| | | |
|---|---|---|
| Docket: | : | A.15-09-013 |
| Exhibit Number | : | |
| Reference Number | : | ORA-27 |
| Commissioner | : | L. Randolph |
| ALJ | : | C. Kersten |
| Witness | : | Nathaniel Skinner |

**OFFICE OF RATEPAYER ADVOCATES**
**CALIFORNIA PUBLIC UTILITIES COMMISSION**

# PUBLIC SUPPLEMENTAL TESTIMONY ON THE SAFETY OF LINE 1600

# APPLICATION OF SAN DIEGO GAS & ELECTRIC COMPANY AND SOUTHERN CALIFORNIA GAS COMPANY FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR APPLICATION 15-09-013 – PHASE 1

San Francisco, California
September 14, 2017

# TABLE OF CONTENTS

**Pages**

# I. INTRODUCTION

This exhibit presents the supplemental Phase 1 analyses and recommendations of the Office of Ratepayer Advocates (ORA) regarding Southern California Gas Company and San Diego Gas & Electric Company (SoCalGas/SDG&E) Application for a Certificate of Public Convenience and Necessity.

On June 6, 2017, ORA filed a motion to amend its safety testimony on Line 1600 based on new facts provided by SoCalGas/SDG&E after ORA had served its opening testimony in April 2017.[1] In response to SoCalGas/SDG&E's updated data that led to ORA's amended testimony, ORA issued Data Request 91 on June 20, 2017 and received a response on July 6, 2017. ORA issued Data Request 92 on June 22, 2017 with a requested response date of June 29, 2017. ORA received the response to Data Request 92 on July 7, 2017, which SoCalGas/SDG&E subsequently amended on July 12, 2017, and made a second amendment on August 2, 2017. In response to the information contained in the first amendment to the Data Response to ORA Data Request 92, ORA issued Data Request 93 on July 21, 2017 and SoCalGas/SDG&E completed its response to Data Request 93 on August 17, 2017.

Due to the new information contained in these responses, ORA presents this supplemental testimony. In its responses to ORA Data Request 92 and 93, SoCalGas/SDG&E for the first time clearly showed that they rely upon certain unknown Longitudinal Joint Factor (LJF) values in establishing the Maximum Allowable Operating Pressure of design. Also in the response to ORA 93, Question 1, SoCalGas/SDG&E for the first time disclosed the total number of Line 1600 segments to be 201,[2] a 63% increase[3] over the 123 segments they identified in their Data Response

[1] Office of Ratepayer Advocates' Motion For Leave To Amend Testimony And For Shortened Time To Respond. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M190/K624/190624443.PDF

[2] SoCalGas/SDG&E Response to ORA Data Request 93, Question 1, including attached spreadsheet. ORA performed a count of the entries in this response to determine the number of segments. ORA has propounded additional discovery to ascertain why the number of segments has increased, as well as to confirm its counts of the segments.

[3] 201/123 = 1.63.

from April 27, 2017.[4] In their response to ORA Data Request 93, SoCalGas/SDG&E did not provide the full information for these new segments, only the supplemental information regarding the longitudinal seam.[5] In ORA's review of the federal regulations regarding joint factors, ORA also determined that Line 1600 must be pressure tested. Compliance with Federal regulations for certain segments of Line 1600 necessitates a pressure test if Line 1600 is operated as a distribution line, and compliance with State regulations requires a pressure test if Line 1600 is operated as a transmission line.

Below is a summary of recommendations resulting from the new information received in SoCalGas/SDG&E's data responses. These recommendations do not replace, but supplement those in the amended version of Exhibit ORA-02.

## II. SUMMARY OF RECOMMENDATIONS

- Line 1600 must be pressure tested, either because it remains a transmission line and must be tested to comply with California Public Utilities Code Section 958, or because of its changed nature to comply with Title 49 of the Code of Federal Regulations (49 CFR) Part 192.
- SoCalGas/SDG&E have assigned a LJF of 1.0 to their long seams on Line 1600, but for much of Line 1600, that 1.0 factor is higher than allowed by the LJF requirements associated with the design, manufacture, and installation standards of those segments of Line 1600.
    - 49 CFR Section 192.113 is used to establish joint factors for all installations post-1970, and for pre-1970 installations where (amongst other requirements) nondestructive examination of the seam must be substantially the same as today's requirements.
    - 49 CFR Section 192.113 requires use of a LJF of 0.8, not 1.0, for unknown pieces of greater than four inches in diameter.
    - SoCalGas/SDG&E's assertion of a LJF of 1.0 on Line 1600 is not supported by the applicable standards at the time Line 1600

[4] SoCalGas/SDG&E Response to ORA Data Request 25, Question 1. ORA performed a count of the entries in this response to determine the number of segments, which is 123.

[5] SoCalGas/SDG&E Response to ORA Data Request 93, Question 1. Part of the response states: "Please note that the spreadsheet provided by ORA reflects historic station segment extents that, in some cases, have been superseded with updated data in the High Pressure Pipeline Database (HPPD). SDG&E and SoCalGas (Applicants) have updated the spreadsheet to reflect the current pipe segment data in the HPPD."

was manufactured and installed, and is not supported by their mill test records.

- SoCalGas/SDG&E should be required to demonstrate how nondestructive examination of the welds for segments of Line 1600 manufactured prior to November 12, 1970 are substantively the same as the current American Petroleum Institute (API) 5L standards.[6] Absent this showing, the Applicants should be ordered to comply with Appendix B of Part 192, Section C (2) regarding pressure testing of pipe with welded seams manufactured to earlier specifications.

## III. LINE 1600 MUST BE PRESSURE TESTED

If Line 1600 is operated[7] at 320 pounds per square inch gauge (psig) as proposed by SoCalGas/SDG&E, then Line 1600 is defined as a transmission line and must be pressure tested in order to comply with California Public Utilities Code Section 958.[8]

---

[6] API 5LX was consolidated with API 5L in the 1980s. Further discussion is in Section V.A.

[7] For concerns around Line 1600 exceeding 20% SMYS at 320 psig, see Section V below, and ORA-02, the Prepared Testimony of N Skinner and M Botros.

