Docket	R.11-02-019
Exhibit Number	
Commissioner	Florio
ALJ	Bushey
Witness	Tom Roberts

OFFICE OF RATEPAYER ADVOCATES
CALIFORNIA PUBLIC UTILITIES COMMISSION

TESTIMONY OF THOMAS ROBERTS REGARDING DOCUMENT MANAGEMENT CONCERNS RAISED BY REVIEW OF PG&E DOCUMENTS AT THE NOVEMBER 19, 2013 WORKSHOP AT PG&E'S WALNUT CREEK FACILITY

San Francisco, California
December 13, 2013

1. What is the purpose of your testimony?

The purpose of my testimony is to amend the record with regard to a workshop led by PG&E on November 19, 2013, and to draw attention to concerns I have regarding PG&E's pipeline mapping, recordkeeping, and document control systems based on a review of documents related to Line 147. The desired outcome is for PG&E to demonstrate that its systems are accurate, and that CPUC engineers can independently use these systems as needed to verify compliance with applicable safety regulations.

2. What are the conclusions of your testimony?

The overarching conclusion of my testimony is that the drawings for Line 147, as reviewed on November 19, 2013, do not represent a modern drawing or document control system. I recommend that the CPUC review PG&E's overall pipeline mapping, recordkeeping, and document control systems for traceability, verifiability, completeness, robustness, and accuracy. This review should focus on the state of these systems once the current updating process is completed, which I understand to be when the new "eGIS" system is completed and fully integrated into PG&E's routine pipeline operations. I further recommend that this review start well in advance of completion of the eGIS system, to help ensure that the completed system fully supports the CPUC's responsibilities and objectives as PG&E's primary regulator.

3. Does this testimony represent a comprehensive evaluation of PG&E's document or drawing control system?

No. This testimony documents my perceptions based exclusively on the documents provided by PG&E in Exhibits A and B supporting its October 2013 Safety Certification for Line 147, and other documents related to Line 147 reviewed at the Nov. 19, 2013 workshop.[1] These perceptions are based on extensive engineering experience in the manufacturing sector, but limited engineering or operational experience with natural gas pipelines. While other workshop participants confirmed that the issues raised in this

[1] Confidential Exhibits A and B were provided with PG&E's October 11, 2013 and October 16, 2013 submissions in response to the October 8, 2013 ruling in this proceeding, but they were not filed in the record of this proceeding.

testimony are relevant, further review would be required to determine whether the issues raised in this testimony are indicative of the quality and usability of PG&E's pipeline documentation systems overall. Further review and discovery would also show whether the documents and systems reviewed during the workshop represent an interim phase of PG&E's records improvement process. My sincerest hope is that PG&E will confirm that this is an interim phase in its document management system and that PG&E can demonstrate that its pending eGIS system, as currently planned, will meet and exceed commonsense standards for accuracy, transparency, archival value, and usability.

4. <u>Did you attend a workshop at PG&E's offices in Walnut Creek on November 19, 2013?</u>

Yes.

5. <u>Why was this workshop held?</u>

My testimony dated November 14, 2013 stated that the supporting evidence provided with PG&E's October 2013 Safety Certification did not demonstrate that the entirety of Line 147 had been hydrotested. In short, the hydrotest reports included conflicting information regarding the start and stop points of each test, which made it impossible to tell if the entire line had been tested. The primary goal of this workshop was for PG&E to demonstrate that all of Line 147 had been hydrotested. The workshop also addressed issues regarding the pressure volume charts included in the strength test pressure reports (STPR) for hydrotests performed on Line 147 in 2011.[2]

6. <u>Did you review drawings of Line 147 during the workshop?</u>

Yes. Staff from GTS, a subcontractor to PG&E, walked participants through as-built drawings of the main line of Line 147 and two "shorts" associated with this pipeline.

[2] 17 RT 2664:15-17 refers to "an extensive discussion about stress-strain curves and evidence and yielding."

