



SOUTHWEST GAS CORPORATION

Jerome T. Schmitz, P.E., Vice President/Engineering

February 28, 2017

Via Email and U.S. Mail

Mr. Kenneth Bruno
Program Manager
Gas Safety and Reliability Branch
Safety and Enforcement Division
California Public Utilities Commission
320 West 4th Street, Suite 500
Los Angeles, CA 90013

Subject: Southwest Gas Corporation's Response to General Order 112-E Inspection of Southwest Gas Corporation's Gas Distribution Pipeline Integrity Management Program (DIMP), October & December 2016

Dear Mr. Bruno,

Southwest Gas Corporation (Southwest Gas or Company) respectfully submits the attached response to the SED Summary of Inspection Findings letter for the General Order 112-E inspection of Southwest Gas Corporation's Gas Distribution Pipeline Integrity Management Program (DIMP) from October 4 through 7, 2016 and DIMP records review and field inspections conducted December 5 through 8, 2016.

We appreciate Staff's consideration of this matter and look forward to discussing any questions or concerns that you may have.

Sincerely,

Attachment

cc: M. Epuna (CPUC)
M. Intably (CPUC)
C. Mazzeo
K. Lang
V. Ontiveroz



I. SED Identified Probable Violation

1. Title 49 CFR, Part 192, §192.1007 What are the required elements of an integrity management plan?

§192.1007 (c) Evaluate and rank risk states:

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

The SWG's Distribution Pipeline Integrity (DPI) matrix is used in the assessment of the risk to its distribution pipelines. SWG referenced the GPTC guidance for the development of the DPI matrix, the definition of risk provided by SWG contradicts the definition provided in the PHMSA's DIMP Enforcement Guidance published on January 29, 2014.

According to SWG's assessment procedure for the DPI application, a point value is assigned to each risk category for each segment. And then, the points from each risk category are summed up, and the total risk scores are used in assessing the risk associated with the pipelines. SED reviewed the risk categories in the DPI matrix and determined that the risk categories can be classified into three groups. Eighteen of the categories in the DPI matrix were related to probability, six to consequence and one to mitigation. The DPI matrix defines the risk as the sum of the point values in these twenty-five categories.

SED is concerned that the summation of the risk categories does not accurately identify the segments with the greatest risk. In fact, the method that is currently used by SWG could possibly result in a different prioritization than the method listed in the PHMSA Enforcement Guidance (i.e., Risk = Probability X Consequence). Let's consider two hypothetical segments with the following scores for likelihood and consequence:

Segment	Likelihood	Consequence	SWG Method (Likelihood + Consequence)	PHMSA Method (Likelihood x Consequence)
1	50	50	100	2,500
2	10	90	100	900

The example above shows that while the two segments show the same risk scores using SWG's method, PHMSA's method indicates that segment 1 would have a higher risk than segment 2.



Given SWG's unique definition of risk, SED is concerned that the risk model does not necessarily address the segments with the highest risk.

Therefore, SWG is in violation of General Order 112-F¹, Reference Title 49 CFR, Part 192, Section §192.1007(c).

Southwest Gas Response:

Southwest Gas respectfully disagrees that it is in violation of General Order 112-F, Reference Title 49 CFR, Part 192, Section §192.1007(c). Southwest Gas follows the Gas Piping Technology Committee (GPTC) Guide Material regarding risk evaluation methods and has chosen to use a Subject Matter Expert (SME) based methodology. The applicability of GPTC Guide Material, and more specifically the SME-based methodology for risk evaluation and ranking, is addressed in PHMSA's DIMP FAQs.

(FAQ B.3.1) PHMSA, State pipeline safety regulators and industry all participated in the development of the GPTC guidelines and have confidence that operators who use them in their programs will comply with the requirements of the rule.

(FAQ 4.b.9) In programs that do not utilize algorithms, Subject Matter Experts should be used to quantify the frequency or probability of the potential threat and then quantify the consequences of a failure to evaluate and rank risks.