[8] California Public Utilities Code Section 958 states:

(a) Each gas corporation shall prepare and submit to the commission a proposed comprehensive pressure testing implementation plan for all intrastate transmission lines to either pressure test those lines or to replace all segments of intrastate transmission lines that were not pressure tested or that lack sufficient details related to performance of pressure testing. The comprehensive pressure testing implementation plan shall provide for testing or replacing all intrastate transmission lines as soon as practicable. The comprehensive pressure testing implementation plan shall set forth criteria on which pipeline segments were identified for replacement instead of pressure testing.

(b) The comprehensive pressure testing implementation plan shall include a timeline for completion that is as soon as practicable, and includes interim safety enhancement measures, including increased patrols and leak surveys, pressure reductions, prioritization of pressure testing for critical pipelines that must run at or near maximum allowable operating pressure values that result in hoop stress levels at or above 30 percent of specified minimum yield stress, and any other measure that the commission determines will enhance public safety during the implementation period. Engineering-based assumptions may be used to determine maximum allowable operating pressure in the absence of complete records, but only as an interim measure until such time as all the lines have been tested or replaced, in order to allow the gas system to continue to operate.

(c) At the completion of the implementation period, all California natural gas intrastate transmission line segments shall meet all of the following:
(1) Have been pressure tested.
(2) Have traceable, verifiable, and complete records readily available.

However, even if SoCalGas/SDG&E could validly propose that at 320 psig, Line 1600 is a distribution line, then the line is still required to be pressure tested in order to comply with 49 CFR Section 192.621 (Section 192.621). Section 192.621 would apply to Line 1600 because of SoCalGas/SDG&E's proposal to de-rate it to a distribution line.[9] Section 192.621 requires that the design Maximum Allowable Operating Pressure (MAOP) is one of several limiting factors, above which a high-pressure distribution line cannot operate. Under Section 192.621, the formula from Section 192.105[10] is required to be used to calculate the design MAOP, and requires a specified minimum yield strength (SMYS) value provided in accordance with Section 192.107. In order to determine the SMYS on Line 1600, Section 192.107(b) applies because Line 1600 is manufactured in accordance with a specification listed in section I of Appendix B of Part 192 (Appendix B), prior to November 1970, and not in conformance with current API 5L specifications.

The underlying logic as to why Line 1600 is manufactured in accordance with a specification listed in section I of Appendix B, but needing additional examination under Section III of Appendix B is as follows:

- Line 1600 was manufactured in 1949 to the API 5LX specification.[11]
- The API 5L specification (including the API 5LX specification) is listed in Section I of Appendix B.
- Most of Line 1600 was manufactured prior to November 12, 1970, which means that Section III of Appendix B applies to those portions of it.

---

(3) Where warranted, be capable of accommodating in-line inspection devices.

[9] 49 CFR Section 192.621. For discussion of the proposal to de-rate Line 1600, see ORA-02.

[10] P = (2St)/D x F x E x T. P = design pressure in pounds per square in gauge (psig); S = yield strength, in psig; t = wall thickness, in inches; D = nominal outside diameter of the pipe, in inches; F = design (class location) factor; E = longitudinal joint factor; and T = temperature derating factor. *See* 49 CFR Section 192.105.

[11] MJ Rosenfeld, PE. Review of Risk Factors for Line 1600. February 2017, p. 3.

- Section III.C of Appendix B allows operators to use steel pipe with a weld, that was manufactured before November 12, 1970, (which includes most of Line 1600), if either:
    - The pipe has been nondestructively inspected during manufacture in accordance with the most current specifications; or
    - The pipe is tested to 1.5 times the MAOP because it is installed in class 2 or 3 locations, or to 1.25 times the MAOP in class 1 locations.
- Line 1600 cannot meet the first requirement of Appendix B Section III.C because the most current API 5LX specifications required nondestructive examination of all welded seams.
    - AO Smith[12] began using ultrasonic examination in 1957.[13]
    - Ultrasonic examination has been a practice since the 11th edition of API 5LX as a method of nondestructive examination.[14]
    - According to the "History of Line Pipe Manufacturing in North America", the API 5LX 11th edition (1963) included for the first time, the use of nondestructive examination of all welded seams.[15]
    - As Line 1600 was AO Smith pipe installed and manufactured prior to 1957, it does not meet the modern requirement under the API 5LX specification to use nondestructive testing of all welded

[12] AO Smith was a manufacturer of line pipe. They are the only manufacturer who fabricated Electric Flash Welded pipe.

[13] Discussion of AO Smith manufacturing in p. 5-3 in JF Kiefner and EB Clark. History of Line Pipe Manufacturing in North America. 1996.

[14] Discussion and specifications of 11th edition API 5LX specifications in pp. 9-34 to 9-35 in JF Kiefner and EB Clark. History of Line Pipe Manufacturing in North America. 1996.

[15] Discussion and specifications of 11th edition API 5LX specifications in pp. 9-34 to 9-35 in JF Kiefner and EB Clark. History of Line Pipe Manufacturing in North America. 1996.

seams. This means that Line 1600 does not meet the requirement of Appendix B, Section III.C.(1) .

- As Appendix B, Section III.C(1) was is not met by most segments of Line 1600, the only other option is to test the line in accordance with Appendix B, Section III.C(2). As Line 1600 runs through class 2 and 3 locations, this means it must be tested to 1.5 times the MAOP. If the MAOP is Applicants' proposed 320 psig, that means the pipeline should be tested at a minimum of 480 psig.[16]

Accordingly, SoCalGas/SDG&E have two options. They can accept a 24,000 yield strength provided under 49 CFR Section 192.107(b),[17] which means at 320 psig, Line 1600 is operating at a hoop stress of approximately 42.6%.[18] Or, Line 1600 can be pressure tested to 480 psig in accordance with 49 CFR Part 192 Appendix B.III.C(2), which would be 1.5 times the proposed MAOP of 320 psig.