7. What is your experience with engineering drawings?

I have over 18 years of technical experience in the manufacturing sector, all of which has involved either the creation or interpretation of engineering drawings. This experience includes roles as:

- Draftsman with a university facilities department and medical instrument manufacturer,[3]
- Intern in the document control department of an aerospace manufacturer,[4]
- Engineer, Draftsman, shop foreman, and installation assistant with a musical instrument manufacturer,[5]
- Field application engineer for a mechanical instrumentation manufacturer,[6] and
- Test engineer at Boeing,[7]

8. Does your experience provide a reference from which to evaluate PG&E's document control systems?

Yes. My past work experience supports the premise that effective drawing and document control systems have the following common characteristics:

- **A logical drawing hierarchy**[8] – For each product, a series of drawings shows the project at various levels of detail. The hierarchy starts with dimensioned drawings of each component part which show all details necessary to manufacture them. It ends with an overall drawing, the master sheet, that provides the overall form and scale of the project, but provides few details. All drawings are numbered, and drawing numbers are carried up through the drawing hierarchy such that a user can easily navigate to the drawing that provides the level of detail needed for a particular task. Such a hierarchy is well supported by modern computer based drawing programs, in that detailed models of individual parts can be combined into

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[3] California Polytechnic University, Pomona CA, and Beckman Instruments, Brea CA.

[4] Honeywell Training and Controls System Division, West Covina CA.

[5] Schoenstien & Co., Benica CA.

[6] Bruel & Kjaer, Orange CA.

[7] Boeing Space Systems Company, Huntington Beach, CA.

[8] Throughout this section "product" refers to the complete assembly that a customer purchases, for example a blood centrifuge, a pipe organ, a 777 airplane, or a seismic upgrade to a dormitory. In the context of this proceeding, PG&E's gas pipeline system is the product.

groups, systems, and ultimately the high level model of the complete product.

- **Revision control** – As designs evolve, drawings are changed accordingly, but saved as a new revision number of the existing drawing number. This provides a complete history of modifications since previous revisions are saved as separate files. Once again, modern computer based drawing programs facilitate this process since an existing drawing file can be copied to a new file, then modified as needed and saved as a new revision. All previous versions are retained to provide an archive. The use of revision numbers also aides in creating a drawing hierarchy, as higher level (less detailed) drawings can continue to refer to the same lower level drawings. For example, a high level drawing of an automotive engine would refer to a drawing number for a piston. If the piston drawing is updated from revision A to revision B due to a design change, the callout on the higher level drawing doesn't need to change.
- **Accuracy** – The current revision of a drawing must be accurate, since it is the document all parties will rely on. For instance, in the case of a manufactured product (or a pipeline), building to the incorrect revision of drawing will result in an incompatibility with connecting parts, and a defective end-product.
- **The use of layers to display different types of information** – Modern computer aided drawings (CAD), which PG&E uses, allow different types of information to be entered into a computer model on separate "layers" which can be displayed and printed as desired by the user. For example, a computer model of a house can have the framing on one layer, plumbing on a second layer, electrical on a third, and dimensions on a fourth. Layering is also used within GIS files. A general contractor could make a drawing by printing all layers to show the entire house, while an electrician would require only a two layer drawing with only the electrical and dimensions layers needed to guide his detailed work.

9. <u>What was your overall impression of the Line 147 drawings PG&E showed you at the workshop?</u>

I was surprised that there was not a master sheet that showed the entirety of this short line – approximately 4 miles long - nor one which documented the history of the line and its component features. I also did not expect that the workshop would require a guided tour through the drawings by PG&E's contractor GTS, yet without this assistance it would not have been possible to verify that the entire line had been hydrotested. This expectation was based on my experience with numerous drawing control systems and this impression was shared by other attendees.

10. Can you provide greater detail regarding your concerns?

Yes, I had multiple concerns regarding these drawings, particularly if they are generally representative of PG&E's drawing control system. First, there was not one drawing that showed all of this short line, and how it integrated with adjacent transmission lines and the downstream distribution pipelines it supplies. Instead, multiple drawings were presented by GTS staff showing different sections of the pipeline, but without the aid of a master sheet that showed the relation between the pipeline sections. This was not consistent with the type of drawing hierarchy discussed previously.

Second, the drawings did not use a mapping nomenclature that clearly showed the relationship of each pipe feature across all drawings for the line. Drawing titles indicate sequential mileage post (MP) numbers, but the shortcomings resulting from the use of historical measurements in miles to represent each foot of every pipe feature were discussed in my November 14, 2013 testimony. Each drawing also includes two sets of "station" numbers which locate individual pipe features using units of feet, as measured from one end of the pipeline shown in the drawing. One set of numbers is comprised of "P-station" numbers that account for changes in the elevation of the pipeline; the other set is comprised of "R-station" numbers that do not account for changes in elevation.[9] While these stationing systems should provide the required level of resolution to locate individual features, they are reset to zero at the start of each drawing, rather than at the start of the pipeline as PG&E does for the station numbers in the PFLs, and as it had indicated in response to a previous discovery question.[10] The lack of a stationing system in feet that runs continuously from one end of the pipeline to the other is a primary reason for the inconsistencies in location data in the STPRs discussed in my November 14, 2013

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[9] PG&E Response to DRA 96 Q4, attached hereto as Exhibit 1.

