BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking on the Commission's Own Motion to Adopt New Safety and Reliability Regulations for Natural Gas Transmission and Distribution Pipelines and Related Ratemaking Mechanisms.	Rulemaking 11-02-019 (Filed February 24, 2011)

TECHNICAL REPORT OF THE CONSUMER PROTECTION AND SAFETY DIVISION REGARDING SOUTHWEST GAS CORPORATION'S PIPELINE SAFETY IMPLEMENTATION PLAN

Respectfully submitted,

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January 3, 2012

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Executive Summary

On August 26, 2011, as required by California Public Utilities Commission (CPUC) Decision 11-06-017 (D.11-06-017), Southwest Gas Corporation (SWG) submitted its Natural Gas Transmission Pipeline Comprehensive Pressure Testing Implementation Plan (Implementation Plan) detailing its proposals for:

1) testing or replacing its California transmission pipeline facilities lacking complete, accurate, and verifiable documentation related to their established operating pressures; and
2) determining locations for installing automated valves that may help SWG to better detect, identify, and provide a timely response and reduce the consequences, in a densely populated area, of any significant breach to the integrity of a transmission pipeline.

As required by the November 2, 2011 Assigned Commissioner Scoping Ruling, the Consumer Protection and Safety Division (CPSD) performed a technical review examining the decision making process and the reasonableness of the actions and prioritizations proposed in the SWG Implementation Plan. CPSD examined the likelihood of these actions being achieved as intended, identified possible modification or elimination of elements of the proposals that will not unduly increase public risk, and raises other issues which the CPUC should be aware of.

The SWG Implementation Plan addresses approximately 15.4 total miles, all of SWG's transmission pipeline facilities in California. CPSD believes SWG's proposal to not test or replace pipeline on its Harper Lake Transmission System (HLTS), and only install a single remote controlled shut-off valve on this system, is reasonable. CPSD suggests that SWG consider installing the valve on the smaller diameter section of the HLTS to obtain optimum results.

CPSD believes replacement of SWG's Victor Valley Transmission System (VVTS) pipeline is reasonable when considering all factors. However, CPSD believes that pressure testing is also feasible to pursue and could present a lower cost to SWG. CPSD believes pressure testing could be performed by SWG without the need to extract 200 coupons from pipe, and using of air or nitrogen as the test medium instead of water. SWG has experience using air/nitrogen mixtures as a testing medium in Class 3 locations. Part of the VVTS was constructed in 1965, when CPUC General Order 112 required pipeline segments operating at or above 20% of SMYS in Class 1 locations to be pressure tested when installed and required SWG to maintain

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specifications for materials and equipment, installation and testing for all facilities; however, SWG has provided no such installation records for VVTS Class 1 pipe. Therefore, whether tested or replaced, costs related to replacement or testing pipeline in VVTS Class 1 locations should not be borne by SWG's ratepayers.

Procedural Background

In response to the September 9, 2010 gas incident involving PG&E's Line 132 in San Bruno, the CPUC instituted Rulemaking 11-02-019 to examine regulatory changes and other actions that CPUC regulated gas transmission operators Pacific Gas & Electric Company, Southern California Gas Company, San Diego Gas & Electric Company, and Southwest Gas Corporation (collectively Operators) needed to take to improve the safety of their systems. A significant part of the CPUC's efforts to improve pipeline safety are focused on Operators validating that all their transmission pipeline segments have their maximum allowable operating pressure (MAOP) established on accurate, complete, and verifiable documentation.

In D.11-06-017, the CPUC directed Operators to identify their respective transmission pipeline segments that have their MAOP established using methods other pressure testing, those with deficiencies in pressure testing documentation, those with testing performed to levels inferior to those that would apply to the segment today, as well as other concerns important to the particular operator, and to prioritize the identified segments for pressure testing, replacement, or other consideration. The CPUC's decision requires Operators to determine where the installation of automated valves, primarily in Class 3 and 4 locations[1], could help in mitigating the consequences of a significant pipeline breach, if it were to occur. D.11-06-017 ordered Operators to prepare and file, by August 26, 2011, their respective Implementation Plans detailing their proposals for pressure testing, replacing, or taking other actions to address the CPUC's concerns about inadequately tested pipeline segments, the installation of automated valves, as well as cost estimates for the activities included in the Implementation Plans, along with a proposal for cost recovery.