Pipe like Line 1600, manufactured to the 1942 American Standards Association (ASA) standards (referred to herein as the ASA Standards) had its S value[19] derated to 60% of minimum effective yield strength. This was noted as S = 0.6K with K being the stipulated minimum yield strength in Section 220(d) of the 1942 ASA Standards. After accounting for the longitudinal seam, which was a derate to the yield strength of the pipe by 0.85 for resistance welded pipe,[20] the S value is calculated at 0.51K, or 51% of minimum effective yield strength.[21] This issue is discussed more fully in Section V,

---

[16] 320 psig * 1.5 = 480 psig.

[17] If Line 1600 has not been tensile tested in accordance with section II-D of appendix B to Part 192.

[18] S = (PD)/(2t), where P = internal pressure in psi; D = diameter, in inches; t = wall thickness, in inches; and S = hoop stress in psi. At 320 psi, S = (320 * 16) / (2 * 0.25) = 5,120 / 0.5 = 10,240 psi. 10,240 psi / 24,000 psi yield strength = 42.6%.

[19] S value is defined in the 1942 ASA Standards as "allowable stress in material due to internal pressure, at the operating temperature in pounds per square inch". *See* 1942 ASA Standards, Section 220(a).

[20] In 1942 ASA standards (Table 6, FN 3, p. 53), 0.85 is the value used to derate S for resistance welded pipe.

[21] 0.6 * 0.85 = 0.51.

below. For grade X-52 pipe, with a stipulated minimum yield strength of 52,000 psi, the resulting calculation results in an S (specified minimum yield strength) value of either 26,520 psi,[22] or 31,200 psi.[23] The use of the highest S value (which is the most favorable towards a lower hoop stress percentage at 320 psig) under these standards results in a hoop stress on Line 1600 of 32.8%.[24]

Accordingly, based on the federal minimum safety requirements or California Public Utilities Code Section 958, Line 1600 must be pressure tested.

## IV. SOCALGAS/SDG&E'S ASSERTION THAT A LONGITUDINAL JOINT FACTOR OF 1.0 IS SUPPORTED BY MODERN STANDARDS MISAPPLIES 49 CRF SECTION 192.113

SoCalGas/SDG&E have represented that Line 1600[25] properly has a longitudinal joint factor of 1.0,[26] and that they ***cannot*** use any other value.[27] SoCalGas/SDG&E reason that, "Because the furnace butt pipe fabrication method for 16" [inch] diameter pipe can be eliminated, these records can be substantiated sufficiently to assign a joint factor based upon specification only."[28] SoCalGas/SDG&E acknowledge that:[29]

---

[22] 52,000 psi * 0.51 = 26,520 psi.

[23] 52,000 psi * 0.60 = 31,200 psi.

[24] 10,240 psi / 31,200 psi.

[25] Line 1600 is approximately 50 miles, or 264,000 feet (50 miles * 5,280 feet per mile) in length. It runs from Rainbow Station, north of Rainbow, CA, to the Mission Valley, San Diego. The portion SoCalGas/SDG&E have brought forward for derating is 45 miles, extending from Rainbow to Miramar. Line 1600 was installed in 1949. *See* http://www.cpuc.ca.gov/Environment/info/ene/sandiego/sandiego.html

[26] *See*, e.g., SoCalGas/SDG&E: Response to ORA Data Request 6, Question 12; Response to ORA Data Request 25, Question 1 (Attachment and Updated Attachment); Response to ORA Data Request 46, Question 9; Response to ORA Data Request 92, Question 1; Response to ORA Data Request 93, Question 1 (and Attachment).

[27] Response to ORA Data Request 92, Question 1a. "49 CFR § 192.113 prescribes use of a 1.0 longitudinal joint factor for electric flash-welded (EFW) and electric resistance welded (ERW). The 1.0 longitudinal joint factor is set forth in Column V of the referenced spreadsheet. The use of a 0.8 longitudinal joint factor to determine design pressure for Line 1600 segments under 49 CFR § 192.105 would be incorrect."

[28] Response to ORA Data Request 93, Question 1i.

"It should be noted that 49 CFR § 192.113 became a regulation in 1970, and appears in subpart C, which is not considered a retroactive section of the code. Regardless, Applicants have used the table listed in 49 CFR § 192.113 to establish joint factors for all installations post-1970 as well as applying comparable joint factors on pipelines installed prior to 1970."

49 CFR Section 192.113 requires that "if the type of longitudinal joint cannot be determined, the joint factor to be used must not exceed that designated for 'Other'."[30] Section 192.113 further requires that pipe designated as "Other" is required to have a 0.8 LJF[31] when it is greater than 4 inches in diameter. Line 1600 is a 16 inch pipeline. Therefore, a LJF of 0.8 should be used on this pipeline for each segment where SoCalGas/SDG&E cannot demonstrate that it meets the requirements of 49 CFR Part 192 to correctly and accurately prove that a 1.0 LJF is warranted.

For reference, the LJF requirements from Section 192.113 are provided verbatim as shown in Figure A, with emphasis added to the end note and entry for unknown pipe.

[29] Response to ORA Data Request 93, Question 1b.

[30] 49 CFR Section 192.113.

[31] The LJF can also be referred to as the joint efficiency factor or JEF. Both terms refer to the strength of the weld compared to the parent metal on either side of the weld.

## Figure A: Longitudinal Joint Factor Requirements

## §192.113 Longitudinal joint factor (*E*) for steel pipe.

The longitudinal joint factor to be used in the design formula in §192.105 is determined in accordance with the following table:

| Specification | Pipe class | Longitudinal joint factor (E) |
|---|---|---|
| ASTM A 53/A53M | Seamless | 1.00 |
| | Electric resistance welded | 1.00 |
| | Furnace butt welded | .60 |
| ASTM A 106 | Seamless | 1.00 |
| ASTM A 333/A 333M | Seamless | 1.00 |
| | Electric resistance welded | 1.00 |
| ASTM A 381 | Double submerged arc welded | 1.00 |
| ASTM A 671 | Electric-fusion-welded | 1.00 |
| ASTM A 672 | Electric-fusion-welded | 1.00 |
| ASTM A 691 | Electric-fusion-welded | 1.00 |
| API Spec 5L | Seamless | 1.00 |
| | Electric resistance welded | 1.00 |
| | Electric flash welded | 1.00 |
| | Submerged arc welded | 1.00 |
| | Furnace butt welded | .60 |
| ***Other*** | ***Pipe over 4 inches (102 millimeters)*** | ***.80*** |
| Other | Pipe 4 inches (102 millimeters) or less | .60 |

***If the type of longitudinal joint cannot be determined, the joint factor to be used must not exceed that designated for "Other."*** (Emphasis added.)

