP Advisors. The weighting given to each possible answer are based on the knowledge and experience of the SHRIMP Development Team and the SHRIMP Advisors.

Threat	Subthreat category	Maximum Score	Minimum Score	Incident Probability Factor
Natural Forces	No subthreats	19	0	1
Other Outside forces	No subthreats	12	0	1.0
Excavation Damage	Grouping by concentration of damages or tickets	39	0	1.25
	Grouping by operator crew or operator contractor damage	34	0	1.25
	Grouping by Third Party Damage	31	0	1.25
	Blasting	15	0	1.25
Corrosion	External corrosion	16	1	1
	Internal corrosion	30	1	1
	Atmospheric corrosion	25	1	1
Incorrect operations	Failure to Follow Procedures	5	1	1.25

Threat	Subthreat category	Maximum Score	Minimum Score	Incident Probability Factor
	Inadequate Procedures	5	1	1.25
	Operator Qualification	5	1	1.25
	Drug & Alcohol	5	1	1.25
Equipment	No subthreats	5	1	1
Material/Welds/Joints	No subthreats	5	1	1
Other	No subthreats	None (User assigns rank)		1

Because there are different numbers of questions for each threat and subthreat, the maximum possible score for each threat and subthreat are different, therefore the probability score for each threat-segment is normalized to a scale of 1 – 10 using this equation:

Normalized probability score = 1 + (9 x (subthreat score - subthreat minimum score) / (subthreat maximum score – subthreat minimum score))

For example, if a segment received a score of 9 for external corrosion the normalized probability score would be 1 + (9 x (9-1) / (16-1) = 1 + 9 x 8/15 = 5.8

Incident Probability Factor

The normalized probability factor described above is useful to rank various sections by the probability of a failure occurring within each of the eight threats, but SHRIMP also must rank sections across the eight threats. Failures due to some threats are more likely to cause death, injury or significant property loss than other threats. DOT Distribution Annual and Incident Report data shown below provide an indication of how likely it is that a failure (e.g. leak) due to one of the 8 threats will result in death, injury or significant property loss.

Reported Cause of Incidents and Failures 2005-2007	# OF INCIDENTS	# OF FAILURES	INCIDENTS/1000 FAILURES	Normalized to corrosion
CORROSION	6	293933	**0.02**	1
EXCAVATION DAMAGE	73	338666	**0.22**	11
INCORRECT OPERATIONS	8	30145	**0.27**	13
MATERIAL FAILURE	8	147384	**0.05**	3
EQUIPMENT FAILURE	6	140442	**0.04**	2
NATURAL FORCE DAMAGE	22	77229	**0.28**	14
OTHER OUTSIDE FORCE DAMAGE*	39	37426	**1.04**	51
ALL OTHER CAUSES	NA	NA	NA	
*Excluding fire first incidents				

51

The results of this analysis find that failures due to three threats (corrosion, material failure and equipment failure) are least likely to result in reportable incidents, that failures due to excavation damage, incorrect operations and natural force damage are moderately likely to result in reportable incidents and that other outside force damage failures are most likely to result in reportable incidents.

The advisors agreed to assign an Incident Probability Factor of 1.0 (no increase in relative risk score) for Corrosion, Materials/Welds, Equipment, and Other Outside Force Threats[1] where it is relatively unlikely a failure will result in a reportable incident. For Excavation, Incorrect Operations, and Natural Force Threats where it is relatively more likely that a failure will result in a reportable incident the advisors agreed on an Incident Probability Factor of 1.25 (e.g. a 25% increase in relative risk score for these threats).

---

[1] Further investigation of the "other outside force" category revealed that virtually all the incidents involved vehicles striking above ground facilities, usually meter sets. The SHRIMP advisors agreed with the PHMSA Phase 1 report conclusions that there was not enough information to conclude that vehicular damage could have been anticipated at the location of these incidents or whether meter protection existed, therefore no additional weighting is provided for this threat. SHRIMP does, however, include assessment of vehicle damage in the threat assessment and offer additional/accelerated actions if vehicular damage is found to be a significant threat.

If the user sections the system by geographic area, the **Consequence Score** is determined by points assigned based answers to threat interview questions as follows:

	Question	Possible Answers	Weighting
CSQ-1	Are the pressure and/or diameter of this section greater than or about the same as the system as a whole?	Substantially greater Somewhat greater About the same	0.2 0.1 0
CSQ-2	Is this section predominantly located in business districts or outside business districts (as those are defined for leak survey)?	Within Business Districts Outside Business Districts	0.15 0
CSQ-3	How long would it typically take utility crews to reach this part of the system after receiving notice of a possible failure?	Less than one (1) hour Between one (1) and two (2) hours More than two (2) hours	0 0.025 0.05
CSQ-4	What would be the impact on the utility and its customers if this section were to fail?	Low Moderate High	0 0.05 0.1

The base consequence factor is 1.0

1. Greater pressure and/or diameter can increase the consequence factor by up to 20% (1.0 to 1.2)

2. Sections predominantly within business districts get an additional 15% increase in the consequence factor

3. The time to respond to a failure results in an increase in consequence factor of up to 5% (1.0 to 1.05)

4. The significance of the facility can result in an increase in consequence factor of up to 10% (1.0 to 1.1)

These weightings are based on the knowledge of the subject matter experts on the SHRIMP Advisory Group. These increases are added together to calculate the consequence factor for the section. If all four questions were answered so that maximum scores were assigned, the

53

consequences factor would be 1.50 (1.2 + 1.15 + 1.05 + 1.1). The overall relative risk score would be increased by 50%.