[10] PG&E response to DRA 92 Q1, attached hereto as Exhibit 2.

testimony. This is inconsistent with the requirement for accuracy discussed above. Recently, PG&E further indicated that: "There are many different labels found on drawings over the last 90 years of pipeline installations. The use of pipe stationing and field or horizontal stationing has been going on for many years but is not consistent throughout the gas transmission jobs."[11]

Third, PG&E explained at the meeting that older drawings of pipelines are not updated based on upgrades and modifications performed over time. Instead, separate drawings are created for each new job, and these drawings are not referenced back to the original drawing. For example, the tie-ins installed upon completion of each hydrotest, and new pipe used to repair the leak on segment 109, were documented on new drawings, but the details were not reflected as changes in the older drawings of Line 147. As such, there does not appear to be a single drawing or computer model that provides an accurate record of all the pipeline features on this line, except the tabular PFLs PG&E recently compiled. Additionally, while the PFL lists the file which contains drawings for each pipe feature, the PFL does not list the most current revision number of the drawings. As such, it does not appear that PG&E has a reliable drawing revision control system, based on documents provided by PG&E and discussed at the November 14, 2013 workshop.

It is important to note that the workshop on November 19, 2013 involved the review of drawings and PFLs for a pipeline that had completed at least two rounds of MAOP validation by PG&E. As such, I understood that these documents are representative of PG&E's post-MAOP validation records. However, I also understand that PG&E is in the process of converting its records to a new GIS system ("eGIS"). It is possible that PG&E will be updating and modernizing its process for documenting pipeline modifications, and archiving this information in revision controlled system level drawings.

[11] PG&E Response to DRA 96 Q4, attached hereto as Exhibit 1.

11. Did you have additional concerns about PG&E's STPRs based on the workshop? If so, please explain.

Yes, the workshop revealed that the as-built drawings of pipelines are an important primary source of the hydrotest data which indicate where the tests were performed, and which pipe features were included. This is an important distinction because the PFL includes links to PDFs which include the as-built drawings, but these PDFs did not provide sufficient resolution to read all the details of the drawings.[12]

In addition, PG&E did not verify the length of all pipe features included in each hydrotest. Instead, only the length of pipe features exposed through field excavations was updated. For features not excavated, length for the "material of record" (MOR) was used. For test T43B of Line 147, which was performed on approximately 1.45 miles of pipe, the length of only approximately 775 feet, roughly 10% of the test section, was verified and updated in the STPR.[13] The length of the remaining pipe, over 1.3 miles, has not been verified.

12. Did you have additional concerns about PG&E's QA/QC process based on the workshop? If so, please explain.

Yes. At the workshop, a representative of PG&E's hydrotest subcontractor, RCP, discussed the use of pressure volume plots to both ensure successful spike testing, and to document that the spike test did not result in yielding that would trigger the use of a lower MOAP based on 49 CFR 192.619(a)(1)(i) and ASME B31.8 N-5. I had two concerns with respect to this discussion. The first is that the RCP representative stated that "MAOP Based Upon Test to Yield" included in two of the STPRs was incorrectly manually adjusted by RCP in revision 2 issued approximately 5 months after the tests

[12] For example, the PFL for Line 147 shows that segment 109 is documented in STPR file "41497361_STPR-Pkg_2_T43B.pdf." See page A-35 of Confidential Exhibit A to PG&E's October 11, 2013 Supplemental Information submitted in this proceeding (Confidential Exhibit A). However the elevation drawing included in this PDF, which is numbered 4197360 since it originated with test T43A, does not have sufficient resolution to read the R-Station and P-Station numbers. See page A-171 of Confidential Exhibit A.

