Southern California Gas Company

and

San Diego Gas & Electric Company

Comments on Hazard Analysis and Mitigation Report

Aldyl A Polyethylene Gas Pipelines

August 11, 2014

I. Background

On June 11, 2014, the staff of the California Public Utilities Commission (Commission) released a Hazard Analysis and Mitigation Report on the topic of Aldyl A Polyethylene (PE) Gas Pipelines (the Report). The Report, authored by Steven Haine, P.E., with technical assistance provided by Dr. Gene Palermo from Palermo Plastics Pipe Consulting (P3), states that it is the first in a series of Hazard Analysis and Mitigation Reports to be prepared by Commission staff to examine the potential hazards in California gas and electric utility operations. The Report includes recommendations for policy improvements (to decision makers) and best practices (to utility operators) with respect to the particular hazard examined.

Gas operators, including SoCalGas and SDG&E, are instructed to submit, within 60 calendar days of the Report, a proposal to the director of the Commission's Safety and Enforcement Division (SED) and the Executive Director on how to address the safety recommendations contained in the Report. Gas operators are further instructed to furnish their proposals to all parties in their respective outstanding general rate case proceedings and the gas safety rulemaking proceeding, R.11-02-019.

In the comments that follow, SoCalGas and SDG&E explain how SoCalGas and SDG&E have been proactively assessing known threats to their distribution systems, including threats related to early-vintage Aldyl A pipes, for decades. Currently, SoCalGas and SDG&E implement comprehensive Distribution Integrity Management Programs (DIMP) that evaluate pipeline risk on a holistic basis, based on a variety of information, including system performance and industry data. Under federal pipeline safety regulations, pipeline operators are required to evaluate and rank risks associated with their distribution pipelines in a comprehensive manner. "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."[1] If pipeline operators address individual threats in isolation, outside of this comprehensive analytical process, this could result in resources being shifted away from addressing higher-risk threats in order to address lower-risk threats.

[1] 49 CFR 192.1007(c).

Accordingly, SoCalGas and SDG&E propose to continue mitigating threats related to early-vintage Aldyl A as part of their comprehensive DIMP, and do not propose to file a separate application to implement a potentially costly program to replace early-vintage Aldyl A pipelines in isolation.

For future staff reports, SoCalGas and SDG&E encourage the Commission to establish a technical peer review process so that draft reports may be vetted and reviewed by technical experts and other interested stakeholders prior to publication. Such stakeholder review and input processes are commonly utilized by other agencies to enhance the accuracy and validity of technical reports, in furtherance of agency objectives. SoCalGas and SDG&E believe the Report would have greatly benefited from such a collaborative review process.

II. Response to Recommendations

SoCalGas and SDG&E have been proactively addressing the issue of potentially defective Aldyl A pipe since the late 1970s. The safety of our customers, employees, and the general public is our top priority. While our current safety and risk mitigation programs already address most of the concerns presented in the SED Report, we are committed to working with the Commission and our peers to identify opportunities for improvement and enhancement of our practices to further mitigate Aldyl A hazards. We respond to each of the Report's seven recommendations as follows.

1. *Operators should develop a more robust asset knowledge and material traceability program on their gas distribution assets.*

SoCalGas and SDG&E have identified key pipeline attributes for tracking. Starting in 1979, SoCalGas and SDG&E began revising the material specifications for PE pipe to require the documentation of key attributes, including manufacturer and manufactured date. Pipe acquisition policies have evolved through continual improvement and currently require that manufacturers submit a certification addendum for PE pipe and tubing purchased.[2] The addendum includes required lot information and quality control data for the shipment (Plant, lot code, footage by lot, etc.). SoCalGas and SDG&E have also augmented their maintenance

[2] *See* MSP 40-00 (Material Specification for PE Pipe and Tubing).

and inspection programs over the years to gather additional information by enhancing field data collection forms. In addition, plastic pipe manufacturers are working on implementing standardized marking requirements (i.e. barcodes) on their products in order to enhance the ability of pipeline operators to track and trace installed materials.

Historically, company practices did not consistently document specific data, such as pipe lot codes, or store pipeline manufacturing data within a central database. In the case of older plastic pipelines, SoCalGas and SDG&E, along with other pipeline operators in the gas industry, did not anticipate the failure mechanisms for newly-introduced materials, as was the case with the Aldyl A resin. In most cases, manufacturer warnings and advisory bulletins were issued well after the pipeline materials had been placed in service. Now, with the implementation of advanced technologies, such as Enterprise Geographic Information System (E-GIS) and the integration of data from Systems Applications and Products in Data Processing (SAP), additional information can be leveraged for trend analysis and data integration.