[1] Class locations, which are defined in Title 49 Code of Federal Regulations, Part 192, §192.5, refer to population densities in the vicinity of a pipeline. Class 1 locations are least densely populated areas while Class 4 locations are considered most densely populated.

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The SWG System

Within California, SWG provides natural gas service to areas surrounding the cities of Barstow, Victorville, Big Bear Lake, Needles, South Lake Tahoe, and Truckee. SWG operations in California consist almost entirely of facilities, which by definitions contained in Title 49 of the Code of Federal Regulations (49 CFR), Part 192, §192.3, are considered as distribution facilities. Such facilities operate at stresses less than 20% of their specified minimum yield strength (SMYS) and supply gas to residential, commercial, or industrial customers who consume relatively low volumes of gas.

Although SWG is primarily a gas distribution operator, it also operates approximately 15.4 miles of transmission facilities in California.[2] The 15.4 miles of facilities are located in two distinct systems, connected by a 4-inch diameter distribution line, which SWG refers to as the Harper Lake Transmission System (HLTS) and the Victor Valley Transmission System (VVTS). The HLTS has all of its 8.3 miles of pipeline, with the exception of approximately ¾ of a mile, located in Class 1. The VVTS has 7.1 miles of pipeline located in Classes 1 and 3.

The Implementation Plan

As required by D.11-06-017, on August 26, 2011, SWG submitted its Natural Gas Transmission Pipeline Comprehensive Pressure Testing Implementation Plan (Implementation Plan). Since the scope of D.11-06-017 is limited to transmission pipeline segments, the SWG Implementation Plan addresses only facilities on its HLTS and its VVTS.

The SWG Implementation Plan details SWG's proposals for: 1) replacing transmission pipeline facilities on its VVTS in order to assure that operating pressures are based on complete, accurate and verifiable records; and 2) installing a single remote controlled shut-off valve (RCV) on its HLTS in order to help SWG better detect and identify a significant pipeline breach on that system and provide a timely response to stop the flow of gas through the damaged pipeline section.

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[2] By definition in 49 CFR, Part 192, §192.3, transmission facilities include those that: 1) operate at pressures which subject these facilities to stresses of 20% or more of SMYS; or 2) primarily supply gas to customers who consume large volumes of gas or resell the gas which they obtain from the line to another party.

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SWG proposes to complete the activities included in its Implementation Plan in two phases, labeled as Priority 1 and Priority 2, within 18-24 months of obtaining CPUC approval for its Implementation Plan. During the Priority 1 phase, SWG proposes to replace 3.1 miles of VVTS Class 3 pipe, of which 1.33 miles is in an HCA. The remaining 4 miles of VVTS Class 3 and 1 pipe is proposed to be replaced, along with the installation of the RCV on the HLTS, as Priority 2.

The HLTS and VVTS , contain 8.3 miles and 7.1 miles of transmission pipeline, respectively, and are very dissimilar to one another in regard to pipe sizes, installation dates, readily available documentation related to design, construction and historical pressure testing, and current ability to accommodate the use of inline inspection (ILI) tools to perform integrity inspections of these pipelines. The Implementation Plan reflects these dissimilarities in proposing different solutions for each system.

The Harper Lake Transmission System

SWG installed the HLTS in 1989. The only source of gas into the HLTS is its tap to a Pacific Gas and Electric Company transmission line. The HLTS starts as a 16-inch diameter line at its tap point, reduces to 12-inch diameter, and eventually to a 10-inch diameter near its terminus point, a solar power farm. In addition to the solar power farm, the HLTS supplies gas to one small customer through a farm tap and one 4-inch, high-pressure distribution line which supplies gas south to the VVTS at its MAOP of 250 psig.