SoCalGas/SDG&E's assertion that a LJF of 1.0 is suitable for the majority of Line 1600 disregards the standards for the era in which these segments of Line 1600 were manufactured, and the requirements under 49 CFR Section 192 when pre-CFR segments of pipeline are brought into compliance with those modern standards. For SoCalGas/SDG&E to validly assert that Line 1600 has an LJF of 1.0 for a given segment of the line in compliance with 49 CFR Section 192, Section 192.113 requires them to know the type of longitudinal joint along the entirety of the segment, and to prove that the original manufacturing and installation was equivalent to modern standards including mill testing and nondestructive examination.[32] However, as explained below, the attachment to ORA Data Request 93 demonstrates that SoCalGas/SDG&E do not know the longitudinal joint types along a significant portion of Line 1600, or are making assumptions about the strength of the original 1949 AO Smith electric flash weld (EFW),[33] contrary to the API specifications, and contrary to the ASA standards. When longitudinal joint types of a pipe segment are unknown, 49 CFR Section 192.113 requires using the "Other" category, which has the 0.8 LJF prescribed for pipe greater than 4 inches.[34] When an operator does not know the longitudinal joint types on certain segments of a pipe, it cannot claim that the line gets assigned an LJF of 1.0, solely because the line consists of no furnace butt welded pipe, and all other identified pipe classes in Section 192.113 have an assigned LJF of 1.0.

In response to ORA Data Request 93, SoCalGas/SDG&E provided on August 17, 2017, an Excel spreadsheet[35] that include the Alphanumeric Value (Longitudinal Long Seam field), Joint Type Specification from 49 CFR Section 192.113, and the Joint Type (Pipe Class) from 49 CFR Section 192.113 for each segment of Line 1600.

---

[32] Appendix B to Part 192 – Qualification of Pipe.

[33] Flash Welding is a type of weld used solely by AO Smith. It is generally categorized as a subset of ERW.

[34] With the exception of butt welded pipe (0.6), the lowest joint efficiency value ORA found in its review is 0.8, going back to the 1942 ASA standards.

[35] *See* ORA-27-C-SA, the Confidential Supporting Attachments to ORA-27 for a pdf version of the Excel spreadsheet.

The following information is taken from the SoCalGas/SDG&E Response to ORA Data Request 93, Question 1, unless otherwise noted.

Prior to the response to ORA Data Request 93, SoCalGas/SDG&E had identified 123 segments[36] on Line 1600.[37] In response to ORA Data Request 93, SoCalGas/SDG&E corrected its previous response and identified for the first time that Line 1600 has approximately 201 segments of varying lengths across its 50 miles.[38] 76 segments contain complete information where SoCalGas/SDG&E have a single Longitudinal Long Seam Type, a single Joint Type Specification, and a single Pipe Class.[39] These 76 segments are approximately X.X% of Line 1600.[40]

Table ORA-27-1 and the accompanying discussion below the table shows that the remaining 125 out of the 201 segments have questionable long seam information, which would require an assigned LJF of 0.8 per 49 CFR Section 192.113, or an assigned LJF of 0.85 under applicable ASA standards at the time Line 1600 was designed, manufactured, and installed. The impacts of the Applicants' lack of records and/or manufacturing vintage issues regarding the long seam on 125 segments of Line 1600 are discussed in the next section including analysis of the applicability of the specific ASA standards and/or 49 CFR Section 192.113.

[36] A segment of pipeline has the same features (yield strength, seam type, etc.) and the same class location. Two lengths of pipe that are otherwise identical and adjacent to each other, but in different class locations would constitute two different segments.

[37] Based on a count of entries to the Response to ORA Data Request 25, Question 1 (Attachment), Updated April 2017.

[38] Applicants have only applied for Pipeline Safety and Enhancement Program (PSEP) treatment in this Application for the northernmost 45 miles of Line 1600, although the underlying data issues are across all 50 miles of the line.

[39] Response to ORA Data Request 93, Question 1 (Attachment).

[40] *See* Table ORA-27-1.

**Table ORA-27-1[41] - Line 1600 Segments with Questionable Long Seam Types**

| Description | Code/Standard | # of Segments | Feet | % of Line 1600 |
|---|---|---|---|---|
| No Joint Type | 49 CFR 192 § 113 | | REDACTED | |
| ERW/DSAW | 49 CFR 192 § 113 | 29 | | |
| ASTM A53 or A106 | 49 CFR 192 § 113 | | | |
| Comparable API Spec | 49 CFR 192 § 113 & ASA Standards | 96 | | |
| **Total** | | **125** | | |

### A. SOCALGAS/SDG&E DO NOT KNOW THE SEAM TYPE ON X.X% (XX SEGMENTS) OF LINE 1600

On XX segments of Line 1600, SoCalGas/SDG&E have listed no joint type (Pipe Class), which demonstrates they do not know the long seam type for these segments.[42] These XX segments span approximately X.X% of Line 1600.[43]

SoCalGas/SDG&E have assigned these segments a LJF value of 1.0 based on 49 CFR Section 192.113. However, Section 192.113 requires that segments are unknown unless they have their pipe class identified and, therefore, are required to have a pipe specification of "Other". Section 192.113 prescribes that "Other" segments greater than 4 inches in diameter have their LJF's set at 0.8, which is consistent with the weakest LJFs (except for butt welded pipe) dating back to 1942.[44] For these XX segments, the Commission should not allow the use of a 1.0 LJF for calculating the Maximum Allowable Operating Pressure (MAOP) of design based upon a value recorded by SoCalGas/SDG&E as "JF=1.0", because SoCalGas/SDG&E lack records to specify the type of joint.

[41] Percentages are based on the approximate calculation of 264,000 feet in Line 1600, although the percentages are slightly high since Line 1600 is slightly under 50 miles in length.