2. *Operators should develop a strategy for better integrating supply chain information (e.g. resin type, manufacturing date, lot number, and other manufacturing data that are typically available during the purchase of materials).*

As addressed in Response 1 above, SoCalGas and SDG&E have long recognized the need for material traceability and have implemented various processes to capture such information. SoCalGas and SDG&E have had internal processes in place to identify and capture supply chain information since 1979 when their first material specification for the acquisition of PE pipe was issued.

In addition to the processes described above, SoCalGas and SDG&E have a comprehensive material specification procedure, which requires the manufacturer to supply a technical proposal prior to acceptance of pipe made from an unapproved resin or from a new supplier. With each shipment of pipe, the manufacturer must also supply a statement of compliance stating that the proposed plastic pipe meets all requirements set forth in 49 CFR 192 and the current edition of ASTM D 2513 (including requirements in the applicable annexes), along with production lot information. SoCalGas and SDG&E have utilized this data to prevent the installation of potentially defective pipe. For example, in 2011, a serious off-specification issue was identified with respect to pipeline materials manufactured by JM Eagle.[3] SoCalGas and SDG&E were able to locate the associated pipe in the material database using the recorded lot numbers, install locations and any unused materials prior to their installation.

3. *Where feasible, operators should make use of opportunistic identification to determine whether an exposed pipe segment is of Aldyl A or some other materials and, if it is Aldyl A, whether the pipe has LDIW characteristics whenever sections are cut out.*

As a preliminary matter, the Report is not accurate in its description of SoCalGas and SDG&E's practices in this regard. Field personnel are required to document all actions taken on every leak investigation. SoCalGas and SDG&E send failure pipe segment samples from pipe cutouts during leak repair activities to the Company Engineering Analysis Center (EAC) for root cause failure analysis. Field reported values and other pipeline data are then confirmed and recorded.[4] The EAC houses state of the art equipment for the testing and evaluation of plastic pipe, pipe fusions and related plastic pipe components. These procedures currently allow for positive identification of Aldyl A pipe, and potentially, pipe with LDIW characteristics, based on manufacturer information.

4. *Operators should react expeditiously to manufacturer warnings and PHMSA safety advisories.*

SoCalGas and SDG&E stay abreast and respond appropriately to manufacture warnings and PHMSA safety advisories.[5] Both Utilities currently hold leadership positions on the Distribution Subgroup Committee of the American Society of Mechanical Engineers (ASME) B31.8 Committee as well as the American Society of Testing and Materials (ASTM) F17.60 Plastic Piping Systems - Gas Subgroup Committee and the AGA Plastic Materials Committee. Participation in these and other industry organizations provides the opportunity to stay abreast of current issues affecting our industry and assists in communicating openly and knowledgeably with legislative and regulatory groups.

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[3] Material was found to have intermittent thin wall issues.

[4] See Gas Standard 184.0235 (PE Pipe Repair) and Gas Standard G8225 (Investigation of Gas Incidents).

[5] See SoCalGas and SDG&E respective Safety Plans, Chapter 8, SP8-SC and SP8-SD.

SoCalGas first learned of problems with Aldyl A pipe in the 1970s, as part of its regular operating and maintenance experience with plastic pipe installations. Unaware of the root cause for Aldyl A pipe failure, SoCalGas initiated the early industry research, evaluation, and testing of Aldyl A pipe failure samples with DuPont, Inc.

SoCalGas and SDG&E responded to warnings from DuPont regarding concerns with certain vintages of Aldyl A pipe resins in the 1970s.[6] In 1979, SoCalGas Engineering contracted with Battelle Memorial Institute to study axial failure samples. In parallel with this, SoCalGas Engineering began extensive field testing. One test conducted by SoCalGas Engineering was the Melt Index (MI) test on samples for pre-1972 and post-1972 Aldyl A pipe to determine if the material properties were changing over time. SoCalGas decided to continue the Battelle work, while initiating a parallel study with DuPont in the 1980s. SoCalGas also conducted field sampling and testing of sections of pre-1972 Aldyl A pipe where pinching had taken place (samples were examined for evidence of crack initiation and growth). This research served as the precursor to further industry research and the later PHMSA advisories.

SoCalGas and SDG&E have been aware of the relevant Aldyl A and LDIW PHMSA advisories since their issuance, and considered those recommendations in the development of their DIMP and Distribution Risk Evaluation and Monitoring System (DREAMS) program. Below are specific actions SoCalGas and SDG&E took in response to the three PHMSA advisory bulletins related to plastic pipe:

1. **ADB-99-01**: This advisory, issued in 1999, warned of brittle-like cracking in pre-1973 Century Utility pipe (made of a specific Tan resin). These materials were never installed in the SoCalGas or SDG&E systems.
2. **ADB-99-02:** This advisory, issued in 1999, warned of the potential susceptibility to brittle-like cracking in plastic pipes installed between 1960 and the early 1980s. In response to this bulletin, SoCalGas and SDG&E conducted several engineering studies and system analyses to determine the key factors contributing to brittle-like cracking, including age factors. With the implementation of DIMP, these risk factors

[6] NTSB Special Investigative Report: PB98-917001, NTSB/SIR-98/01 and Advisory Bulletins ADB-99-01, ADB-99-02, ADB-02-07, and ADB-07-01.

have been built into the risk algorithm used to drive repair decisions. In this manner, SoCalGas and SDG&E avoid allocating resources to low risk pipeline segments and instead rely on system (leak) analysis to drive remedial action.

