



California Public Utilities Commission

Staff Report on Investigation of Pacific Gas and Electric Company's Gas Transmission Pipeline Welding Practices



Consumer Protection and Safety Division

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Executive Summary

The California Public Utilities Commission (CPUC) is developing new safety and reliability rules for natural gas pipelines in Rulemaking (R.) 11-02-019. In February 2012, the United Association of Plumbers, Pipe Fitters, and Steamfitters, Locals 246 and 342, submitted prepared written testimony in this proceeding through two of their individual members, Marshall Worland and Mike Mikich. This testimony alleges that certain welds performed by Pacific Gas and Electric Company (PG&E) on specific gas pipeline segments were problematic, perhaps in an effort to reduce costs, and further that a non-independent process was used to inspect welds in PG&E's pipeline hydro-testing program. The testimony includes allegations of: extensive corrosion on the exterior surface of the pipelines; "wedding bands" used to join pipe sections in lieu of joining the sections by butt welding; the installation of "stub-ins", which can damage in-line cleaning and inspection; cracked coatings; deep and long arc marks made through poor welder workmanship; and, girth welds with incomplete penetration not meeting accepted criteria.

The CPUC's Consumer Protection and Safety Division extensively investigated these allegations. CPUC staff interviewed Worland and Mikich, reviewed records related to PG&E's hydro-testing program, oversaw the excavation and reexamination the pipe and welds at two locations where Worland would have performed inspections, and reviewed related PG&E inspection documents.

Based on its investigation, CPUC staff did not find any instances in which welds were not inspected in compliance with federal and state gas pipeline safety regulations. Further, CPUC staff found that as part of its hydro-testing program, PG&E is evaluating defects when they are found, and that any significant defects are cut-out of the line prior to hydro-testing. Any defects remaining on the line, for example those that may remain on non-exposed sections of pipelines, are then evaluated through the hydro-testing. Any defects that fail through hydro-testing are then also removed from the line. PG&E has processes in place to determine the extent of remaining defects that may pass hydro-testing, and can use this information in planning for future assessments of the tested sections.

Though the allegations described above were determined to be unfounded, CPUC staff continues to monitor PG&E's gas pipeline safety programs and practices. This oversight includes a careful review of PG&E's pipeline welding practices and techniques, as well as its hydro-testing program and methods.

Background

On February 24, 2011, the California Public Utilities Commission (CPUC) issued R. 11-02-019, an Order Instituting Rulemaking on the CPUC's Own Motion to Adopt New Safety and Reliability Regulations for Natural Gas Transmission and Distribution Pipelines and Related Ratemaking Mechanisms. Related to this proceeding, on February 6, 2012, the Law Firm of Davis, Cowell & Bowe, LLP, attorneys representing the United Association of Plumbers, Pipe Fitters, and Steamfitters Local Union Nos. 246 and 342, and their individual members (U.A. or Locals) submitted prepared direct testimony from Marshall Worland and Mike Mikich. The Locals did not participate in the March 2012 Evidentiary Hearings related to PG&E's Proposed Implementation Plans.

The Locals represent welders that are employed by firms, such as ARB, that contract with utilities to perform gas pipeline-related work. ARB has been performing work for PG&E since the hydro-testing began following the PG&E pipeline rupture in San Bruno in 2010. Locals and their signatory employers (non-PG&E) co-sponsor apprenticeship and training programs that train employees who perform pipeline-related work. Utilities, including PG&E, maintain their own training programs. All welders performing work on a jurisdictional pipeline, whether employed by a utility or a contractor working for the utility, are required by federal regulations to be qualified per American Petroleum Institute Standard 1104 (API 1104).

Federal and state regulations (49 CFR, Part 192, Section 192.225) specify that all welding procedures used to perform welding on gas pipelines must be qualified by the operator. Although the locals made allegations related to conditions on pipelines, the speed with which welds were performed by PG&E's welders, pre-heating issues, or inspections related to welds, the Local's testimony did not identify any issues or concerns related to PG&E's welding procedures.

Marshall Worland

Marshall Worland was employed by CANUS, a firm engaged by PG&E to provide excavation oversight and inspection services to PG&E's hydro-test program (Program). Mr. Worland performed Program-related welding inspections on various Program tests. Mr. Worland was trained by PG&E to perform stand-by duties, an Operator Qualified (OQ) covered task per PG&E's standards.