[42] Response to ORA Data Request 93, Question 1 (Attachment).

[43] Response to ORA Data Request 93, Question 1 (Attachment).

[44] In 1942 ASA standards (Table 6, FN 3, p. 53), 0.8 has been the weakest LJF except for butt welded pipe, which had a 0.6 LJF. 49 CFR Section 192.113 indicates that "Other" pipe has a 0.8 LJF, and in the 1955 ASA standards, Table 841.12, other welds also received a LJF of 0.8.

### B. SOCALGAS/SDG&E DO NOT KNOW IF X.X% (XX SEGMENTS) OF LINE 1600 HAS ERW OR DOUBLE SUBMERGED ARC WELDED WELDS (DSAW)

XX segments, or approximately X.X% of Line 1600, are identified as "ERW/DSAW". For these segments, SoCalGas/SDG&E do not know if the weld is ERW or DSAW.[45] This is a recent disclosure and contradicts information that SoCalGas/SDG&E provided to Safety and Enforcement Division (SED) in February 2016. When asked by SED Data Request 1, Question 1 for the "long seam type for Line 1600 pipeline/segments", SoCalGas/SDG&E's response did not identify that Line 1600 could have DSAW seams. Instead, SoCalGas/SDG&E responded that Line 1600 had "Electric Flash Weld (EFW), Electric Resistance Weld (ERW) and seamless pipe." ERW and DSAW are subject to different manufacturing threats,[46] and may not be of equal strength to the rest of the pipeline based on their vintage.[47] Applicants' statement that a segment is either ERW or DSAW still means they cannot determine the longitudinal joint type. Section 192.113 does not allow for an operator to assign an LJF of 1.0 unless they can determine the longitudinal joint type; otherwise, it requires them to assign an LJF of 0.8.

### C. APPLICANTS DO NOT KNOW THE PARTICULAR SPECIFICATION TO WHICH X.X% (XX SEGMENTS) OF LINE 1600 WAS MANUFACTURED

SoCalGas/SDG&E have identified XX segments, or approximately X.X% of Line 1600, as "either ASTM A53 or A106," and "seamless". The American Society for

[45] Response to ORA Data Request 93, Question 1 (Attachment).

[46] *See* Integrity Characteristics of Vintage Pipelines. For example, transportation fatigue cracking is particularly found in DSAW, while arc burns are particularly noted for ERW pipe (Table 3, p. 17).

[47] See subsequent discussion on AO Smith pipeline. ERW welds, depending on the vintage of the pipe, had a joint efficiency factor of as low as 0.85 in the ASA standards through the 1952 edition. The 1955 edition uses a 1.0 "E" factor for API 5L and API 5LX ERW and EFW pipe. The 1955 edition states at section 804.6 "It is not intended that this code be applied retroactively to existing installations insofar as design, fabrication, installation, established operating pressure, and testing are concerned. It is intended however, that the provisions of this code shall be applicable to the operation, maintenance and up-rating of existing installations."

Testing and Material (ASTM) A106 is a "standard specification for seamless carbon steel pipe for high-temperature service",[48] while ASTM A53 is a "standard specification for pipe, steel, black and hot-dipped, zinc coated, welded and seamless."[49] In this case, the manufacturing specification has not been provided. SoCalGas/SDG&E's failure to identify the manufacturing specification means they have not properly identified the longitudinal joint. 49 CFR Section 192.113 requires longitudinal joints without manufacturing specifications to be identified as "Other", and assigned an LJF of 0.8. As SoCalGas/SDG&E do not know the specific specification to which the pipe and joint were manufactured, a 0.8 LJF is appropriate and consistent with the ASA standards dating back to 1942.

## V. SOCALGAS/SDG&E'S ASSERTION OF A 1.0 LONGITUDINAL JOINT FACTOR ON LINE 1600 IS NOT SUPPORTED BY THE STANDARDS AT THE TIME IT WAS MANUFACTURED AND INSTALLED AND IT IS NOT SUPPORTED BY THEIR MILL TEST RECORDS

According to SoCalGas/SDG&E, Line 1600 has 96 segments identified as "Comparable API Spec (AO Smith), or XX.X% of Line 1600."[50] SoCalGas/SDG&E have identified these segments as having an EFW seam.[51]

[48] *See,* https://www.astm.org/Standards/A106.htm

[49] *See*, https://www.astm.org/Standards/A53.htm

[50] Response to ORA Data Request 93, Question 1 (Attachment).

[51] Response to ORA Data Request 93, Question 1 (Attachment).

### A. SOCALGAS/SDG&E'S ASSERTED CHARACTERIZATION OF 96 SEGMENTS OF PIPE AS "COMPARABLE API SPEC (AO SMITH)" APPEARS TO MEET, BUT GENERALLY NOT EXCEED, THE 1940'S API 5LX SPECIFICATION REQUIREMENTS

In 1949, an 85% mill test was the standard for API 5LX.[52] As discussed in Section V.B below, the mill test on Line 1600 at the time it was manufactured was 85%. In addition to the 85% mill test, the tentative 1948 API 5LX standard also included:[53]

- Certain chemical property limits;
- Sampling rates of "one of each of two lengths from each lot of 100 lengths for pipe of 14-inch diameter and larger";
- "Transverse specimens were prescribed for welded pipe and cold-expanded seamless pipe of 8 5/8-inch diameter and larger";
- "A transverse tensile test of the weld [same sampling rate as the pipe body test] was required for tensile strength only";
- Flattening tests.

The 2nd edition of API 5LX standard in 1949, adopted several changes, including:[54]

- More restrictive chemical property limits;
- "The chemistry and tensile requirements for higher grades [than X-42] were to conform to the requirements agreed upon between the purchaser and the manufacturer."; and
- "The [API] monogram was required now that the specification was no longer tentative."

[52] White Paper, p. 14, citing to "Evaluating the Stability of Manufacturing and Constructing Defects in Natural Gas Pipelines" by JF Kiefner, April 2007.

[53] API 5LX was a tentative standard from 1948 until 1949 when the 2nd edition was published and adopted. Discussion and specifications of early API 5LX specifications in pp. 9-24 to 9-27 in JF Kiefner and EB Clark. History of Line Pipe Manufacturing in North America. 1996.