3. **ADB 02-07 / ADB 02-07a:** These advisories warned of premature, brittle-like cracking caused by rock impingement (during backfill), shear/bending stresses (at joints), and squeeze-off installations. Prior to the 2002 advisories, SoCalGas and SDG&E already had procedures in place instructing field personnel on the appropriate bedding materials to use (free of rock and debris). After the publication of the 2002 advisories, SoCalGas and SDG&E formalized a materials specification to avoid potential rock impingement. Guidance was provided for approved base/bedding and shading materials (to provide a clean, free-draining well-graded sand or native free-draining material suitable for backfilling).[7] Current practices require that operating regions having pre-1987 DuPont® Aldyl A pipe in their systems reinforce all two to six-inch PE pipe squeezes with a full encirclement 360° stainless steel band clamp.[8]

5. *Operators should re-examine their risk assessment and mitigation strategies to ensure they will be replacing the at-risk pipes at a sufficient rate to mitigate the risk associated with LDIW Aldyl A pipes due to squeeze-offs and to pre-1983 non-LDIW pipes due to rock impingement.*

SoCalGas and SDG&E's DREAMS program evaluates pipeline risks and prioritizes pipelines for replacement based on analysis of overall system risk. Because company practices over the years did not consistently include record of the pipe lot codes (from which the manufacturing date is derived) in a manner that makes it expeditious to identify all Aldyl A pipe installations, SoCalGas and SDG&E conservatively assume that all pipe installed between 1969 and 1985 is "susceptible to brittle–like cracking," and refer to such pipe as "Non-State-of-the-Art" (NSOTA). In comparison, the issued PHMSA advisories indicated that the hazard associated with Aldyl A pipe was only recognized for pipe manufactured from the 1960s to 1981, even though pipe from this resin formulation was produced through 1983. The DREAMS program

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7 MSP 26-10, Material Specification for Utility Trench Backfill - Base and Shading Material.

8 Gas Standard 184.0235 (PE Pipe Repair).

has been developed to address NSOTA pipe for priority repair or replacement. Replacement of a given PE pipe segment may be warranted for a number of reasons. The risk management strategy currently in place, is a sound approach to dealing with the risk associated with LDIW Aldyl A pipe.

To address historical data limitations, SoCalGas and SDG&E implemented policies and procedures designed to mitigate potential risk (DREAMS) while continuing to update old data records or new data discoveries (samples sent to EAC) to our information databases. These procedures will help us positively identify the location of LDIW pipes that have had leaks. The next steps in our risk mitigation activities would be to locate where leak repairs (squeeze-offs) have taken place along a pipe. These factors may be used in the risk scoring of pipeline segments in the future.

Our risk model already considers the threat of rock impingement along with many other known root causes. SoCalGas has collected the type of soil in contact with plastic pipe during leak repair activities for many years. SDG&E also began collecting this information since the implementation of SAP in 2010. As previously noted, SoCalGas and SDG&E have a material specification for approved base/bedding and shading materials to provide field personnel guidance on proper backfill, thereby reducing the threat of rock impingement. Experience has shown that the type of fill above the pipe is not as significant as the "bedding" or type of soil in contact with the bottom of the pipe.

6. *Operators should, if not already doing so, explicitly consider the impact of at-risk Aldyl A pipes in their next risk assessment and mitigation strategies provided to the Commission.*

The SoCalGas and SDG&E DIMP contains factors to consider the unique configuration and environment of its distribution systems, and any known existing or potential threats, to asses risk in a holistic manner. These factors are assigned weighted values proportional to the Utilities' historic experience and industry statistics. Since the implementation of DIMP, the process of threat identification and risk evaluation are performed in a holistic and consistent manner. It is important to recognize the risks identified are not limited to Aldyl A, but include other known threats to our system, such as the sewer lateral conflicts and third-party damage. The risk assessment and mitigation strategies for Aldyl A fall within the DREAMS, and our

NSOTA replacement program. Since 2008, SoCalGas and SDG&E have requested funding for DREAMS through the General Rate Case (GRC) and request $65 million for SoCalGas and $20 million for SDG&E in the 2016 GRC.

7. *When acquiring systems, operators should ensure relevant pipeline records are transferred as a condition for final acquisition of a system.*

   SoCalGas and SDG&E agree.