Under the SME method of risk evaluation described in the GPTC Guide Material Appendix G-192-8, section 5.3(a)(1) (see attached), an individual SME or group of SMEs reviews the information gathered during routine operations and maintenance activities, as well as any special field surveys or patrols to determine where problems occurred and if problems will likely recur. When combined with perceived or known consequences, a relative risk ranking can be assigned to each facility or group of facilities experiencing problems, such as leaks. The DPI Matrix developed by Southwest Gas is a tool for use in the SME risk evaluation process and was never intended to be a pure mathematical risk algorithm.

To clarify, Southwest Gas did not create a unique definition of risk; it created a unique SME-based risk evaluation process for leaking pipe segments, consistent with the requirements of the GPTC Guide and General Order 112-F. It is tailored to the characteristics of the Company's distribution systems, as distribution systems by their very nature are unique.

The DPI Matrix prompts the SME to review a wide range of operations and maintenance information and field conditions, with due consideration to the likelihood and consequence of a pipe segment failure. Further, each of the 25 risk categories of the DPI Matrix, whether favoring likelihood or consequence, is a risk category in which the SME has assigned a risk value that represents a component of the overall relative risk. As such, each segment of pipe evaluated under the DPI Matrix has a composite relative risk score (representing the 25 risk



categories) which effectively takes into consideration coexisting threats that may be present on the pipe segment. This relative risk value is used to determine pipe replacement.

Southwest Gas has over 17 years of demonstrated program effectiveness using the DPI process and other risk evaluation and mitigation programs to ensure that pipe segments of highest risk are addressed. Notwithstanding, the Company is evaluating a DIMP software solution to replace the DPI process. As SED may be aware, the Company recently migrated from its legacy mapping system to *esri ArcGIS*, a mapping and spatial analytics software platform. In an effort to leverage this software platform, Southwest Gas is currently implementing an MAOP software solution that is a prerequisite to the DIMP software. Following the successful implementation of the MAOP application, Southwest Gas will implement the DIMP software solution which consists of the following: development of the algorithm, data integration, algorithm refinement (to ensure threats are adequately considered and depicted in the models) and validation. At this time, the Company does not anticipate that the DIMP software solution will be fully implemented before 2020. In the interim, Southwest Gas will review the “validation of the risk ranking” sections of its Operations Manual and GPTC Guidelines to reaffirm that the results accurately reflect the highest risk pipelines are identified and addressed. Furthermore, in preparation for the planned transition to an algorithm based evaluation process, Southwest Gas will enhance its SME training with an emphasis on risk determination utilizing the quantitative definition of risk as the product of likelihood and consequence.

2. Title 49 CFR, Part 192, §192.1007 What are the required elements of an integrity management plan?

§192.1007(c) Evaluate and rank risk, states in part:

“...This evaluation must consider each applicable current and potential threat, the likelihood of failure associated with each threat, and the potential consequences of such a failure...”

According to the Title 49 CFR, Part 192, §192.1007(c), the operator should consider the current and potential threats in assessing the risk to the segments. Given SWG's unique definition of risk, the DPI matrix included the “type of leak/failure (based on the predominant leak grade over last 6 years or worst case if event dispersed)” as one of the categories in evaluating the risk to the segments. In fact, if the root cause of the pipeline failure is integrated in the repair, it may not be appropriate to predict that the same segment will have a higher likelihood to fail again in the future than other segments. Thus, by assigning a higher risk score to the same segment solely based on previous leak/failure, the rankings provided by the DPI matrix may not properly address the segments with the highest risk to public safety.

Instead of assigned a higher risk score solely based on previous leak/failure in the segment, SWG is expected to identify the threats, the failure mechanisms and why a segment failed



multiple times. For example, if a pipeline failed multiple times due to corrosion, it would be appropriate to justify that corrosion is the threat and assigned higher risk score to the corrosion. However, it would be inappropriate to assign higher risk score solely based on the facts that the pipeline failed in the previous six years.