[54] Discussion and specifications of early API 5LX specifications in pp. 9-27 to 9-29 in JF Kiefner and EB Clark. History of Line Pipe Manufacturing in North America. 1996.

These 1948 and 1949 API 5LX specifications also appear to have been conducted on the 96 segments of Line 1600 that SoCalGas/SDG&E have identified as "Comparable API Spec (AO Smith)". SoCalGas/SDG&E have identified a 52,000 psi yield strength[55] for these segments of Line 1600.[56] A 52,000 psi yield strength is consistent with grade X-52 under the API 5LX specification. Based on ORA's review, it does not oppose the identifications of these segments consistent with grade X-52, API 5LX, 1949 edition. However, ORA notes that the original purchase order did allow the customer to purchase substandard pipe.[57] Therefore, these segments appear to meet the requirements for the 1949 edition of API 5LX, but generally not exceed them.

### B. FOR API 5LX ERW PIPE, THE ASA STANDARDS AT THE TIME LINE 1600 WAS MANUFACTURED AND INSTALLED PRESCRIBED A LJF OF 0.85 ON THE 96 SEGMENTS UNLESS TESTS PROVING THE MINIMUM TENSILE STRENGTH WERE MADE

The ASA standards at the time Line 1600 was originally manufactured and installed (1949) prescribed a joint factor of 0.85 for the ERW pipe on the line.[58] For purposes of the applicable ASA standards at the time Line 1600 was originally manufactured, EFW pipe is a subset of ERW pipe.[59] The 1942 and 1952 ASA standards both prescribed this 0.85 LJF, and that factor did not change until the 1955 standards.[60]

---

[55] Tensile strength is defined as "the highest unit tensile stress (referred to the original cross section) that a material can sustain before failure (psi.)" Yield strength is defined as "the stress level at which a material exceeds its elastic limits and the material begins to permanently deform." *See* https://www.phmsa.dot.gov/staticfiles/PHMSA/Pipeline/TQGlossary/Glossary.html

[56] Exhibit SDGE-12, p. 145, lines 17-18. "YS = Yield Stress, psi, (established by the pipe manufacturer; e.g., Grade X52 pipe is 52,000 psi)".

[57] Response to ORA Data Request 86, Question 2, Attachment. This language is in the "SPECIAL INSTRUCTIONS" portion of the A.O. Smith Corporation purchase order.

[58] ASA standards 1942 edition, Table 6, FN 3, p. 53.

[59] ASA standards,1952 edition, Section 807, p. 12.

[60] White Paper, p. 12, citing the 1952 edition of the ASA standards.

The 1952 ASA standards were the first edition to include the API 5LX specification, but did so without identifying a specific grade of pipe.[61] The 1955 ASA standards were the first to include API 5LX grades X-42, X-46, and X-52.[62] As discussed above, ORA does not oppose the identifications of the 96 segments of Line 1600 as consistent with grade X-52 for API 5LX, 1949 edition.

The ASA standards do allow ERW (and later EFW) pipe to exceed the 0.85 LJF "… if supplemental tests and/or heat treatments demonstrate the strength characteristics of the weld to be at equal to **minimum tensile strength** specified for the pipe, the 'S' values equal to the correspond seamless grades may be used."[63] The API 5LX specification for the earliest entry of grade X-52 provides for a minimum tensile strength of 66,000 psi,[64] but the specified minimum tensile strength for these 96 segments of Line 1600 is XX,XXX psi.[65] A mill test to 85% of yield strength, which is calculated to be a mill test of XX,XXX for Line 1600,[66] is approximately to XX% of tensile strength. These 96 segments of Line 1600 are appropriately assigned a LJF of 0.85 consistent with EFW pipe according to the ASA standards of the time.

Under the applicable ASA standards at the time Line 1600 was manufactured and installed, the only way Line 1600 could have a LJF higher than 0.85 was if it was subjected to sufficient tests of the welded seam. However, Applicants have conceded that they "do not have records from 1949 that provide sufficient detail to determine whether or not specific requirements contained within ASA 1942 B31.1 (or subsequent

---

[61] ASA standards, 1952 edition, Section 827, p. 28.

[62] ASA standards,1955 edition, Appendix C, p. 85.

[63] 1942 ASA standards, 1942 edition, Table 6, fn 3, pp. 52-53.

[64] *See,* Specifications of early API 5LX specifications at p. 9-64 in JF Kiefner and EB Clark. History of Line Pipe Manufacturing in North America. 1996.

[65] *See,* Confidential response to ORA Data Request 39, Question 4, Attachment. "A.O. Smith Corporation Specifications for Electric Welded Line Pipe" for Southern Counties Gas Co.

[66] Confidential response to ORA Data Request 39, Question 4. The mill test result is the hoop stress (in psi) to which the pipe segments were subjected to is compared to the tensile strength (in psi) to create the percentage of which the tensile strength was tested.

edition) were followed as part of the design and construction of Line 1600."[67] In 2012, a Kiefner White Paper (White Paper) titled "Joint Efficiency Factors for A.O. Smith Line Pipe", was released.[68] The White Paper recommends a 1.0 LJF for EFW pipe manufactured between "1930(?) and 1969".[69] However, the White Paper does not assert that federal regulations require the use a LJF of 1.0 for AO Smith pipeline of this period. The White Paper also acknowledges that the ASA standards between 1942 and 1952 prescribed a joint factor of 0.85 for ERW pipe,[70] which was considered equivalent to EFW on these 96 segments of pipe.[71] [72] ORA's review, as previously identified, agrees with the White Paper's assessment that ASA standards had a 0.85 LJF for ERW pipe, which did not change until the 1955 standards.[73]

### C. SOCALGAS/SDG&E'S ASSERTED LJF OF 1.0 IS NOT SUPPORTED BY THEIR OWN MILL TEST RECORDS

If AO Smith's standard testing practices, as described in the White Paper,[74] were followed in the case of Line 1600, then the White Paper's recommended LJF of 1.0 for AO Smith might apply to Line 1600.[75] However, in order to follow AO Smith's standard testing practices at the time Line 1600 was manufactured and installed, the documented mill test would need to be 90% of the stipulated specified minimum yield strength. As shown below, it is mathematically impossible for the mill test to have been done at least

[67] Response to ORA Data Request 6, Question 8.