SWG has complete documentation related to the construction and pressure testing performed on HLTS to establish its current MAOP of 720 pounds per square inch gage (psig). At its MAOP, the HLTS operates at 50% of its SMYS and at its maximum operating pressure (MOP) of 550 psig, it operates at 39% of its SMYS. Other than approximately ¾ of a mile which is located in a Class 3 location, the HLTS is located in a Class 1 location. The HLTS can accommodate ILI tools, but it does not currently have any launchers or receivers installed for these tools.

Because the HLTS is constructed, pressure tested, and documented to current regulatory standards, the Implementation Plan proposes to not perform any pressure testing or pipeline replacement on the HLTS. However, SWG proposes to install a single remote controlled shut-off valve (RCV) on the HLTS which SWG states would allow it react faster than the anticipated 60 minutes it could now take its technician to reach and fully shut off natural gas flow from the HLTS. The installation of the RCV

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would be treated as Priority 2 and occur in the latter phase of the 18-24 month implementation time frame.

The Implementation Plan provides no details regarding the exact location on the HLTS where the proposed RCV would be installed; however, from cost estimates provided by SWG for the single RCV, it appears to CPSD that the valve is intended to be installed somewhere on the 16-inch diameter portion of the HLTS, most likely at the tap point to Pacific Gas and Electric Company's pipeline from which the HLTS sources its gas.

FINDING: The SWG proposal to install a single RCV on its HLTS is reasonable in light of SWG estimates for its technicians to reach manual valves in an emergency.

- SWG has not provided any details as to where exactly on the HLTS its proposed RCV would be installed; however, based on SWG's cost estimates, is appears to CPSD it is intended to be installed at its tap point to PG&E.
- If CPSD is correct about the intended location of the RCV, CPSD notes that this valve will primarily protect a very low population density Class 1 area surrounding the HLTS pipe.
- Since the HLTS Class 3 location is primarily the final ¾ miles of the line, CPSD suggests that SWG install the RCV closer to the Class 3 location instead of where the HLTS is tapped to PG&E's pipeline. While this would result in the larger diameter Class 1 piping upstream of the valve not being protected by the RCV, it would allow SWG to use a smaller 10-inch diameter valve instead of a 16-inch diameter valve. The smaller diameter valve would lower costs and reduce the consequence to the Class 3 area at the terminus of the HLTS.

The Victor Valley Transmission System

In contrast to the availability of complete records for its HLTS, the 7.1 miles of transmission pipe on the VVTS does not have any documentation to show VVTS was pressure tested to a level of 1.5 times its current MAOP of 250 psig, nor does it have complete, accurate, and verifiable records to show initial system construction and all subsequent alterations occurring on the VVTS. Current MAOP for the VVTS, therefore, is established based on conservative engineering assumptions. Although SWG has previously replaced some sections of original pipe, SWG does not have sufficient data on all pipe properties, fittings and capped laterals, or past alterations, to provide it with confidence for conducting a 1.575 times MAOP hydro-test, which includes a minimum 5% spike test, on the 7.1 miles of the VVTS piping.

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Table 1 – Data related to the Victor Valley Transmission System

Installation Date	Length of Pipe (feet)	Pipe Diameter (inches)	USDOT Class Location	Hoop Stress at 250 psig MAOP	SWG Assigned Priority
Dec-57	34,450	8.625	3	24%	1 some 2
Dec-57	875	6.625	3	23%	1 some 2
Jan-65	2,175	6.625	1	23%	2