III. Responses to Questions

In addition to the recommendations made in the Report, pipeline operators were asked to respond with a description of the actions they will take to address the following three questions:

1. *What actions will the operator take to remedy the historical deficiencies in asset knowledge with respect to Aldyl A pipes highlighted in this paper?*

The actions taken in response to this concern have been discussed in greater detail in our Responses to Report Recommendations 3 and 5, above. In summary, deficiencies in asset knowledge are addressed through conservative assumptions (DREAMS risk algorithm) and the updating of asset information in conjunction with leak repair activities (opportunistic identification) and continuous improvement efforts in conjunction with data verification and integration from legacy systems. Pipe segments that have never leaked or that have never been excavated or altered are considered to be low-risk in relation to segments that have a history of leakage.

2. *What actions will the operator take to address the different waves of expected failures on Aldyl A pipes due to the different stress intensifiers acting on the different vintages of pipes given the historical deficiencies in asset knowledge? The operators should not limit themselves to only the intensifiers we highlighted in this report.*

Based on over forty years of performance data from the SoCalGas and SDG&E system, and the lack of peer or industry validated research, SoCalGas and SDG&E do not agree with the Report's prediction of impending "waves of failures." The information provided in the Report is not consistent with our system performance. Consistent with federal distribution system integrity regulations, SoCalGas and SDG&E will continue to assess and address pipeline risk in a holistic manner and monitor pipe segments that have been identified as high-risk under the DREAMS application.

3. *In what forum (e.g. a general rate case or a separate application) will each operator intend to address the mitigation of the potential hazards posed by early vintage Aldyl A pipes?*

SoCalGas and SDG&E have used, and will continue to use, the General Rate Case to request funding for their Distribution Integrity Management Programs, which comprehensively assesses and addresses all known threats to distribution pipelines.

IV. Comments to Findings

In addition to the more detailed responses to the Report's recommendations and questions above, SoCalGas and SDG&E offer the following brief comments in response to the fourteen findings set forth in the Report:

1. *All early vintage Aldyl A pipes have low resistance to slow crack growth.*

"Low" is not defined in the Report, so it is difficult to fully assess the accuracy of this finding. In the NTSB report on Brittle Like Cracking, Century pipe is noted as being ten times more susceptible to failure than Aldyl A pipe that has the LDIW condition. Thus, this finding may be misleading and should be placed in perspective with other vintage PE materials.

2. *Aldyl A pipes with LDIW characteristics have both a significantly shortened crack initiation time and a low resistance to slow crack growth.*

Without further clarification, this finding may also be misleading. This finding primarily holds true only in locations where material stresses are intensified above the primary stress resulting from internal pressure. In other words, the finding is stated as if it is applicable to all Aldyl A pipe with LDIW characteristics, but there is insufficient evidence to support such a broad finding.

3. *There is no non-destructive test in the field that can distinguish LDIW Aldyl A pipes from standard Aldyl A pipes.*

No further comment.

4. *California operators typically did not record the resin type and manufacturer of PE pipeline installation.*

SoCalGas and SDG&E have manufacturer records for the majority of the PE pipeline installations in their systems. These records are not instantly available, however, and in many cases, are still in hard paper format. As part of ongoing continuous improvement efforts, SoCalGas and SDG&E have transitioned to managing data sets in their E-GIS. Converting historic paper records into a more readily-accessible electronic format is a laborious effort, given the size of their distribution systems, which are comprised of more than a 100,000 miles of distribution main and services. The transition of historic records into E-GIS included data sets available on posted maps (generally, size, material, fittings and installation dates). This is a massive, continual effort that focuses on integrating additional data sets and leveraging information obtained through additional records research and pipe sampling. It appears that because SoCalGas and SDG&E could not easily quantify the precise mileage of manufacturer information for SED in response to data requests in a limited timeframe, the Report concluded that manufacturer information is not in any of our records. This is not accurate and misrepresents the standard practices of SoCalGas and SDG&E, as much of this information was recorded at the time of installation, but remains in hard paper form at this time. This example emphasizes the need for the Commission to implement a technical review process, through workshops or some other forum, to provide pipeline operators and other stakeholders with the opportunity to comment on draft technical reports, prior to the reports being finalized.

With respect to resin type information in particular, pipeline operators will remain unable to record this information unless and until industry standards call for the provision of such information by manufacturers. When early-vintage Aldyl A pipes were manufactured and sold, “resin type” (perhaps better described as resin formulation) information was not made available to pipeline operators. When DuPont made changes to their resin formulations, DuPont used ambiguous terms such as “Standard” resin, “New” resin, “Improved” resin, and then “New and Improved” resin. There was no reference to the resin numbers being referred to today. A structure requiring resin or pipe manufacturers to report changes in resin formulation was also lacking.