If all four questions are answered so the minimum scores are assigned, then the consequence factor will be 1.0 and the relative risk score would be unchanged by this factor.

If the user does not create subsections for a threat, then these consequence questions are not asked.

For the threats shown below where the geography based threat questions do not apply the following threat specific consequence questions are asked:

	Question	**Possible Answers**	**Weighting**
CSQ-EXC1	Have the (crews/contractors/excavators) identified for this section caused damage that resulted in a reportable incident?	Yes No	0.3 0
CSQ-EXC2	Considering disruption of service and cost to return the system to service, how serious are the damages caused by the (crews/contractors/excavators) identified for this section when compared to all other excavation caused damages?	More serious Less serious About the same	0.2 0 0.1
CSQ-GEN1	What would be the potential consequences (injuries and/or property loss) if a failure were to occur because of this problem?	High likelihood of serious injury and/or property loss. Moderate likelihood of injury and/or property loss. Not likely to result in injury and/or property loss.	0.5 0.25 0
EQIPCSQ-1	Is the size/capacity of the equipment substantially greater or lesser than other equipment in the system as a whole?	Substantially greater Somewhat greater About the same	0.2 0.1 0
EQIPCSQ-2	Does the equipment primarily affect the system located in the business district?	Within Business Districts Outside Business Districts	0.15 0
EQIPCSQ-3	How long would it typically take utility crews to reach this part of the system after receiving	Less than one (1) hour Between one (1) and two (2) hours	0 0.025

54

	notice of a possible failure?	More than two (2) hours	0.05
EQIPCSQ-4	What would be the impact on the utility and its customers if this equipment were to fail?	Low Moderate High	0 0.05 0.1

Leak Cause Factor

While most leaks are repaired without incident, the SHRIMP advisors felt that the users integrity management plan should consider the relative percentage of leaks by cause.

The Leak Cause Factor equals 1 + the percentage of leaks associated with threat to the total number of leaks for the system.

If the number of total leaks over a five year period are less than 50, the national average is used rather than the user's leak history data because with fewer than 50 leak repairs the relative percentages of leaks by cause may be skewed by a handful of leak repairs that are not representative of the system. The national average is shown below, taken from leak repair data reported to PHMSA by all distribution operators on Annual Report Form 7100.1-1..

Reported Cause of Failures 2005 – 2009

Threat	Failures	Percent	Leak History Factor
Corrosion	399,378	26	1.26
Excavation Damage	161,079	11	1.11
Incorrect Operations	38,416	3	1.03
Material/Welds Failure	155,255	10	1.10
Equipment Failure	326,793	21	1.21
Natural Force Damage	82,565	5	1.05
Other Outside Force Damage	40,529	3	1.03
All Other Causes	329,401	22	N/A*
	1,533,416	100	

* Since the threat category "Other" is not assigned a relative risk score by SHRIMP the leak history factor is not used for that threat.

Appendix C: Definition of threats
From Instructions for the Distribution Annual Report Form 7100.1-1

Leak causes are classified as:

CORROSION: leak resulting from a hole in the pipe or other component that was caused by galvanic, bacterial, chemical, stray current, or other corrosive action.

NATURAL FORCES: leak resulting from earth movements, earthquakes, landslides, subsidence, lightning, heavy rains/floods, washouts, flotation, mudslide, scouring, temperature, frost heave, frozen components, high winds, or similar natural causes.

EXCAVATION DAMAGE: leak resulting from damage caused by earth moving or other equipment, tools, or vehicles. Include leaks from damage by operator's personnel or contractor or people not associated with the operator.

OTHER OUTSIDE FORCE DAMAGE: Include leaks caused by fire or explosion and deliberate or willful acts, such as vandalism.

MATERIAL OR WELDS: leak resulting from failure of original sound material from force applied during construction that caused a dent, gouge, excessive stress, or other defect that eventually resulted in a leak. This includes leaks due to faulty wrinkle bends, faulty field welds, and damage sustained in transportation to the construction or fabrication site. Also include leak resulting from a defect in the pipe material, component, or the longitudinal weld or seam due to faulty manufacturing procedures. Leaks from material deterioration, other than corrosion, after exceeding the reasonable service life, are reported under Other.

EQUIPMENT: leak resulting from malfunction of control/relief equipment including valves, regulators, or other instrumentation; stripped threads or broken pipe couplings on nipples, valves, or mechanical couplings; or seal failures on gaskets, O-rings, seal/pump packing, or similar leaks.

INCORRECT OPERATIONS: leaks resulting from inadequate procedures or safety practices, or failure to follow correct procedures, or other operator error.

OTHER: leak resulting from any other cause, such as exceeding the service life, not attributable to the above causes.