When SWG installed the 2,175 feet of 6.625-inch diameter pipe in 1965 in a Class 1 location, GO 112 required a pressure test to a level of 1.25 times the MAOP, held for a minimum of 1 hour, to be performed, for pipe segments operating at 20% or more of SMYS, and for documents to be maintained, for the life of the pipe, to demonstrate compliance with GO 112. If the MAOP of the line at time of installation was 175 psig, which the VVTS Class 1 pipe appears to have operated at prior to being uprated by SWG in 1973, then the newly installed line would have been operating at approximately 16.3% of SMYS. As such, a strength test would not have been required by GO 112 or industry code requirements, due to the installation operating under 20% of SMYS and being in a Class 1 location. However, CPSD cannot know for certain what the test values should have been, or were, because SWG has provided no documents related to the construction or testing related to the 1965 installation even though such records were required to be maintained by GO 112, Sections 301-303.

When SWG installed the 8.625 and 6.625-inch diameter pipe in 1957 in Class 3 locations, ASA B31.1.8-1955 was the pipeline industry standard code for the design, installation, and testing of transmission pipelines.[3] ASA B31.1.8-1955 contained requirements covering material qualification, welding, and strength testing of new and used pipe after installation, among others. If such testing was conducted on the VVTS pipe when it was installed in 1957 in a Class 2 or 3 location, ASA B31.1.8-1955 would have required the pipe to be pressure tested to a minimum level of approximately 263 psig (1.5 times 175 psig MAOP, the MAOP of the VVTS prior to it

[3] The American Standards Association (ASA), sponsored by the American Society of Mechanical Engineers, established gas pipeline industry standards at the time.

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being uprated in 1973). This test pressure is lower than the 394 psig pressure test now required to establish an MAOP of 250 psig with a 5% spike test.

SWG uprated the VVTS from 175 psig to 250 psig in 1973. GO 112-C, which codified California's gas safety regulations at that time, required design, operating, and maintenance history to be reviewed, before commencing with the uprate, and records of the review maintained for the life of the segment. SWG indicates that such records are not readily available now, nor has SWG included the findings of its uprate review in its Implementation Plan.

As a result, SWG proposes to simply replace all 7.1 transmission miles, as shown in Table 1, on the VVTS with new 8.625-inch diameter coated steel pipe of .322-inch wall thickness and 52,000 yield strength. Replacement will lower operating stresses on the VVTS and allow it to legally be considered and operated as a distribution system. As such, transmission integrity management requirements would no longer apply to the VVTS after system replacement. SWG estimates annual savings of approximately $41,000 for the 1.1 miles of HCA in the VVTS.

CPSD's review noted that SWG concluded a project on December 15, 2011, started on August 29, 2011, to replace Class 3 VVTS pipe. This project was not addressed in the SWG Implementation Plan; however, through this project, SWG may have replaced approximately 0.2 miles of HCA mileage on the VVTS. CPSD has requested, but not yet received, information from SWG to explain the 0.2 mile difference between the 1.3 miles of HCA it provided in its Implementation Plan and the 1.1 mile it noted in its recent response to an information request from the CPSD.

The SWG Implementation Plan does not propose automated valve installations for the VVTS because SWG estimates that its technicians can reach and close any existing manual valves that are necessary to isolate a breached section of pipe on the VVTS in less than 25 minutes.

SWG presents the following advantages which it believes replacing pipe instead of testing provides:

1) A new system, with known pipe specifications, would be constructed to modern standards using materials and procedures superior to those that existed, and were most likely used, when the original system was constructed;

2) More predictability and system reliability since SWG should be able to develop more accurate estimates (i.e., costs, schedules, etc.) for new construction vs. replacement of multiple sections that fail under testing;

3) Eliminates the need to assure material specifications, through the extraction and testing of approximately 200 coupons from existing pipe (as required by 49 CFR Part 192), and in order to have records considered "traceable, verifiable and complete."

4) Pressure testing is incapable of finding certain deficiencies on the pipeline unless a high enough test pressure is used; however, if SWG were to perform a test to 1.5 times MAOP with a 5% spike test (i.e., 1.575 times MAOP) there is possibility that some unknown facilities connected to the system could fail under the test pressure;

5) Pressure testing of existing line "would not lead to modifications to make the line capable of 'smart-pigging'." However, replacement "Provides capability of accommodating in-line inspection tools."