Allegations in Mr. Worland's Direct Testimony Include:

- Pipe installed from 1949 had weld quality that would not meet today's standards.
- Welds had defective root passes on the "butt" welds that were defective with no 12-inch portion of any root pass that could meet current welding standards.
- Gaps in root passes, which are known as "inadequate penetrations."
- Burn-through and "internal undercuts" and overall poor quality.

- Numerous observations of substandard welding performed by PG&E employees doing tie-ins. This work may have jeopardized the integrity of PG&E's gas transmission pipelines.
- PG&E's welders were too slow, resulting in substandard welds due to loss of pre-heat during welding.
- Pre-heating is "absolutely necessary" to proper pipeline welding procedures, and that if the weld is x-rayed, hydrogen cracks may not form until "a day or more" after the weld has been made and therefore not discovered unless the x-ray is made after the weld has completely cooled.
- A "cozy" relationship between CANUS and PG&E; many employees of CANUS are previous employees of PG&E. In addition, CANUS inspectors are required to be members of the same union that represents most of PG&E's employees, including its welders. Therefore, CANUS did not perform its task as an independent inspector, and encouraged "corner-cutting and the failure to enforce pipeline-integrity standards."
- In contrast to the work he had performed for CANUS, Mr. Worland stated that on each of his other pipeline inspection jobs, the "inspection company and its employees were independent of the company that owned and operated the pipeline." Mr. Worland also stated that other inspection companies did not have "so many executives and inspectors" who were former employees or retirees from the operator nor did those companies require their inspectors to join the same union as that representing the employees of the operator.

Mr. Worland performed Program-related work from May 25, 2011, to August 15, 2011. On August 16, 2011, PG&E requested that CANUS remove Mr. Worland from the Program. PG&E records allege that Mr. Worland was removed from work on the Project on August 16, 2011, due to the following issues: insubordination involving the communication of information to supervisors and engineers, improper documentation of process steps, and failure to bring personal protective equipment to safety meetings.

During the time Mr. Worland performed Program work, he did not communicate concerns related to any deficiencies he may have observed in his capacity as a welding inspector, or any other, to CANUS' Chief Inspector. This is required by the PG&E/CANUS contract, Section 5.6.8, *Welding Inspections*, which requires welding inspectors to advise the CANUS Chief Inspector of all decisions, problems, and possible alternatives to assigned work. CPUC staff reviewed all of the daily inspection reports generated by Mr. Worland during his time inspecting welds on PG&E facilities and found no entries correlating with the issues and concerns stated in his direct testimony filed by the Locals.

Mike Mikich

Mike Mikich, a welder employed by PG&E's contractor ARB, performed work related to the PG&E hydrostatic test program from March 29, 2011, until he left ARB on May 30, 2011. Mr. Mikich passed PG&E's welding qualification tests on March 21, 2011.

Allegations in Mr. Mikich's Direct Testimony Include:

- Mr. Mikich indicated he has 25 years experience as a welder and pipe fitter with about 70 percent of that time on gas pipeline work (pipeline construction, testing, restoration and repair, and gas storage facilities), in California, Oregon, and Alaska.
- Since November 2011, Mr. Mikich has worked as a Business Representative for the Local, “representing and advising welders and pipe fitters employed on gas pipeline work.” Mr. Mikich stated that he collected his own observations while working on PG&E’s gas transmission pipelines along with the observations of his fellow U.A. pipeline welders and another Local 342 Business Representative.
- While performing Program-related welding for ARB, Mr. Mikich stated that he and his fellow welders saw defective welds and corroded pipe “that appear to be extremely hazardous.” Mr. Mikich also stated that foam pigs used to push air out of pipes did not completely seal the pipe, sometimes came out of the pipe badly damaged, and that “we did not see any high-point vents in the pipeline” used to remove air from the pipeline as the water used for testing would flow into it.
- The testimony indicated that the “vast majority of welds we saw on Line 132 in several parts of the Bay Area were defective.” These defects included “wedding bands” that did not have root passes and “arc marks”, some as much as “one-sixteenth of an inch” and some “a foot long” that were “too many to count” and in “almost every piece of pipe we took out.” The testimony also stated that the overwhelming majority of the welds “we saw on Line 132 and elsewhere on the San Francisco peninsula, the South Bay and the southern part of the East Bay showed extraordinary poor workmanship.” There were “stub-ins” on the lines, which are an “unworkmanlike” way to connect a branch or a valve to the main line; and the presence of 8-inch by 8-inch plates “seal” welded on the outside of the surface of the pipeline had no “root passes, hot passes, or other penetrations” and would not be an “accepted practice anywhere.”
- Mr. Mikich stated: “We saw lots of corrosion on four pipeline segments in Palo Alto and several more in Redwood City” and “cracked coating everywhere we went.” Instead of replacing the segment of pipeline found to be corroded 50 percent through its wall, PG&E placed a “six-foot-long wedding band” on it before hydro-testing the pipeline. The “same test section” failed a hydro-test requiring another wedding band to be placed. The tested section eventually passed the hydro-test; however, Mr. Mikich’s testimony expressed concern about “how much and how many other defects it has, and how long the pipeline will last.”
- According to Mr. Mikich, a PG&E engineer limited the extent of longitudinal seam to be examined through radiographic examination after an earlier radiograph of a girth weld, which tied a length of pipe back into the main line after “camera work” on the pipeline had been completed, failed the portion of the longitudinal weld included in the radiograph. The PG&E engineer instructed radiographs to be shot until “3 inches” of longitudinal weld not containing any seam defects was obtained and replace the section of pipe up to that point.

