REBUTTAL TESTIMONY OF RICHARD KUPREWICZ EVALUATING PG&E'S PIPELINE SAFETY ENHANCEMENT PLAN

CALIFORNIA PUBLIC UTILITIES COMMISSION
PIPELINE SAFETY RULEMAKING
R. 11-02-019

Submitted on behalf of
THE UTILITY REFORM NETWORK (TURN)
By

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Rebuttal Testimony of Richard Kuprewicz

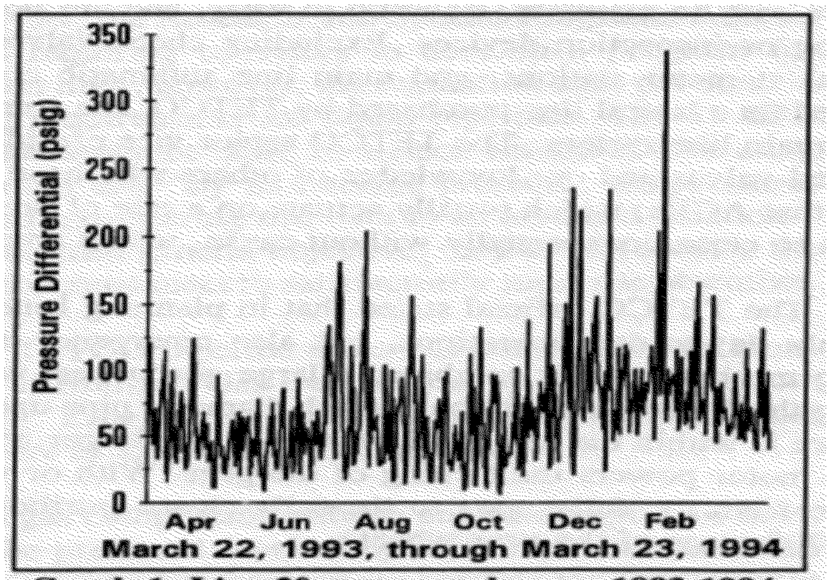
1) Response to DRA regarding Manufacturing Threats Decision Tree

The testimony of DRA witness Rondine concerning manufacturing threats recommends that for any pipe with a post-1955 strength test, the operator conduct a fatigue analysis prior to any decision to replace. (DRA-04, p. 2 and 11).

While I am in general agreement with the thrust of Mr. Rondine's recommendation that additional testing or fatigue analysis should be performed prior to any decision to replace, I cannot concur that the existence of any post-1955 strength test is sufficient to support reliance on fatigue analysis for manufacturing threats. There should be additional information showing that the test was conducted at sufficiently high pressures to support fatigue analysis.

Low-pressure, low % SMYS, hydrotesting can leave very large imperfections in the manufactured pipe seam welds that are much more susceptible to further growth to rupture failure in a relatively short time from pressure cycling than the much smaller imperfections left in high-pressure hydrotesting. This is especially true on many gas transmission pipelines that undergo considerable variations in their operating pressure, which occurs on most gas transmission pipelines. It is a myth that gas transmission pipelines do not pressure cycle. Figure 1 below is an example of a gas transmission pipeline pressure cycle spectrum (MAOP of 975 psig) in the public domain whose pipe ruptured from time -delayed damage many years after the damage occurred.[1]

Figure 1: Pressure Cycling, MAOP = 975 psig



Graph 1. Line 20 pressure changes 1993-1994.

The NTSB Report on San Bruno cited an important pressure cycle industry study,[2]

> "the risk of pressure -cycle-induced fatigue can be dismissed if and only if the pipeline has been subjected to a reasonably high-pressure hydrostatic test. Therefore, it would seem that eliminating the risk of failure from pressure -cycle-induced fatigue crack growth of defects that can survive an initial hydrostatic test of a pipeline requires that the test pressure level must be at least 1.25 times the maximum operating pressure."

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[1] NTSB, "Texas Eastern Transmission Corporation Natural Gas Pipeline Explosion and Fire, Edison, New Jersey March 23, 1994 Addendum stamped May 18, 2001, p. 11.

[2] NTSB San Bruno Report p. 38; citing to John F. Kiefner and Michael Rosenfeld, "Effects of Pressure Cycles on Gas Pipelines," prepared for: Process Performance Improvement Consultants, LLC and Gas Research Institute, September 17, 2004.

This NTSB citation did not mention that the cited study fatigue or pressure cycling analysis supporting the 1.25 times the maximum operating pressure was based on a hydrotest performed <u>at a minimum test pressure of 100% SMYS</u>.

Accufacts concurs with fatigue or pressure cycling analysis for manufacturing threats on gas transmission pipelines <u>only</u> if a proper high-pressure hydrotest, usually performed at a minimum pressure of 90% SMYS, a requirement <u>not defined in Subpart J or other federal minimum regulatory requirements related to hydrotesting</u> of at-risk seam pipe, has been performed <u>prior to the fatigue analysis</u>. The minimum and maximum % SMYS for the hydrotest as well as the pipe grade, minimum toughness, diameter, thickness, as well as pressure cycle spectrum play an important role in any such fatigue analysis. Given many uncertainties associated with transmission pipelines, such fatigue analysis should incorporate very large safety margins.