[68] MJ Rosenfeld, PE. Joint Efficiency Factors for A.O. Smith Line Pipe. December 2012.

[69] White Paper, Table 1, p. 2.

[70] White Paper, pp. 11-13, citing the 1935, 1942, and 1952 editions of the ASA standards.

[71] EFW pipe is included in the same listing as ERW pipe.

[72] Response to ORA Data Request 93, Question 1 (Attachment).

[73] White Paper, p. 12, citing the 1952 edition of the ASA standards.

[74] MJ Rosenfeld, PE. Joint Efficiency Factors for A.O. Smith Line Pipe. December 2012.

[75] See White Paper, p. 12.

at the required 90%, and for Line 1600 to remain a transmission line at the proposed 320 psig.

Although the manufacturers' purchase order specifications for Line 1600 indicate that the pipe was to be mill tested to the recommended 90%,[76] several of SoCalGas/SDG&E's records show an actual mill test pressure that was less than 90%.

First, a November 2015 study (Wright Study) performed for SoCalGas/SDG&E identifies a lower mill test pressure than required to reach 90% of yield on Line 1600.[77] Second, the less than 90% mill test pressure identified in the Wright Study is confirmed by self-titled AO Smith pipe specification records that SoCalGas/SDG&E provided.[78] These records, for the mill test, state: "Each length of pipe tested for a period of 10 seconds to a pressure of XXXX lbs/sq. in. [pounds per square inch] test stress - XX,XXX".[79] As noted above, SoCalGas/SDG&E have represented that Line 1600 has a specified minimum yield strength of XXXX psig, which corresponds to a maximum hoop stress of 52,000.[80] With a SMYS of XXXX psig, and using the mill test of XXXX pounds per square inch shown in the A.O. Smith pipe specifications, this would result in a mill test to approximately XX%.[81] This calculation is confirmed in the Wright Study.[82]

For SoCalGas/SDG&E's represented SMYS on Line 1600 of XXXX psig to be accurate, this would mean AO Smith deviated from its standard practices of the time to

---

[76] Response to ORA Data Request 86, Question 2, Attachment. This language is in the "SPECIAL INSTRUCTIONS" portion of the A.O. Smith Corporation purchase order.

[77] Response to ORA Data Request 36, Question 15, Attachment, page 2. The study, conducted by Kiefner and Associates, is entitled, the "Analysis of the Effect of Pressure Cycles on Pipeline 1600".

[78] Confidential response to ORA Data Request 39, Question 4, Attachment. "A.O. Smith Corporation Specifications for Electric Welded Line Pipe" for Southern Counties Gas Co.

[79] Confidential response to ORA Data Request 39, Question 4. The pressure test values were not identified as confidential.

[80] *See* Ex. ORA-02-C Confidential Workpapers of M Botros, tab "PercentSMYS – CONF".

[81] XXXX / XXXX = just under XX%.

[82] Response to ORA Data Request 36, Question 15, Attachment, page 2. The study, conducted by Kiefner and Associates, is entitled, the "Analysis of the Effect of Pressure Cycles on Pipeline 1600".

mill test to 90% of SMYS.[83] Given this change from the AO Smith standard practices, SoCalGas/SDG&E should not assume, and the Commission should not accept, that the weld on these portions of the pipe is any stronger than for any other ERW (and EFW) pipe manufactured in 1949, with an associated LJF of 0.85 consistent with the 1942 and 1952 ASA standards, as discussed above.

Alternatively, if AO Smith's standard practice was followed in the case of Line 1600, and the documented mill test of XXXX pounds per square inch was in fact to 90% of the specified minimum yield strength of Line 1600, then the yield strength of the pipe would only be XXXX psig[84], not the XXXX psig claimed by the Applicants. At 320 psig, with a SMYS of XXXX, Line 1600 would operate at or above 20% of SMYS[85], which makes it a transmission line under the definitions of 49 CFR Section 192.3. As a transmission line, Line 1600 must be pressured tested or replaced to comply with California Public Utilities Code Section 958.

This difference between the AO Smith standard practices and the specifications used for Southern Counties Gas Company (a predecessor of Southern California Gas Company) presents an underlying conflict as to the actual parameters of the mill test, and thus the corresponding assumptions that can be made about the strength of the weld utilized in the White Paper. This discrepancy is not discussed[86] in the "Review of Risk Factors for Line 1600" by MJ Rosenfeld (Review of Risk Factors), provided as Attachment C to SDG&E-12, Supplemental Testimony in February 2017[87], although the

[83] White Paper, p. 1.

[84] XXXX / 0.9 = XXXX.

[85] 320 / XXXX = XXXX.

[86] A search for "mill test", had one result, at page 13. This section describes at page 12 "AOS also practiced hydrostatic pressure testing to a high percentage of the SMYS early on. Testing to 90% of SMYS became a standard AOS practice in 1940." Continuing to page 13, "… AO Smith mill testing practices significantly exceeded general industry requirements until 1956."

[87] MJ Rosenfeld, PE. Review of Risk Factors for Line 1600. February 2017.

Review of Risk Factors does appear to refer to the 2015 analysis of pressure cycles provided in response to ORA Data Request 39, Question 4.[88]

The White Paper slightly but significantly misquotes Paragraph 807 of the 1952 edition of the ASA standards stating:[89]

> "The value of E [the joint efficiency factor] shall be taken from the following list, excepting that it may be taken as 1.00 for electric-resistance-welded (including electric flash welded and continuous-electric-resistance-welded) and double-submerged-arc-welded pipe if tests of representative weld-test specimens and/or cylindrical examples demonstrate the strength of the **weld to be at least equal to the strength of the pipe** and for double-submerged-arc-welded pipe that has been stress-relieved and radiographically inspected…" (Emphasis added.)