Mr. Mikich's testimony expressed concern about how this approach could discount the possibility of seam defects existing on the pipeline "a few inches or feet or miles farther along."

- CANUS inspectors held non-PG&E welders to more lenient standards by allowing PG&E welders to perform "informational" radiographic shots between passes, while only taking shots of non-PG&E welders after all three or four of the welding passes had been completed. This afforded PG&E welders more opportunities to repair the weld and avoid rejected welds having to be cut-out of the pipeline, versus non-PG&E welders, and harmed the pipe through multiple, repetitive heating and cooling cycles endured by the pipeline.
- The testimony also provided photographs "we took" while working on PG&E's pipelines in the Bay Area during 2011.

Investigation Findings

Review of PG&E's Hydro-Test Documentation:

On February 12, 2012, soon after the Locals submitted direct testimony from Messrs. Worland and Mikich, CPUC staff met with PG&E to review records related to the allegations made in the testimony. CPUC staff's primary concern was to confirm that all girth welds performed for hydro-testing projects that Mr. Worland and/or Mr. Mikich were associated with, had been radiographed, and that the radiographs were evaluated by an independent, qualified radiographer meeting PG&E's Weld Inspection Standard (D-40).

PG&E representatives indicated that all blow down and tie-in welds are performed by PG&E General Construction (GC) welders. PG&E's GC staff also examines the shoring of the excavation. PG&E employed CANUS for construction project supervision including weld inspection, stand-by, coating inspection, and utility inspection. PG&E indicated it did not initiate any "change" in policy regarding visual inspection of welds when the hydro-testing program was started and that as a general approach, it chose to use its own labor force to perform, supervise, and inspect the welds performed by its own employees and primarily directed CANUS to oversee the work of its contracted labor force. PG&E stated that there was never "an express policy, in the contract or otherwise, that prohibited a PG&E inspector from inspecting a contractor's weld, or vice versa."

PG&E's Standard D-22, Section 3(G), specifies that for welding circumferential welds on pipe larger than 12-inches (nominal) in diameter, a minimum of two welders are required to work simultaneously on opposite sides of the pipe. In 2011, all hydro-tests completed by PG&E were on lines with a diameter of 24-inches or larger. With few exceptions, for pipelines under a nominal diameter of 6-inches and limited number of welds on pipelines operating under 40 percent SMYS, PG&E requires 100 percent radiographic inspections of pipelines operating at or above 20 percent of SMYS in Class 3 or 4 locations, or operating at a Maximum Allowable Operating Pressure (MAOP) of 200 psig or over and located on bridges. CPUC staff's review did not find any hydro-test records where the girth welds had not been radiographed per the requirements of PG&E's Standard D-40.

Standard D-40, requires a visual inspection of all welds, but does not require that an inspector be present during the entire welding process as long as various specified items are checked “frequently enough to ensure that the welding standards are being met.” Moreover, Standard D-40 requires the visual inspections to be performed by an experienced welder or former welder, and does not limit a welder who has the proper Operator Qualification, knowledge, and complete comprehension of the applicable numbered document and welding procedure, from being designated as an inspector of his/her own welds by a supervisor who takes responsibility for determining the inspection qualifications of the welder.