Today, there is still no requirement in the industry for resin and pipe manufacturers to provide this information. It remains difficult for operators to stay informed of resin formulation changes due to the proprietary manner in which the Plastic Pipe Institute currently manages listings for resins and pipe in the PPI TR-4 document. Even in the current (2013) version of industry standard ASTM D2513, the markings on manufactured pipe are only required to contain a code from which the manufacturer can determine the resin that was used in the production of the pipe and fittings.

5. *California gas operators typically recorded only the installation date and not the manufacturing date of the PE pipes.*

The Report, in general, and this finding, in particular, fails to acknowledge that industry requirements are still evolving. In fact, it was not until the publishing of the 2013 version of ASTM D2513 that a standardized required format for manufacturing date information was implemented by the plastic gas pipe industry. This version of ASTM D2513 has not yet been incorporated by reference in CFR 49 Part 192 and the manufacturing industry is still working to develop capabilities to comply with these new marking requirements. This is further discussed in Response to Recommendation 1 above, and the associated actions described in the Responses to Questions 3 and 5.

6. *Since historical installation records did not capture the relevant information, the mileage and location of Aldyl A pipes and LDIW Aldyl A pipes cannot be reliably determined after installation without performing excavation and possibly destructive testing.*

Based on the reasoning included in response to Recommendations 3, 4 and 5, this should not be considered a finding. SoCalGas and SDG&E have installation records for the majority of the PE pipeline installations in their systems. These records are not instantly available, however, and in many cases, are still in hard paper format. As part of ongoing continuous improvement efforts, SoCalGas and SDG&E have transitioned to managing data sets in their E-GIS. Converting historic paper records into a more readily-accessible electronic format is a laborious effort, given the size of the distribution systems, which are comprised of more than a 100,000 miles of distribution main and services. The transition of historic records into E-GIS included data sets available on posted maps (generally, size, material, fittings and installation dates). This is a massive, continual effort that focuses on integrating additional data sets and leveraging information obtained through additional records research and pipe sampling.

7. *California gas operators do not have a standard practice to use opportunistic identification when pipelines are exposed to capture relevant information that would aid in the identification of Aldyl A pipes and any stress intensifiers acting on the Aldyl A pipes.*

As described in Response to Recommendation 3 above, this finding is not accurate with respect to SoCalGas and SDG&E.

8. *Lack of specific and accurate record keeping distinguishing Aldyl A pipes from other assets highlights the need for better records for material traceability and asset knowledge. California gas operators have a sizable quantity of pipes with unknown manufacturing dates, unknown resin types, unknown lot numbers and even unknown manufacturer sources.*

SoCalGas and SDG&E have been implementing best practices as a result of our past experiences with Aldyl A pipes and other areas of concern. Please see the responses to the Report's Recommendations above for a description of the strong efforts and improvements the Utilities have made to collect more detailed pipeline data and the safety programs in place to mitigate risk.

9. *Without more robust material traceability to know with a great degree of certainty what assets are in the ground, risk assessment and risk mitigation strategies will be ineffective and expensive.*

This finding is inaccurate and inconsistent with federal regulations governing distribution integrity management.[9] Effective system management can be achieved through robust inspection and maintenance strategies and the identification of key variables that contribute to the risk of individual pipeline segments. This has been demonstrated to be true

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[9] Federal DIMP regulations recognize the lack of perfect historic records for pipelines and specifically require that pipeline operators "[i]dentify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities)."

based on our performance history in managing our Aldyl A pipeline infrastructure for over 45 years.

10. *DuPont provided warning letters in 1982 and 1986 regarding pre-1973 LDIW Aldyl A pipes.*

Topic addressed in response #4, no further comment.

11. *Initial PHMSA advisories were issued as early as 2002, providing certain knowledge of the risks of premature failure on pre-1973 LDIW Aldyl A pipes.*

No further comment.

12. *California gas operators have not acted on PHMSA safety warnings in a timely fashion. No meaningful action to identify inventory of Aldyl A pipes was undertaken until 2011/2012 when PHMSA's gas Distribution Integrity Management rules went into effect.*

Topic addressed in response to Recommendation 4, above.

13. *Depending on the different stress factors created by an operator's unique operating conditions, there could be different waves of failures unique to the operator in the oncoming decades. It is highly probable that the waves will occur sooner and with more intensity if the pipe is early vintage Aldyl A.*

This is not a valid prediction, as evidenced by the performance history of the SoCalGas and SDG&E system and the performance history reported by the industry in the latest report from the Plastic Piping Data Collective Initiative.

14. *Some important pipeline data were not transferred by Avista Utilities to Southwest Gas when the South Lake Tahoe system was purchased from Avista Utilities.*

No comment.