6) Replacement would eliminate the need to introduce water into the existing lines which, if not properly removed, could cause internal corrosion and damage pressure regulating equipment. Water would also present permitting issues due to environmental concerns surrounding its disposal after its use in testing.

Many of the concerns expressed in SWG's Implementation Plan are valid and it is difficult to argue that its proposed new system, built using modern materials and techniques, would not be superior to, and would not qualitatively decrease the risk presented by, its existing system. The cathodic protection system for VVTS would also receive benefit from the higher quality coatings that would be applied to the new pipe versus the coatings on existing pipe.

CPSD believes that some of SWG's concerns can be addressed through currently available measures which might argue in favor of pressure testing rather than replacement. For example, through the application of a 5% spike test, and the safety factors built into pressure test levels, growth rates for remaining time dependent flaws, such as corrosion, can be estimated, while non-time dependent flaws that survive a minimum 1.5 times MAOP pressure test plus a 5% spike test are unlikely to grow after the test. Regarding concerns about the inability of pressure testing to sufficiently test girth welds, while it is true that a pressure test will not subject a girth

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weld to the same stresses as the longitudinal weld, most pipeline failures that occur due to a weld failure occur on the longitudinal weld. Concerns related to water remaining in the pipelines following hydro-testing, and water disposal permitting issues, can be addressed by SWG using a medium other than water for pressure testing of the existing pipe, at its current MAOP. CPSD notes that replaced pipe will require water as the test medium, due to SWG's intended test pressures in Class 3 locations, and will not be immune to potential permit issues.

In Class 3 locations, the minimum test pressure required to test existing VVTS pipe, for an MAOP of 250 psig, including a 5% spike test, would be 394 psig (38% of SMYS) held for one hour. CPSD believes 49 CFR, Part 192, subpart J, §§192.503 and 192.507, allow for the minimum required pressure testing levels, plus a 5% spike pressure test, to be achieved through the use of air or an inert gas (i.e., nitrogen), or a combination of the two as the test medium, in both Class 1 and 3 locations. CPSD's review of SWG documentation indicates that SWG has experience with using this pressure medium to perform testing in Class 3 areas.

In Class 1 locations, with few exceptions, current safety regulations require a minimum test pressure to a level of 1.1 times the MAOP to be performed. The minimum test pressure required to test existing VVTS pipe, including a 5% spike test, would be 289 psig (27% of SMYS) held for one hour. A few Class 1 VVST locations or facilities, such as regulator station piping, would be required to be tested to Class 3 levels. 49 CFR, Part 192, §192.201 currently allows for a 10% increase in pressure above MAOP in the event of a regulator failure; therefore, for VVTS Class 1 pipe, the spike test pressure would exceed by only 5% (the amount of the spike test itself) the 10% increase in pressure allowance currently provided for by Part 192, §192.201.

CPSD also disagrees with some of the assumptions that SWG uses to reject pressure testing. For example, CPSD believes there is no mandate for SWG to extract approximately 200 coupons, which it states are necessary, in order for it to learn of the pipeline specification prior to performing a pressure test to confirm the existing MAOP. This is because 49 CFR, Part 192, §192.109 and Appendix B, Table 2(d), both of which are related to pipeline design, are not retroactive as the regulations generally do not apply new design requirements to existing pipeline systems. In addition, SWG data for wall thickness readings of pipe intended to be replaced, albeit very limited, indicate that wall thicknesses may be higher than the conservative values SWG has used as minimum values in its calculations. CPSD has requested, but not yet received, additional information from SWG regarding its policies and history of collecting wall thickness data during excavations and other operations.