Although Mr. Mikich, during his interview with CPUC staff, stated that he did not actually observe the patches on the pipeline noted in direct testimony, CPUC staff investigated where such patches may have been observed by PG&E during its hydro-testing. According to PG&E, it found patches, fillet welded on its Line 153, during camera inspections. PG&E stated that the patches had been placed on the line to pull a communication cable into the line at sometime in the past. PG&E also stated that this was not a common practice and many of the patches have been, or will be, cut-out of the line. Two segments from which the patches were cut-out have undergone hydro-testing and the third segment containing the patches was to have been addressed through identification by camera inspection performed in March/April 2012 and then cut-out of the sections following that. Moreover, the segment that has not yet been hydro-tested continues to operate at a CPUC ordered reduced pressure of 246 psig vs. the 420 psig existing prior to the order.

February 21, 2012 Telephonic Interview of Marshall Worland:

On February 21, 2012, CPUC staff interviewed Mr. Marshall Worland over the telephone. Mr. Worland, who was not under any oath during the interview, was represented by his counsel, Jack Davis. During the interview, Mr. Worland expressed concerns that generally re-iterated his direct testimony. Mr. Worland did not provide specifics regarding what exactly he had observed, on which testing project, or the specific geographic location of the testing project.

In response to questions related to his concerns regarding the pre-heating of pipe, Mr. Worland agreed with CPUC staff that not all welding procedures require pre-heating and the need to pre-heat is primarily driven by material properties, the thickness of pipe being welded, and ambient temperature conditions prevailing at the time welding is performed. Mr. Worland indicated that his concerns related to the absence of pre-heating of pipe prior to welding and the potential inaccuracies associated with radiographic inspections performed before a weld has had sufficient time to cool, stemmed from his experience on one particular non-PG&E project on which he worked in the past.

On that project, involving thick-wall, large diameter pipe installed on an interstate transmission pipeline, Mr. Worland indicated that weld cracking occurred after the pipe had passed the radiographic inspections. As a result, the operator on that project modified its welding and inspection procedures to address the failures. However, Mr. Worland could not identify any specific instances of these issues he observed on inspections he performed on PG&E's Project.

In addition, regarding any observations noted in his testimony related to PG&E's welders not confirming the temperature of the pipeline, Mr. Worland was not able to recall the specific location of the project or the exact PG&E procedure being performed. Mr. Worland also indicated he may have been as far as 40 feet away from the welding he observed and he did not observe the entire weld being performed.

April 19, 2012 In-Person Interview of Mike Mikich:

An examination under oath (EUO) of Mr. Mike Mikich occurred after a March 27, 2012, subpoena was issued by CPUC Executive Director Paul Clanon compelling him to appear and be interviewed by CPUC staff in relation to his direct testimony submitted by the Locals. CPUC staff interviewed Mr. Mikich on April 19, 2012. During his interview, Mr. Mikich was represented by Marc Joseph, from the law firm of Adams Broadwell Joseph & Cardazo, a law firm that often represents PG&E employee unions.

During his interview, Mr. Mikich stated that he did not support, nor accept responsibility for, many parts of the testimony submitted in his name. In fact, Mr. Mikich stated that he had only read the testimony after receiving the subpoena. Mr. Mikich was unable to confirm who prepared certain parts of the direct testimony. Mr. Mikich stated that in addition to not knowing who prepared most of the statements in the testimony, he did not conclusively know the origins of many of the photographs included in the testimony, or who took those photographs.

Mr. Mikich refuted many of the allegations made in the testimony. For example, Mr. Mikich stated that he had no issues related to "wedding bands" found on historic pipe and the fact that they bridged large gaps and did not have any root weld passes on the inner surfaces. Mr. Mikich understood "wedding bands" to be weld sleeves that had been used to join pipe instead of butt welding the joints and expressed his belief that repair sleeves, which generally function and appear to be similar to "wedding bands," are currently used as an acceptable method to repair pipeline or joints. Mr. Mikich did not consider a "wedding band" to be inappropriate and in fact stated, "I've applied them." Mr. Mikich stated that any statements regarding problems related to wedding bands on Line 132 or are not his and that, in fact, he never worked on the job referenced in the related discussion within the testimony.