V. Report Inaccuracies and Mischaracterizations

As noted above, SoCalGas and SDG&E encourage the Commission to establish a technical peer review process so that draft reports may be vetted and reviewed by operators, industry organizations and subject matter experts prior to publication. Such stakeholder review and input processes are commonly utilized by other agencies to enhance the accuracy and validity of technical reports, in furtherance of agency objectives. SoCalGas and SDG&E believe the Report would have greatly benefited from such a collaborative review process. Specifically, there are several inaccuracies and mischaracterizations in the Report that could have been easily remediated, prior to being presented to the Commission, through open dialog with gas operators, industry organizations or other subject matter experts. Specific examples of technical inaccuracies contained in the Report that could have been remedied through such a process, include the following:

<u>Cause of San Juan, Puerto Rico Incident</u>: The Introduction to the Report begins with the alarming claim that "one of the most devastating gas pipeline incidents, occurring on November 26, 1996 in San Juan, Puerto Rico, where thirty-three people were killed and at least sixty-nine were injured, was caused by a small slit fracture (Figure 1) on a small section of Aldyl A plastic gas service line."[10] A review of the NTSB report cited in support of this claim, however, attributes this propane (not natural gas) pipeline failure to absences and deficiencies in the pipeline operator's risk management and safety programs and does not reference the pipeline material as a cause at all.[11] Specifically, the NTSB determined that the probable cause of the propane gas explosion was the failure of the pipeline operator to oversee employees' actions to ensure timely identification and correction of unsafe conditions and strict adherence to operating practices, and failure to provide adequate employee training. In addition, the NTSB report indicates that the incident was the direct result of excavation activity that eventually led to a propane leak reported several days prior to the incident. Propane is a highly volatile substance that differs significantly in properties from natural gas. Given the combination of these facts, SoCalGas and SDG&E believe it is misleading to cite this Report as an example of an Aldyl A resin failure and that this incident has little to no relevance to the Report.

<u>Low Ductile Inner Wall (LDIW) Cracking</u>: In the section titled, "History of Aldyl A Pipes," the Report states that samples "with LDIW characteristics have an oxidized inner surface that predisposes the inner surface to initiate cracks faster."[12] As documented in several PHMSA advisories, this statement must be qualified by adding "under cases of stress intensification"

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[10] Report, p. 4 (citing NTSB report on San Juan Incident: http://www.ntsb.gov/doclib/reports/1997/PAR9701.pdf.)

[11] NTSB report on San Juan Incident: http://www.ntsb.gov/doclib/reports/1997/PAR9701.pdf

[12] Report, p. 7.

such as pipe geometry, installation, etc. Without this qualification, this broad statement may be misleading and inaccurate.

<u>System Knowledge of LDIW</u>: The Report states, "Sempra has no knowledge of any LDIW pipes because no efforts were made to document LDIW pipes until the 2011 to 2012 timeframe."[13] This statement appears to be based on a misreading of previous statements by SoCalGas and SDG&E, in response to inquiries by SED, that we are not aware of current pipeline segments in our system that have LDIW condition. SoCalGas and SDG&E perform testing of previously in service pipe at the EAC. Our response does not support the conclusion that "no efforts were made to document LDIW."

<u>Sampling Program</u>: The Report states, "It is also not customary for Sempra to send cutout sections to laboratories to determine whether a failed segment has LDIW characteristics, nor are reverse bend tests performed in the field."[14] As outlined in SoCalGas and SDG&E's November 12, 2013 response to an inquiry from SED, "Failure samples are sent to the Engineering Analysis Center (EAC) for root cause failure analysis to confirm the field-reported values." This process is further discussed in response to Recommendation 3.

<u>Dedicated Aldyl A Replacement Program</u>: The Report states, "Sempra does not have a dedicated program to replace Aldyl A pipes."[15] SoCalGas and SDG&E have replaced Aldyl A pipes based on system performance since the late 1970s, when leaks from Aldyl A were first identified. Since 2009, the Utilities have also implemented a programmatic, performance-based PE pipe replacement program aimed at preventing future hazardous leaks. Since 2011, E-GIS and the DREAMS risk program are comprehensively evaluating system risk and prioritizing pipe segments for replacement. Enhancements to the DREAMS model are ongoing. Although the Report states, "Sempra further uses a normalization methodology to combine the risk ranking for plastic segments with the risk ranking for steel pipes segments to arrive at a combined ranking," beginning in 2014, SoCalGas and SDG&E enhanced the DREAMS model so

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13 Report, p. 13.
14 Report, p. 13.
15 Report, p. 14.

that the separate risk models for evaluating the risk between steel and plastic pipe segments are no longer normalized.[16]

<u>Identification of LDIW</u>: The Report claims that LDIW samples "can be easily identified" by a reverse bend test and that "an immediate crazing pattern on the inner surface during the reverse bend test" would confirm LDIW characteristics. This procedure cannot be easily accomplished, as suggested in the Report. Visual inspections in order to detect crazing patterns would be subjective and depend on the observations of the many individuals conducting the inspections. SoCalGas and SDG&E continue to believe the best approach, which is currently in place, is to send pipe samples into the EAC for more consistent and reliable engineering analysis.