[13] See pages A-160 to A-162 of Confidential Exhibit A.

were completed.[14] This erroneous data was not discovered until this error was presented to SED staff during the course of discovery in this OSC, approximately two years after the tests were completed. I question PG&E's explanation for these errors because the two STPRs were authored by different engineers.[15] The error of manually typing over a calculated value would be unusual by itself; it seems unlikely that two different engineers made the same error on these two certifications, but not on other certifications. As a result of this correction, PG&E submitted a third round of revisions to the test certifications which alter the original hydrotest certification by deleting and changing the forms.[16] Neither of the revised certifications is signed by the original certifying engineer who was present at the test. One of these certifications is not signed at all.[17]

In addition, the RCP representative discussed the deviations between the actual and predicted pressure volume curves for hydrotest T43B.[18] He explained that RCP uses this type of chart for all hydrotests it performs, and that 85% of the time the actual curve falls within the shaded area shown for the predicted line. He also explained that the deviation was due to "lots of air" in the pipeline, as noted in revision 2 of the STPR.[19] Since deviations in the actual curve could be caused by a leak in the test section, or actual pipe features under test that differ from those listed in PG&E's records and used to calculate the predicted curve, it is my opinion that additional value can be obtained from hydrotests if there were a limit on the amount of entrained air allowed. A California State Lands Commission hydrotest procedure states that the presence of excess air may

[14] See pages A-88 and A-184 of Confidential Exhibit A to PG&E's October 11, 2013 filing in this proceeding. RCP's representative stated orally during the workshop that this MAOP value is normally automatically calculated by RCP's spreadsheets, but that it was manually changed, incorrectly, for an unknown reason.

[15] Compare the signatures on pages A-88 and A-184 of Confidential Exhibit A

[16] The "Established Minimum Yield Pressure" was corrected for tests T42 and T43B, and the "MAOP Based Upon Test to Yield" field was deleted. These revised reports were provided by PG&E to parties as attachments 3 and 4 of a November 15, 2013 email, attached hereto as Exhibit 3.

[17] This can be seen in the confidential versions of the documents described in footnote 19 above.

[18] See page A-183 of Confidential Exhibit A.

[19] See the remarks section on page A-176 of Confidential Exhibit A.

make it hard to detect small leaks.[20] That procedure recommends bleeding out the air and refilling if the PV calculations reveal more than 1% excess air.[21] It is possible that the spike portion of T-43B caused segment 109 to start leaking immediately, but the excess air in the line prevented observation of the leak during the subsequent 8 hour hold. If this is plausible, it would warrant changes to General Order 112-E to include limits for entrained air in a hydrotest.

13. Did you express your concerns to PG&E?

I expressed some of them at the workshop but not all. In the hearing on November 20, 2013, I explained that the issues regarding inconsistencies within the STPRs, as expressed in my November 14, 2013 testimony, had not been resolved during the November 19, 2013 workshop. I have not discussed the other issues raised in this testimony with PG&E.

14. What was PG&E's response to your concerns?

PG&E has not had the opportunity to respond to my comments at the November 20, 2013 hearing. At the November 18, 2013 hearing PG&E suggested that the issues raised in my previous testimony were the result of me being confused.[22] To the degree that I misinterpreted the station numbers provided in the STPRs, this is largely due to the fact that the PFLs and PG&E's data responses during discovery indicated that stationing numbers began at the westernmost end of the line and continued sequentially moving east.[23] But even this does not negate the finding of my prior testimony that the STPRs provide conflicting information regarding the location of the hydrotests. This is clearly evident by comparing the map for test T42, which shows the east end of the test at MP

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[20] California State Lands Commission, A Procedure for the Hydrostatic Pressure Testing of Marine Facility Piping dated December 3, 2003, attached hereto as Exhibit 4. See page 7: "If a small leak is present, the expected pressure loss due to the leak may not be apparent since expanding air within the pipeline will tend to keep the pressure constant." http://www.slc.ca.gov/division_pages/mfd/slpt/revised_slpt_guidelines_12-03-03.pdf

[21] *Ibid*, page 15, § 4.4.3.

[22] 17 RT 2530: 5 (PG&E/Malkin).

[23] See Exhibit 2 to this testimony.

.85 (the intersection of Crestview Drive and Bow Road), and the adjacent photo which shows the same east end at MP 1.1321 (the intersection of Pebble Drive and La Mesa Drive.)[24] If these STPRs are not corrected, the "confusion" I experienced will be repeated by any reasonable engineer who attempts to review these STPRs without additional interpretation by PG&E staff and consultants. This negates the effectiveness of these particular STPRs as an accurate archival record of the Line 147 hydrotests.

15. <u>In your opinion, how should PG&E address this issue?</u>

First, PG&E should acknowledge these issues with the STPRs and commit to explaining and correcting them. Second, PG&E should ensure that the current process of updating its drawing, mapping, and GIS systems will "find and fix" other similar conflicts and/or errors in the STPRs, PFLs, and other pipeline records throughout its system. This should include the use of a mapping system or systems that accurately accommodates global satellite positioning (GPS) data, and historic MP and station numbers where needed. A robust mapping nomenclature system will not be subject to misinterpretation by engineers, technicians, or attorneys, regardless of whether they are employed by the CPUC, PG&E, or one of PG&E's many subcontractors.