Mr. Mikich also stated that he did not observe extensive corrosion being found on PG&E's pipelines and what corrosion-related pitting he did observe on the pipeline was cut-out along with any observed defective welds (i.e., welds with incomplete penetration). In regard to corrosion found on existing pipelines, Mr. Mikich stated, "Most all the pipe that I seen...was in good shape." Mr. Mikich indicated that he did not measure any of the arc strikes and stated that the depth measurements included in his testimony were "pure speculation." In regard to questions from his testimony regarding defective welds that he observed on existing pipelines, Mr. Mikich indicated he did not agree with that characterization and stated, "Everything looked really good. We were really surprised how good the pipe actually looked." Finally, Mr. Mikich indicated that in regard to the discussion in his testimony related to plates used to seal holes used to pull a cable into pipe, Mr. Mikich stated, "I never seen a plate on the pipe so I don't ...know what they are really referring to there..."

Mr. Mikich also refuted testimony related to the absence of vents to purge air during the water fill process or the fact that many foam pigs came out damaged. Mr. Mikich indicated that he had no observations related to the absence of vents and as far as foam pigs, he never saw any pigs come out bad from a pipeline. Moreover, Mr. Mikich stated that he did not observe any facilities being installed on the pipelines, including Sav-A-Valve type fittings, that intruded beyond the inner surface of the pipeline, referred to in the testimony as “stub-ins” and which could be damaging to any internal inspection or cleaning devices that may be used in the pipeline subsequent to hydro-testing.

Excavations on March 23, 2012, on Line 153:

In order to investigate the allegations related to the poor welding practices used by PG&E welders to perform tie-in welds on some Project tests, on March 23, 2012, CPUC staff required PG&E to excavate two locations on its Transmission Line 153, located in San Leandro.

Neither Mr. Worland’s testimony nor the interviews identified specific pipeline or geographical locations related to the allegations in the testimony. However, during his interview with CPUC staff on February 21, 2012, Mr. Worland recalled that one of the projects was near Hayward. According to PG&E’s records, the only welds for which Mr. Worland performed inspections near the Hayward area was PG&E Hydro-test T-47A on Line 153. CPUC staff identified two locations for CPUC staff re-examination because:

- Together they contained a total of four tie-in welds;
- They contained one weld that at the time of the initial testing had been repaired – after being rejected by the first radiographic examination - and the repair having passed a second radiographic examination; and,
- The excavations contained two tie-in welds that had been performed by PG&E and two by ARB welders, thereby providing an opportunity to review work performed by both groups.

The hydro-tests conducted as part of Test-47A were performed in August 2011. CPUC staff examination of the documentation for the hydro-tests for Line 153 related to the two excavations in San Leandro, and others with which Mr. Worland was involved, found that it complied with the procedures used to perform the hydro-tests and the pressures used to establish MAOPs of the line following the hydro-test.

Documentation examined by CPUC staff also showed that all welds, including tie-in welds, had been radiographed, and the radiograph results evaluated per standardized acceptance criteria developed by the American Pipeline Institute (API), applied by the pipeline industry towards the testing of welds on pipelines, and accepted by federal and state gas pipeline safety regulations. Moreover, radiographs of the welds, and the evaluation of these radiographs, was performed by an independent vendor not affiliated in any way with PG&E. CPUC staff’s review found that all the welds had passed the independent review at the time of initial hydro-test.

During the examination performed on March 23, 2012, the coating applied to the pipeline, after completion of the 2011 hydro-testing, was examined and then removed to sufficient extent to enable radiographs to be made of the tie-in welds. Non-destructive magnetic particle testing was used to evaluate any indications on the pipeline and all tie-in welds were radiographed and evaluated by an independent company not affiliated with PG&E or the company that performed the same service on the subject welds of Line 153 during the 2011 hydro-testing. CPUC staff's review found some minor disbonding of coating that had been applied in 2011. However, this review did not find any issues related to weld quality not meeting acceptance criteria established by API 1104 or any other indications on the exposed portions of the pipeline that would impact or reduce the on-going integrity of the pipeline.

Finding minor disbonded coating, so soon after it has applied, indicates that there exists a need for PG&E to better monitor its coating application process and to improve the quality control of this process. However, because coating can become damaged at anytime, and because damage to the coating can lead to corrosion occurring on the pipeline, gas pipeline safety regulations require pipelines to be protected with cathodic protection. Through adequate cathodic protection, and related monitoring activities, locations of damaged or poor coating requiring remediation can be identified and the extent of corrosion activity occurring on the pipeline eliminated or reduced through mitigation.

Review of H-Form from T-46 (Line 153) and the Overall Chain of Custody Process Related to Pipe Samples Removed for Analysis:

On June 14, 2012, CPUC staff visited PG&E's pipeline storage yard where PG&E is currently storing sections of pipe removed for cause (i.e., further testing to evaluate material properties, or further evaluation of defects noted through its examination of the pipeline). All pipeline sections removed from Line 132, regardless of reason, are also stored at this facility.