<u>Company Data</u>: In the section "Description of Utility Systems," Table 2, "Current Miles of Aldyl A Mains Installed by Installation Year," a glance at the row "unknown manufacturer or installation year" falsely indicates that SoCalGas and SDG&E do not know the installation dates for their pipelines. SoCalGas and SDG&E previously provided mileage counts by installation year to SED on November 12, 2013. The only data identified as unknown by SoCalGas and SDG&E in that response is the manufacturer data for the vintage of 1973-1985.

<u>Failure Modes</u>: The Report states that slow crack growth is the focus of the Report since it is "the mode of failure that has the most potential to cause significant property damage, injuries or fatalities."[17] On page 24, however, the Report acknowledges data from the American Gas Association (AGA), which shows that "failures due to fittings account for almost 50% of all leaks on Aldyl A pipelines." It would therefore be more accurate, to include a failure modes category for "Fittings" in the summary.

<u>Unsubstantiated Claims</u>

In order to facilitate meaningful technical review and analysis of the Report, the Report should be revised to include support for several factual claims that are set forth in the Report

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[16] Report, p. 14.

[17] Report, at pp. 9-10.

without citation to any source whatsoever. Examples of such unsubstantiated factual claims include:

- Aldyl A pipes made of Alathon 5043 with LDIW characteristics have a median projected time to failure only 1/10th that of Aldyl A pipes made of Alathon 5043 resin that have no LDIW characteristics."[18]
- The contents of Table 1: Different Vintage and Resins of Aldyl A[19]
- "There are on average only a handful of rapid crack propagation (RCP) failures a year in the entire country."[20]

Mean-Time-to-Failure for Different Vintages Under Different Stresses: The concept of using the Rate Process Method as a mathematical model of predicting future performance of PE piping systems is not new. It is the original approach put forth by the DuPont Company and used by the Plastic Pipe Institute as the means of establishing the long term hydrostatic strength (LTHS) of the base PE resin, and from which the hydrostatic design basis (HDB) for the piping system is derived. The HDB in turn is used in the calculation of the design pressure of the piping system. It is, however, a new and bold assertion that mean-time-to-failure is an effective way of measuring the resistance of installed piping systems to slow crack growth. This assertion is technically unsound and without validation with actual operating experience.

Mean-time-to-failure is a statistic that is derived from a mathematical regression analysis of data obtained from testing pipe samples and piping assemblies in elevated temperature water baths and at stress levels very near the yield point of the material. Simulations of a few types of secondary loads have been performed, but the approach is very limited as to the types of stress points that can be successfully simulated. Even for those stresses that can be successfully simulated to generate failures that closely resemble what is seen in real life, the results should only be viewed as an initial approximation of the material's performance under the limited set of conditions being investigated. When using such an approach, care must be taken to validate simulated results against actual performance.

18 Report, at p. 7.
19 Report, at p. 8.
20 Report, at p. 9.

Much more could be written about the technical approach and the nature of the statistics involved in mean-time-to-failure analysis, but that is beyond the scope of these brief comments. In general, testing at worst case conditions yields one set of numbers. Testing at more realistic conditions will yield a different set of numbers. While mathematicians and statisticians may build models explaining those relationships, not enough test data is available to explain the real system performance data. In reality, distribution statistics will change under more realistic stress regimes and the standard deviation of time-to-failure will increase. This means that in real life these “waves” of failures are going to be much more spread out in time than the limited data set currently being discussed is able to demonstrate.

The assertion that it is even reasonably possible to test in the laboratory “a population of sufficiently large samples” to be able to use “MTTF projections” as a means of determining which pipelines will fail in the future and should be replaced is pure speculation. There are too many variables involved and no practical means of identifying where in the piping system the pipe is being subjected to the stresses that are of concern. Rock impingement is an illustrative example. A range of indentation depths (meaning variation of point stresses) along with the coincidence of minor variations in the pipe material at the exact location of the indentation, are a few of the variables observed in real field failures. In contrast, the explanation on pages 21 and 22 of the Report is based on data that reflects only one indentation depth at one service temperature and only three fixed operating pressures.