Therefore, SWG is in violation of General Order 112-F¹, Reference Title 49 CFR, Part 192, Section §192.1007(c).

Southwest Gas Response:

Southwest Gas respectfully disagrees that it is in violation of General Order 112- F, Reference Title 49 CFR, Part 192, Section §192.1007(c). As noted in the response to SED-1, each segment of pipe evaluated under the DPI Matrix has a composite relative risk score (representing the 25 risk categories) which effectively takes into consideration coexisting threats that may be present on the pipe segment.

In the example provided by SED, a pipeline segment that failed multiple times due to corrosion would have a composite risk score in the DPI Matrix which takes into account not only the leak history, but the corrosion history (manifested within the coating condition and pipe condition categories). Furthermore, the same segment that failed multiple times due to corrosion would have a higher composite risk score if it were in a Class 3 versus a Class 1 location, or if the soil/cover were rock/caliche versus sand. It is important to note that a valid relative risk score requires all 25 risk categories be applied to the subject segment.

The DPI process is only one of several methods the Company employs to evaluate threats. In SED's example, leakage due to corrosion-related threats would be evaluated under various sections of the Operations Manual addressing corrosion leaks, including but are not limited to: Remediation Design, Corrosion Control Policy, and Corrosion Control Procedure Sections I & II. As a result, additional or accelerated actions (A/As) would be implemented including, but not limited to, leak survey, increased patrolling/monitoring, or replacement.

Further, the DPI Matrix takes into account potential threats associated with the distribution facilities beyond the leak cause. This approach is more inclusive than solely focusing on the original leak cause. If a threat is deemed to be systemic, a threat checklist or revision to the Operations Manual will be made to mitigate the threat.

3. Title 49 CFR, Part 192, §192.1007 What are the required elements of an integrity management plan?

§192.1007(c) Evaluate and rank risk states in part:

“An operator must evaluate the risks associated with its distribution pipeline. In this evaluation, the operator must determine the relative importance of each threat and estimate and rank the risks posed to its pipeline...”



The regulation requires each operator to evaluate the threats and rank the risks to its pipelines. The evaluation process should have identified any pipelines that posed the greatest public safety concerns regardless whether the pipelines have leaked in previous years.

Instead of solely reacting to the pipelines that have leaked in previous years, SWG should consider the potential threats attributes to the pipeline failure. According to the DIMP Enforcement Guidance:

“It is inadequate for an operator to conclude that a pipeline is not subject to any particular threat or threats, based solely on the fact that it has not experienced a pipeline failure that has been attributed to the threat(s). An operator also must consider potential threats.”

However, by limiting the scope of DPI matrix to the pipelines that have leaked in previous 6 years, the DPI algorithm is unable to proactively/predictably forecast the safety issues of the pipelines that have not experienced a leak.

Therefore, SWG is in violation of General Order 112-F¹, Reference Title 49 CFR, Part 192, Section §192.1007(c).

Southwest Gas Response:

Southwest Gas respectfully disagrees that it is in violation of General Order 112-F, Reference Title 49 CFR, Part 192, Section §192.1007(c). In Section 7. *EVALUATION AND RANKING OF RISK* of the Southwest Gas DIMP Plan, the Company acknowledges that:

“non-leaking facilities do have threats associated with them which are considered low risk and are not included in the DPI process. Non-leaking facilities are monitored through ongoing operations and maintenance activities. Appropriate measures to address the greatest risks due to threats to non-leaking facilities are implemented as necessary.”