All sections of pipe removed and transported to this facility are required to be tracked under a chain-of-custody process in which every component, or any section removed from that component, must be tracked and its whereabouts known. The process will also allow for associated H-Forms, used to track the results of pipe examined in excavations, to be tracked and allow for their easier review. An H-Form from Line 153 was used to perform a review of the chain-of-custody process.

Changes Made by PG&E to its Welding Forms to Better Track All Welds:

Since the Locals' February 2012 filing, PG&E has reviewed its welding and inspection process and based on this review, has developed new inspection forms that will allow the company to capture more detailed information related to each weld. In addition, PG&E has stated that in 2011 it

utilized contractors, working under PG&E supervision during the tie-in process, to supplement its own workforce; however, starting late July or early August 2012, PG&E contemplates having contractors conduct the entire tie-in process. The company has identified 10 projects where contractors would conduct the tie-in process and the welds would be inspected, using the PG&E form, by one of two independent inspection companies contracted by PG&E. The first of 10 tie-ins with the contractor conducting the tie-in process will likely occur in August 2012. .

Conclusions and Recommendations

The testimony of both witnesses raised concerns about a “cozy” relationship between PG&E and its contracted inspector, CANUS, because employees who had worked for PG&E also worked for CANUS. The testimony implied that this relationship somehow created financial incentives, or provided other encouragement, for CANUS to override its contractual obligations to perform quality inspections of PG&E’s welds. However, neither witness provided evidence to support this allegation. Moreover, during his interview, Mr. Worland agreed with CPUC staff that it was not unusual for other inspection companies with whom he has worked to have employed ex-employees of an operator whose welds were being inspected.

The applicable regulations do not prohibit an operator from determining what parts of its operations and maintenance activities are performed by its own employees or by some other qualified entity. Regulations also do not mandate that an operator have inspections of welds performed by someone other than the operator’s own employees. However, in all cases, the operator remains responsible for the qualifications of the individuals performing the work and the final work product.

The CPUC staff investigation was unable to obtain any data, or written documentation, to identify specific welds or weld locations noted as concerns in the direct testimony of Messrs. Worland and Mikich. However, CPUC staff’s review and radiographic inspection of tie-in welds, made by PG&E and ARB welders at a location where Mr. Worland implied he observed pre-heat issues on pipeline welds, found the welds, once again, passed the API 1104 acceptance criterion.

Given the discrepancies between the issues raised in Mr. Mikich’s direct testimony, and the CPUC staff interview with Mr. Mikich, CPUC staff believes that much of Mr. Mikich’s testimony may have been prepared by someone other than Mr. Mikich. Mr. Mikich disputed many of the issue items raised in his own testimony and stated clearly that he did not know who prepared a significant amount of the testimony, or the source of many of the photographs included therein. Mr. Mikich also indicated he had not read much of the testimony, submitted under his name by the Locals, until he was contacted for an interview by the CPUC. Mr. Mikich disagreed with many of the characterizations related to existing pipe included in his testimony. In general, Mr. Mikich stated his belief that he considered the condition of the existing pipelines he observed to be surprisingly good and that any defects he believed should have been cut-out of the line, were cut-out of the line.

Based on its experience overseeing PG&E’s hydro-test program and other inspection activities in which the pipe is exposed allowing for an inspection of coating or base metal, CPUC staff has observed minor corrosion or cracked asphalt coating on pipelines. Although not common, this is also not unusual, nor unexpected, since, after all, the pipelines are installed in a subsurface environment

that has rocks, tree roots, and other features that work to initiate such damage. Since the coating on the pipeline is the first barrier to help prevent external corrosion on the pipeline, cathodic protection is then used to address breaches in this barrier. However, because cathodic protection also has limitations, it can help to significantly reduce the rate of external corrosion on pipelines to extremely low levels, but may not be able to prevent all corrosion from occurring. While observing cracked coating or minor corrosion on pipelines is possible, through CPUC staff inspections of PG&E's operations and maintenance activities, CPUC staff will continue to work towards identifying deficiencies in pipeline coating or cathodic protection levels and will require PG&E to take actions to mitigate these deficiencies.

Through its oversight of PG&E's hydro-testing effort, CPUC staff will also continue to monitor the standards to which PG&E holds all staff involved in the Program, including its contractors as well as its own employees.