In contrast, the actual language from the 1952 standards states:[90]

> "… if tests of representative weld-test specimens and/or cylindrical examples demonstrate **the strength of the weld to be at least equal to the stipulated minimum tensile strength of the pipe**…" (Emphasis added.)

## VI. APPLICANTS' PROPOSAL TO OPERATE LINE 1600 AT 320 PSIG EXCEEDS 20% OF SPECIFIED MINIMUM YIELD STRENGTH WHEN THE APPROPRIATE LJF VALUES ARE USED

The LJF matters for Line 1600 due to the application of 49 CFR Section 192.621, the federal regulations for high-pressure distribution systems. 49 CFR Section 192.621 applies because Applicants have proposed to classify Line 1600 as a distribution line. 49

[88] MJ Rosenfeld, PE. Review of Risk Factors for Line 1600. February 2017. *See*, p. 14, which refers to "Kiefner performed an analysis to determine the susceptibility of fatigue crack growth in Line 1600 due to pressure cycles acting on a defect such as a hook crack.", although the 2015 report is not specifically cited.

[89] White Paper, p. 12.

[90] 1952 ASA standards, Section 807 (a) (1), at p. 12.

CFR Section 192.621 requires, without exception, using design pressure as a constraining factor for determining MAOP for a distribution line. This makes 49 CFR Section 192.621 different than 49 CFR Section 192.619, which allows certain transmission lines installed prior to 1970 to have MAOP determined without considering design pressure and without pressure testing. The design pressure required by 49 CFR Section 192.621 is prescribed in 49 CFR Section 192.105. The elements necessary to calculate the design pressure are: yield strength of the steel, thickness of the pipe, diameter of the pipe, the LJF of the pipe, temperature derating factor, and the class location.

Applying the required LJFs to a sample of Line 1600, at Applicants' proposed de-rated MAOP of 320 psig, the hoop stress on Line 1600 exceeds 20% of the SMYS. The majority of the pipeline, made from the original 1949 installation of the AO Smith pipeline would operate at 32% SMYS at 320 psig, requiring Line 1600 to be defined and thus operated as a transmission line.[91] The sample of the other segments ORA selected is contained in its confidential workpapers, ORA-27-C-SA.[92] Not all segments have a pressure increase over 20% SMYS at 320 psig when the appropriate LJF factor is applied.

Since segments of Line 1600 would operate at or above 20% SMYS at 320 psig, the line remains, by definition under 49 CFR Section 192.3, a transmission line, and must be pressure tested or replaced in compliance with California Public Utilities Code 958.

[91] The applicable 1942 ASA standards in Section 220(d) prescribed that pipe without listed specifications, such as Line 1600, could use a maximum of 60% of yield strength. Line 1600 was required to have this 60% de-rating factor because its API 5LX specification was not a listed specification in the 1942 ASA standards. As the pipe has an EFW seam, an additional 0.85 factor is prescribed, resulting in 51% of the yield strength. This reduces the allowable stress in material due to internal pressure from 52,000 psi to 26,520 psi.

[92] To choose this sample, ORA did several things: ORA selected segments which SoCalGas/SDG&E overstated LJF values in one of the manners explained in Section IV of this testimony; and where identical engineering stations could be matched between the responses to ORA Data Request 25, Question 1, and ORA Data Request 93, Question 1. ORA could not readily compare all responses due to the increase in the number of segments between OA Data Request 93, Question 1 and ORA Data Request 25, Question 1.

## VII. CONCLUSION

Line 1600 must be pressure tested, either because it remains a transmission line and must be tested to comply with California Public Utilities Code Section 958, or because of its changed nature to comply with Title 49 of the Code of Federal Regulations (49 CFR) Part 192. Additionally, SoCalGas/SDG&E have demonstrated that they lack sufficient records of the longitudinal seam, or have contradictory records, for the majority of Line 1600. SoCalGas/SDG&E should be required to use the proper specified minimum yield strength values in determining the percentage hoop stress at which Line 1600 would operate if derated to 320 psig, and should be required to establish the MAOP of design using the proper LJF of 0.8 where the longitudinal seam type is not properly established.

# QUALIFICATIONS AND PREPARED TESTIMONY
# OF
# NATHANIEL SKINNER

**Q.1. Please state your name and business address.**

A.1. My name is Nathaniel Skinner. My business address is 505 Van Ness Avenue, San Francisco, California, 94102. I am employed by the California Public Utilities Commission as a Program and Project Supervisor in the Office of Ratepayer Advocates' Energy Safety and Infrastructure Branch. I am sponsoring ORA's recommendations and analyses in this testimony, exclusive of the calculations contained in Ex. ORA-02-C, Confidential Workpapers and Supporting Attachments of M Botros. I have also sponsored ORA's recommendations and analyses in Ex. ORA-02.

**Q.2. By whom are you employed and in what capacity?**

A.2. Since joining the Commission in 2008, I have worked on various matters in an advisory role with the Commission's Energy Division primarily in the area of Long Term Procurement Planning for electric resources including reviewing models and assumptions for renewable energy integration. Since transitioning to ORA in 2013, I have worked on the General Rate Case Rulemaking (R.13-11-006) and the successor proceedings, the PG&E Orders to Show Cause issued August 2013, PG&E's PSEP Update Application (A.13-10-017), General Order 112-E, SoCalGas's North-South Project Application (A.13-12-013), the SoCalGas/SDG&E 2016 Triennial Cost Allocation Proceeding (TCAP) (A.14-12-017), PG&E's 2015 Gas Transmission and Storage Proceeding (A.13-12-012), PG&E's 2017 General Rate Case (A.15-09-001), and various issues related to Natural Gas Transmission Safety Plans in R.11-02-019 and its successor proceedings.

**Q.3. Briefly describe your educational and professional experience.**

A.3. I am currently a PhD Candidate in Homeland Security and Emergency Management Policy at Walden University. I have a MA in International Policy Studies with a focus on Environmental Security from the Middlebury (formerly Monterey) Institute of International Studies. I have a BA with Distinction in Scandinavian Area Studies, and a BA in Political Science from the University of Washington. I have also taken various graduate-level courses in critical infrastructure protection.

**Q.4. Does that complete your prepared testimony?**

A.4. This completes my prepared testimony.