During the audit, Southwest Gas offered examples of how the Company proactively addresses safety issues on pipelines that have not experienced a leak. The Company's approach to the nonconforming Driscopipe M8000 (NCDP) was one such example. The risk mitigation activities listed below apply to all NCDP companywide whether the pipeline experienced a failure or not:

- Accelerated leak patrols for Mains and Services, up to 6 times per year (geographic area specific)
- Abandonment of known ½” and 1” M7000 and M8000 service stubs



- Abandonment of ½” and 1” M7000 and M8000 services that have been inactive for ≥ 36 months
- Replacement of ½” and 1” M7000 and M8000 services that have been inactive for consecutive periods ≥ 36 months

As discussed above, the DPI process is only one of several methods the Company employs to evaluate threats. By design, the DPI is a reactive tool and its application is limited to only those pipeline segments satisfying certain leak criteria. As noted by SED, the DPI application is unable to forecast safety issues on pipeline that have not experienced a leak. However, Southwest Gas also conducts an annual Leak Analysis, reviews failures to identify trends, and creates Threat Checklists in response to existing or emerging threats. Accelerated replacement projects for PVC and AA are other examples of proactive activities that the Company has undertaken.

Lastly, as discussed during the Audit, Southwest Gas addresses many risks through its operations and maintenance activities which are included as part of the Company's Operations Manual. By July 31, 2017, Southwest Gas will review these activities and where appropriate include a reference in its DIMP Plan

3. Title 49 CFR, Part 192, §192.1007 What are the required elements of an integrity management plan? Evaluate and rank risk states in part states in part:

§192.1007(b) Identify threats states in part:

“.....An operator must consider reasonably available information to identify existing and potential threats....”

PHMSA's DIMP Enforcement Guidance states in part:

“Unavailability of information is not justification for exclusion of a threat. Where data are missing or insufficient, conservative assumptions may be used in the risk assessment...”

While DPI matrix does not exclude a threat when information is unavailable, the risk weighting factors should have been more conservative when data is unavailable or insufficient. For instance, if a condition of a pipeline is unknown, it should be considered as the worst-case scenario. However, DPI matrix does not consider pipeline with unknown condition as the worst-case scenario. For example, the DPI matrix assigns lower risk to pipeline with unknown pipe cover than the ones with pipe cover less than 18-inches.

In addition, pipelines may be exposed to multiple threats for external damage. During the audit, SED provided an example to SWG regarding a segment of the railroad crossing, which is subject to potential ground movement and electrical fault activity, the risk score from each of



those threats should be added up to derive the risk ranking. Currently, SWG selects only one threat with the highest risk score.

SWG should review the risk weighting factor of each risk category and assign the appropriate level of risk to the pipeline with unknown condition. In addition, the DIMP plan does not specify the action plan to acquire missing or incomplete data. SWG should develop a plan to acquire and minimize the possibility of skewing the risk ranking score due to unavailability, inaccurate, or incomplete data.

Therefore, SWG is in violation of General Order 112-F¹, Reference Title 49 CFR, Part 192, Section §192.1007(b).

Southwest Gas Response:

Southwest Gas acknowledges that the risk weighting factors should be more conservative when data is unavailable or insufficient. Southwest Gas modified its DPI Matrix this past January to reflect the worst-case scenario in the point values when an “unknown” pipeline condition is encountered.

Southwest Gas also acknowledges that multiple threats may exist for external damage. The Company will review its DPI Matrix to evaluate which categories merit more than one selection and make appropriate changes to the scoring by July 31, 2017.

However, Southwest Gas respectfully disagrees that its DIMP Plan does not specify actions to acquire missing or incomplete data. Section 5.1.3.2 *Additional Information Needed* of the DIMP Plan covers activities specific to acquiring additional information.

II Concerns and Recommendations

1. During the record review, one SWG's staff explained that a segment is equivalent to all pipeline segments on a tile; yet, another staff explained that segments are those pieces of pipe that were installed under the same job. SWG does provide some guidance in the “DS-Distribution_Pipeline_Integrity_Procedure”, Section 1.3 (Segment Identification), but the guidance seems unclear. Does a segment only include distribution pipe on one tile only? Does it include pipe that was constructed under the same job? SWG should provide a clear definition of the segment in the “DS-Distribution_Pipeline_Integrity_Procedure”. The DIMP plan does not identify the minimum qualification requirements for the Subject Matter Experts (SMEs). While SED is satisfied with the qualifications of SMEs provided during the audit, the DIMP plan should specify the minimum qualifications for SMEs and the evaluation process to ensure that SMEs are meeting those standards. SED recommends that SWG provide a clear definition of “segment” in its procedure.