Ideally, PG&E would be able to produce a data management plan to the Commission, complete with specifications and procedures, that demonstrates how its current upgrade activities, and the pending eGIS system, will provide accurate data that is not subject to misinterpretation.

16. <u>In your opinion, how can the CPUC facilitate resolution of these concerns?</u>

First, I suggest that the CPUC review PG&E's plans for its new eGIS-based recordkeeping system. This review should be performed early in 2014 to ensure that time and effort is not wasted creating a system that is not consistent with SED's ongoing responsibility to oversee PG&E's pipeline operations and implementation of the Pipeline Safety Enhancement Plan (PSEP). The CPUC should consider addressing the following issues in its review:

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[24] See pages A-73 and A-74 of Confidential Exhibit A.

- ☐ Does the system provide an effective link to historical data from legacy data systems, assuming that all data cannot be migrated to the new eGIS system?
- ☐ Is the system accurate as of the online date?
- ☐ Does the system provide for archiving and revision control on a forward looking basis?
- ☐ Are the processes for updating the data based on ongoing operations and maintenance (O&M) activities designed to remove residual inaccuracies over time?
- ☐ Are the processes for updating the data based on ongoing O&M activities robust such that the data will remain accurate over time?
- ☐ Are there robust security procedures to ensure data integrity is not compromised through error or intentional damage?
- ☐ Is the data subject to misinterpretation by inexperienced system users?
- ☐ Does the data support a wide range of uses, including routine O&M, Transmission Integrity Management Programs (TIMP), PSEP Phase 2, routine Commission audits, and general rate cases (GRC)?
- ☐ Is the system reasonably accessible and understandable to SED staff without ongoing guidance from PG&E staff?

As with all SED reports related to public safety, this review should be publicly available.

Second, the CPUC should determine if General Order 112-E should require a pressure volume plot, whether it should include automated checks for yielding, and whether PG&E should have limits for the amount of entrained air in a hydrotest.

Finally, the CPUC should incontrovertibly establish that in filings before the CPUC, such as the Safety Certification PG&E provided in response to the October 8, 2013 ruling, utilities must provide supporting documentation that accurately and completely justifies the utility's narrative claims. In each case, the CPUC should require such evidence to be admitted into the record and archived for future reference.

QUALIFICATIONS AND PREPARED TESTIMONY
OF
THOMAS ROBERTS

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

A.1. My name is Thomas Roberts. My business address is 505 Van Ness Avenue, San Francisco, CA 94102.

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

A.2. I am employed by the California Public Utilities Commission as a Senior Utilities Engineer in the Electric Pricing and Consumer Program Branch of the Office of Ratepayer Advocates ("ORA").

Q.3. Please describe your educational background and professional experience.

A.3. I received a Bachelor of Science Degree in Mechanical Engineering from the California Polytechnic University in 1988, and a Masters of Business Administration from the Peter F. Drucker Center at the Claremont Graduate School in 1994. I am currently registered in California as Professional Mechanical Engineer.

As a Regulatory Analyst and Engineer, I have contributed to a wide variety of proceedings, including advanced metering infrastructure (AMI), energy efficiency (EE), and avoided costs. I have served ORA as project coordinator for AMI programs, and for distributed generation programs including the California Solar Initiative (CSI) and the Self-Generator Incentive Mechanism (SGIP). I was an ORA witness in the pipeline safety improvement applications of PG&E and the Sempra Utilities in 2012.

Prior to joining DRA, I held various professional positions including Senior Test Engineer/Scientist, Facility Manager, and Program Manager at Boeing Space Systems, and as an applications engineer for a mechanical instrumentation manufacturer. In the former position, I conducted tests of launch rocket components and systems which simulated the mechanical stresses of launch, the transonic boundary, and on-orbit payload delivery. My responsibilities included preparing test procedures, operating National Institute of Standards and Technology (NIST) traceable instrumentation systems, ensuring the safety of personal and test specimens, ensuring test objectives were met, and documenting test results in reports and archived data. I supervised tests of complete launch vehicles at National Aeronautics and Space Administration

(NASA), Department of Defense (DOD), and subcontractor facilities nationwide, which entailed integration with fuel and oxidizer storage and piping systems.