The reference to “normal temperatures and pressures” is another example of an assertion that fails to take into consideration real life situations. Throughout our service territory, operating temperature is dependent on a very large number of variables, such as the above ground ambient temperature, the type of ground surface and its ability to absorb or reflect solar radiation, the insulating properties of the surrounding soil, the moisture content of the soil, the temperature and rate of gas flow in the pipeline, the proximity to other underground manmade structures or geologic formations that is influencing the ground temperature, etc. The internal pressure of a pipeline also varies depending on where it is in relation to the District Regulator, the pressure drop through the distribution network, and the customer demand at any given point in time. Both of these factors are variable in and of themselves, and can vary from point to point along a pipeline, as well as change over time due to changes in the operating environment (such as area of construction, paving changes, changes to the distribution network, new/abandoned mains and services, added customer load, etc.). While the data provided in Table 5 of the Report provides for some relativistic comparisons obtained from a very limited set of data and service conditions, it cannot reasonably be assumed, given the multitude of variables, to apply to real life applications.

The Report relies on a relativistic model utilized limitedly in the industry to predict the future performance of PE pipe systems to boldly prognosticate three waves of Aldyl A resin failures as a "primary conclusion" based on the limited data presented. This is not consistent with the data cited elsewhere in the Report indicating that over 50% of all leaks on Aldyl A pipelines are from fittings, as reported by the AGA Plastic Pipe Data Collection Committee.

In summary, the data which forms the basis of this study, and the Report's conclusions, do not resemble the 45 years of operating history of the many thousands of miles of pipe being operated by SoCalGas and SDG&E within the state of California. The types of pipe failures discussed in the Report have, in the predominant number of cases, been successfully and safely managed by SoCalGas and SDG&E for over 40 years, primarily through leak survey and changes in our leak response policies that require remediation of the plastic leaks within 15 months.[21] The idea that waves of failures predicted "far enough into the future that…all such Aldyl A pipes will have been replaced"[22] greatly misrepresents the facts. It has the potential of shifting focus from other system threats of greater concern and may hamper the ability of Commission-regulated pipeline operators to address and respond to other system threats that are of as great or greater concern.

The overemphasis on detailed historic knowledge of Aldyl A pipeline assets and missing data again misrepresents the facts—the knowledge that would be needed to construct mathematical models, as suggested for the prediction of "future failures by year due to each mechanism for each respective vintage of Aldyl A pipe,"[23] still could not be done with a perfect set of the type of pipeline asset data that is being suggested pipeline operators should have

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[21] Gas Standard 223.0125 (Leakage Classification and Mitigation Schedules).
[22] Report, p. 19.
[23] Report, p. 24.

gathered over the years. Pipeline operators would also need to gather data on lots and resins of Aldyl A fittings, data on fusion joints, data on installation stress from things like compaction, bending, tension, compression, point stresses, and operating environment data such as temperature, pressure, proximity to other substructures, proximity to above-ground structures, etc. What the Report fails to recognize is that SoCalGas and SDG&E have developed meaningful mathematic models in consideration of the history and availability of technologies, data, and activities currently in place to manage the system, while concurrently and continually revising policies and procedures, developing and implementing new tools and technologies, converting paper and other legacy records into new and more powerful data management and mining technology platforms and gathering new data as work is executed on our legacy Distribution piping assets.

Finally, SoCalGas and SDG&E must reiterate the soundness and comprehensiveness of the approach we utilize to address risk and prioritize specific pipeline segments for replacement. The MTTF models employed in this Report only provide a snapshot approximation from a limited set of data combined with "many simplifying assumptions"[24] and debatable failure spike predictions, but have no method for locating and prioritizing pipeline segments for replacement. In contrast, SoCalGas and SDG&E's risk methodology identifies specific pipe segments for priority replacement based on real-life data and scenarios and available data. Even if all the data fields the Report recommends were readily available (such as manufacturer and lot code), this added data would likely not change the priority of Aldyl A pipe replacement. In addition, this data would not provide insight as to the location of stress intensification points where leaks are likely to develop.

VI. Closing Comments

SoCalGas and SDG&E have successfully assessed and mitigated threats to their distribution systems, including threats related to early-vintage Aldyl A pipes, for decades. Both Utilities implement a comprehensive and robust risk assessment methodology that looks at the system in a holistic manner and takes into consideration a variety of key factors in identifying

[24] Report, p. 24.

and prioritizing pipelines for replacement. If pipeline operators address individual threats in isolation, outside of this comprehensive analytical process, this could result in resources being shifted away from addressing higher-risk threats in order to address lower-risk and perhaps even stable threats. Accordingly, SoCalGas and SDG&E propose to continue mitigating threats related to early-vintage Aldyl A as part of their comprehensive integrity management programs, and do not propose to file a separate application to implement a potentially costly program to replace early-vintage Aldyl A pipelines in isolation.

For future staff reports, SoCalGas and SDG&E encourage the Commission to establish a technical peer review process so that draft reports may be vetted and reviewed by technical experts and other interested stakeholders prior to publication. Such stakeholder review and input processes are commonly utilized by other agencies to enhance the accuracy and validity of technical reports, in furtherance of agency objectives. As discussed in greater detail above, the Report would have greatly benefited from such a collaborative review process.