Southwest Gas Response:

Southwest Gas appreciates SED bringing this issue to its attention and the Company will review Section 1.3 of its Distribution Pipeline Integrity Procedure and make any necessary changes by July 31, 2017.

Regarding minimum qualifications for Subject Matter Experts (SMEs), the Company utilizes Construction, Customer Service, and Technical Services department managers as SMEs for the program's evaluation and implementation. Additional, SMEs may be selected to participate in the program based on the identification of specific threats. This practice is consistent with DIMP FAQ C.4. a.3. which identifies SME's as:

“simply people who have specific knowledge of topics and/or facilities under consideration. This includes the operator's operations and maintenance personnel – the people who construct, inspect, maintain and oversee its distribution facilities day-to-day.”

The above notwithstanding, Southwest Gas will review its DIMP Plan to determine if any clarification is necessary. Any changes identified as a result of the review will be made by July 31, 2017.

2. During the record review at the central office in Las Vegas, SWG's personnel that oversees the DIMP Program were not able to provide an overall statistic about the primary threats on the pipelines and the personnel deferred the questions to the division personnel. SED recommends that the DIMP Program should have the mechanism that will track and communicate information from division levels to the headquarter so that DIMP SME personnel at headquarters will be better informed and be able to provide an overall statistic for the primary threats on its pipelines on both a division level and on a company wide basis.

Southwest Gas Response:

Southwest Gas is unclear as to what overall statistics are being referenced in SED's recommendation. During the audit, various statistics were provided, including Leak Analysis Reports, DIMP Annual Reports, and analysis of Incorrect Operations. The information was provided at both a companywide and division level. Notwithstanding, the Company will review its overall statistics process for primary threats to ensure that this data is communicated at multiple levels throughout the organization. Southwest Gas will complete the review by December 31, 2017.

3. During record review, SWG's 2016 Pipe Integrity Matrix category the “Potential for External Damage” (Row 52), SED noted that the DPI matrix does not provide instructions for how SWG's personnel should determine which pipeline segments are susceptible to electrical fault. SED recommends that SWG provide instructions on how to determine pipelines that are susceptible to fault/ stray current.



Southwest Gas Response:

Southwest Gas appreciates SED's recommendation and will review its DPI Matrix regarding how personnel determine which pipeline segments are susceptible to electrical faults. Any necessary changes or clarifications will be made by July 31, 2017.

4. Under the category captioned "Potential for External Damage", SED recommends that SWG add a footnote to the "Excavation Activities Present" category on the DPI matrix to provide further explanation for this category (Row 54). In addition, one call ticket frequency history (i.e., over the last 5 years) is a primary indicator of the potential for excavation damage that may have already occurred, but is not known by SWG. SED recommends this be included in the category.

Southwest Gas Response:

Southwest Gas appreciates SED's recommendation and will review its DPI Matrix regarding the "Excavation Activities Present" category. Any necessary changes or clarifications will be made by July 31, 2017.

5. During record review SED noted that the DIMP plan only considers six years of leak records, but it does not explain the rationale for why the leak records only look back six years. SED recommends SWG either justify the lookback period of six years or extend the lookback period to the lifetime of the pipeline segment.

Southwest Gas Response:

Southwest Gas appreciates SED's recommendation regarding the use of a six-year leak history. The Company utilizes a six-year look back of its facilities as this timeframe previously covered one complete five-year cycle of leak survey plus one year, and maintenance records. However, with the migration to a combined leak survey and atmosphere corrosion survey which is conducted on a three-year interval, the Company is now able to review two leak survey cycles during the look back. The six-year look back also provides for a relevant snapshot into the performance of the segment being evaluated.