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SWG argues that pressure testing, unlike replacement, "would not lead to modifications to make the line capable of 'smart-pigging'." Because of the low operating pressure of the VVTS, it appears to CPSD that neither replacement nor pressure testing would support smart-pigging because SWG intends to retain the same MAOP and looped nature of the VVTS. As SWG notes in its Implementation Plan, the current VVTS MAOP makes it "…challenging for current pigging technology to be effective." Since SWG provides no estimates for replacing any existing pipeline features within the VVTS system that would be obstacles to ILI tools (i.e., non-full opening valves), it appears that none exist. Therefore, the same emerging robotic, self-powered, technology proposed to be used in replacement pipe could be used by SWG in existing pipe, after testing of the pipe. CPSD has requested, but not yet received, additional information from SWG related to the use of ILI tools on the VVTS.

In its Implementation Plan, SWG lists general concerns regarding customer constraints that could result while lines are undergoing pressure testing or possible failures that result from the testing. However, SWG has not developed or provided any specifics that allow CPSD to determine the extent of outages that may result under either of these scenarios or that SWG does not have the ability to plan for and execute contingency measures to avert pressure testing from unduly impacting SWG's ability to continue supplying all customers with gas service while testing is underway.

FINDING: SWG's Implementation Plan clearly details why SWG would prefer to replace, instead of pressure test, its 7.1 miles of VVTS transmission piping. CPSD agrees that the new piping would be state of the art, and that pressure testing to 1,080 psig, to establish a segment MAOP of 720 psig, a system MAOP of 250 psig, and a system MOP of 240 psig, would result in the new system pipe operating at 6% of its SMYS. This would allow the new pipe to be removed from SWG's Transmission Integrity Management Program. According to SWG, this would entail an average annual savings of approximately $41,000.

FINDING: Whether the existing VVTS pipe is replaced or pressure tested, current, non-self-powered, ILI tools, cannot be used on the VVTS due to pressure and flow conditions which inhibit their use. Any inline inspections of the VVTS system will have to be performed using robotic, self-powered, tools.

- CPSD is aware that robotic tools, with capabilities to maneuver through obstacles that have historically prohibited the use of today's commercially available ILI tools, are already available. Further research related to such tools

is progressing rapidly and work is underway to resolve some of their limitations (i.e., the limited length of pipe the tools can inspect).
- CPSD believes that the same emerging robotic, self-powered, technology SWG proposes to use in replacement pipe could be used in existing pipe.

FINDING: SWG did not consider or address the use of air, inert gas, or some combination of the two as a test medium in its implementation plan.
- CPSD believes existing regulations allow SWG to perform required pressure testing to establish an MAOP of 250 psig with a 5% spike test, using air or an inert gas as the test medium.
- The use of air, inert gas, or some combination would avoid any damage to pipeline facilities or equipment that could occur from any water not removed from the pipeline after pressure testing and avert potential permitting difficulties related to the disposal of water after testing.

FINDING: Pressure testing of the VVTS is feasible, likely at lower cost than estimated by SWG.

FINDING: When SWG installed the 2,175 feet of 6.625-inch diameter pipe in 1965 in a Class 1 location, GO 112 required a pressure test to a level of 1.25 times the MAOP, held for a minimum of 1 hour, to be performed and for documents to be maintained, for the life of the pipe, to show SWG's compliance with GO 112 regarding pipelines operating at or above 20% of SMYS. However, because SWG has provided no documentation of pipeline specifications, installation, or testing related to the 1965 installation, CPSD cannot confirm if SWG complied with GO 112.
- CPSD believes the costs for new testing or replacement of the Class 1 segments should be borne by SWG shareholders because of its failure to follow GO 112.

FINDING: GO 112-C, in place when SWG uprated the VVTS from 175 psig to 250 psig in 1973, required design, operating, and maintenance history to be reviewed, before commencing with the uprate, and records of the review maintained for the life of the segment. SWG indicates that such records are not readily available now, nor has SWG included the findings of its uprate review in its Implementation Plan.

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