2) Response to UA Locals 246 and 342

I strongly concur with much of the technical testimony submitted by Mr. Royce Don Deaver on behalf of the United Association of Plumbers, Pipe Fitters and Steamfitters Local Unions 246 and 342 (UA Locals). However, I need to highlight two differences in our interpretation of the data.

a) Not All EW Pipe Needs to Be Replaced

Mr. Deaver discusses the safety problems associated with pre-1980 electric weld ("EW") pipe. He first notes that "[a] pressure test to 90% of SMYS would have identified those pipes that had cold weld problems, but pipes were often only tested to 75% of SMYS."[3] He then discusses adequate testing levels for different Class locations, and concludes that "[i]t may be more efficient to simply replace existing EW pipe than to test it to sufficiently high levels, experience failure, and then replace the failed pipe."[4]

While I agree with much of Mr. Deaver's testimony, I do not believe the field data support the conclusion that it is more "efficient" to go directly to replacement for EW pipe.

I concur with Mr. Deaver's testimony warning to avoid treating EW pipe with a seam factor of 1 and his further testimony cautioning about EW failures associated with low-pressure hydrotesting to just 1.25 MAOP ratios , especially if the federal minimum ratios or test Factors are cited out of context.[5] I do not concur, however, with related testimony and the conclusion to replace all EW pipe. The science of EW failure has progressed considerably in the past several decades since the Office of Pipeline Safety's issued the 1989 Report on which Mr. Deaver relies for his data analysis. Many thousands of miles of EW pipe in California , including almost two thousand miles in PG&E's system ,[6] have operated decades without leak or rupture failure. EW pipe can be successful utilized provided the pipe has been high-pressure hydrotested and prudently operated. Much of the EW pipe in PG&E's system should be able to operate many more decades without failure, provided a high-pressure, high % SMYS , hydrotest has been

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[3] UA Locals Exhibit B, Testimony of R. D. Deaver, p. 14. Mr. Deaver apparently agrees with this conclusion from a Kiefner 2002 paper.
[4] UA Locals Exhibit B, Deaver, p. 19.
[5] UA Locals Exhibit B, Testimony of R. D. Deaver, pp. 14 - 15.
[6] PG&E's PSEP database indicates that 46 miles (out of 185.5 miles) scheduled for Phase 1 replacement is ERW pipe, and 175.1 miles (out of 783 miles) scheduled for Phase 1 testing is ERW pipe. The Phase II work includes 1,616.5 miles (out of 4,845.9 miles) of ERW pipeline.

performed. Accufacts would concur with Mr. Deaver, however, that if a prudent high-pressure high % SMYS hydrotest cannot be successfully completed, the next step of replacing the EW pipe should be taken.

b) The Number of Pipeline Incidents at Pressures Below 30% SMYS Do Not Necessarily Reflect Pipeline Ruptures

Mr. Deaver extensively analyzes DOT incident data and concludes that about half of all "incidents" occurred at a hoop stress of less than 20% SMYS.[7] Mr. Deaver concludes that there should be no distinctions based on operating hoop stress, using either the 20% SMYS defining a gas transmission pipeline or 30% SMYS criteria based on pipe fracture mechanics.

I greatly appreciate Mr. Deaver's attempt to inject real world data into this discussion. However, I would caveat his conclusions in at least two significant ways. First, as he explains in Exhibit C, the DOT "incident" data includes both leaks and ruptures and the definition of rupture has not been well defined in such Office of Pipeline Safety databases. His Table A2 shows that for the 1970-1973 data, about 38.3% of ruptures occurred at below 9 ksi hoop stress, while Table A3 shows that about 54.3% of leaks occurred at below 9 ksi hoop stress. Mr. Deaver does not provide any similar break down between leaks and ruptures for the later data presented in Tables B1, B2 and C1. While some leaks are hazardous, many leaks are not. Ruptures are always very dangerous as ruptures are the high mass rate of release associated with pipe fracture mechanics causing the very high rate of gas release, such as the San Bruno failure. I would strongly caution against any decisions to replace pipe based on reported leak incidents.

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[7] UA Locals Exhibit B, Testimony of R. D. Deaver, p. 10.

While PHMSA has worked to improve its pipeline failure or incident reporting database in the past decade, it is not unusual for historical pipeline databases to be incomplete and inaccurate. These are industry numbers that cannot be audited. Accufacts has often cautioned about recognizing the limits of such historical databases. I further believe that a more fracture mechanics based analysis of the OPS/PHMSA database will support an equal to or greater than 30 % SMYS threshold for pipeline rupture dynamics.

However, I would agree with Mr. Deaver that the hoop stress should not be used as a decision criterion in the Fabrication and Construction Threats decision tree (PG&E's Step 2D). For the majority of the construction threats identified in Step 2E, the hoop stress is not a proper screening parameter.[8] For example, poor acetylene girth welds and other older pipe segment joining methods, in unstable soils or earthquake faults, can fully separate under external load regardless of their % SMYS level and exhibit gas release rates that technically may qualify as leaks because of the lower hoop stresses. However, such a leak would be a high mass rate of release, characteristic of a rupture mass rate of release, for such full girth weld connection or separation failures.

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[8] PG&E proposed IP, " Implementation Plan Pipeline Modernization Decision Tree," Attachment 3A, filed August 26, 2011.